



TNG Limited
Mount Peake Project
Draft Environmental Impact Statement
Volume III
February 2016



Volume III

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Appendix L

Economic and Social Impact Assessment Report





TNG Limited
Mount Peake Project
Economic and Social Impact
Assessment Report

December 2015

Executive summary

The Project

The Mount Peak Project will include the mining of a polymetallic ore body through an open-pit truck and shovel operation and processing of the ore to produce a magnetite concentrate. Road haulage of the concentrate will be done by trucks via the access road to a new railway siding and loadout facility on the Alice Springs to Darwin railway near Adnera. An underpass of Stuart Highway will be constructed to separate road trains from Stuart Highway traffic. Concentrate will be transported by rail to TNG's proposed Darwin Refinery located at Middle Arm, Darwin.

The life of mine is expected to be 19 years, inclusive of construction (2 years), mining (15 years) and closure (2 years).

The construction and operations workforces are estimated to peak at 225 and 170 personnel respectively. The workforces will be largely fly-in fly-out due to low population numbers in the local area. The workers will fly to Ti Tree and will then be bussed to the accommodation village for the duration of their roster. All of the workforce, when on roster, will be accommodated at the accommodation village located approximately 5 km to the east of the mine site.

As a consequence of the Project it is expected that Ti-Tree airport will be upgraded through the Federal Government's Development Fund for Northern Australia.

The Economic and Social Impact Assessment (ESIA) for the Mount Peake Project was prepared in accordance with the Project's environmental assessment requirements and was primarily guided by the:

- Project Terms of Reference issued in March 2014 by Northern Territory Environmental Protection Agency (NT EPA) and
- NT EPA Guidelines for the Preparation of an Economic and Social Impact Assessment.

Methodology

The key steps in the methodology included:

- Identification of the social study area, where the local study area was considered to be the area under the Project footprint, the regional study area included the Central Desert Shire and the key localities of Ti Tree, Wilora, Stirling Station and Anningie Station, and the wider area of social influence from where the Project would attract workforce and goods and services was considered to be Alice Springs and Darwin
- Preliminary scoping of social issues in the study area and those likely to arise from the project
- Establishing a social baseline for the study area against which the impacts would be measured
- Identification and assessment of social impacts that may be generated from Project activities
- Recommendation of management strategies to avoid/minimise negative social impacts and enhance the positive benefits.

Social baseline

The social baseline showed the following characteristics of the regional study area:

- A large Indigenous population within the regional study area (80% in the LGA), almost 50% in Ti Tree SSC and the entire Wilora ILOC community
- An increase in the population of all study areas from 2011 to 2014
- Generally younger population with higher percentage between 25-44 years of age and communities mostly made up of 'couple families with children'
- Ti Tree SSC reported no unemployment, Central Desert LGA recorded 14.5% and a high level of unemployment was noted in Wilora (35.7%) and among the Indigenous population of Central Desert LGA (26.3%)
- Public administration and safety were the key industry of employment in both Ti Tree SSC and Central Desert LGA
- The majority of dwellings in the study area were rented and a high percentage of dwellings were unoccupied compared to the territory
- Basic social infrastructure is located within the communities with higher order services provided within the wider area of influence.

Impact assessment

The identification and assessment of social and economic impacts identified Project benefits as potential business development opportunities, employment opportunities and flow on benefits for the regional study area and wider area of influence. A potential negative impact was the draw of existing workers from other industries into better paying resource jobs leading to shortfalls in other industries. This may not be specific to the Mount Peake Project but a cumulative impact from a number of resource projects in the region.

Management of social and economic impacts

Due to the limited social and economic impacts arising from the Project, impact management strategies mainly involved monitoring of impacts and enhancing the positive benefits. Key strategies include:

- Ongoing stakeholder engagement through the life of the Project and grievance management
- Developing opportunities for Indigenous communities to benefit from employment and business prospects with the Project
- Developing a Workforce Management Plan to manage the Project workforce, maximise benefits for local employment and manage cumulative impacts on demand for local workers
- Establishment of a community benefit fund to recognise the long term relationship with the regional communities by providing support for social infrastructure or other suitable development activities in the regional study area
- Periodic monitoring of social impacts and review of the ESIA.

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1. Introduction

1.1 Project Overview

1.1.1 Project location and components

The Mount Peak Project will comprise:

- The mining of a polymetallic ore body through an open-pit truck and shovel operation
- Processing of the ore to produce a magnetite concentrate
- Road haulage of the concentrate to a new railway siding and loadout facility on the Alice Springs to Darwin railway near Adnera
- Rail transport of the concentrate to TNG's proposed Darwin Refinery located at Middle Arm, Darwin.

The mine site is located approximately 235 km north-northwest of Alice Springs and approximately 50 km west of the Stuart Highway (Figure 1-1).

Mining will occur at a rate of up to 8.4 million tonnes per annum (Mtpa).

Ore processing involves crushing, grinding and magnetic separation to produce a magnetite concentrate. Up to 1.8 Mtpa of magnetite concentrate will be produced annually.

The concentrate will be trucked via the access road to a new rail siding and loadout facility at Adnera. Road trains used to transport the concentrate will be highway compliant and will operate under shared usage conditions with other highway compliant vehicles such as delivery trucks, busses and light vehicles. An underpass of Stuart Highway will be constructed to separate road trains from Stuart Highway traffic.

Trucks will dump concentrate to a stockpile adjacent to the rail siding. Train loading will be by front-end loaders directly loading in to rail wagons. Around one train movement per day is expected.

A borefield will be established within the alluvial aquifer of the Hanson River to provide water for mining, processing, dust suppression and potable use.

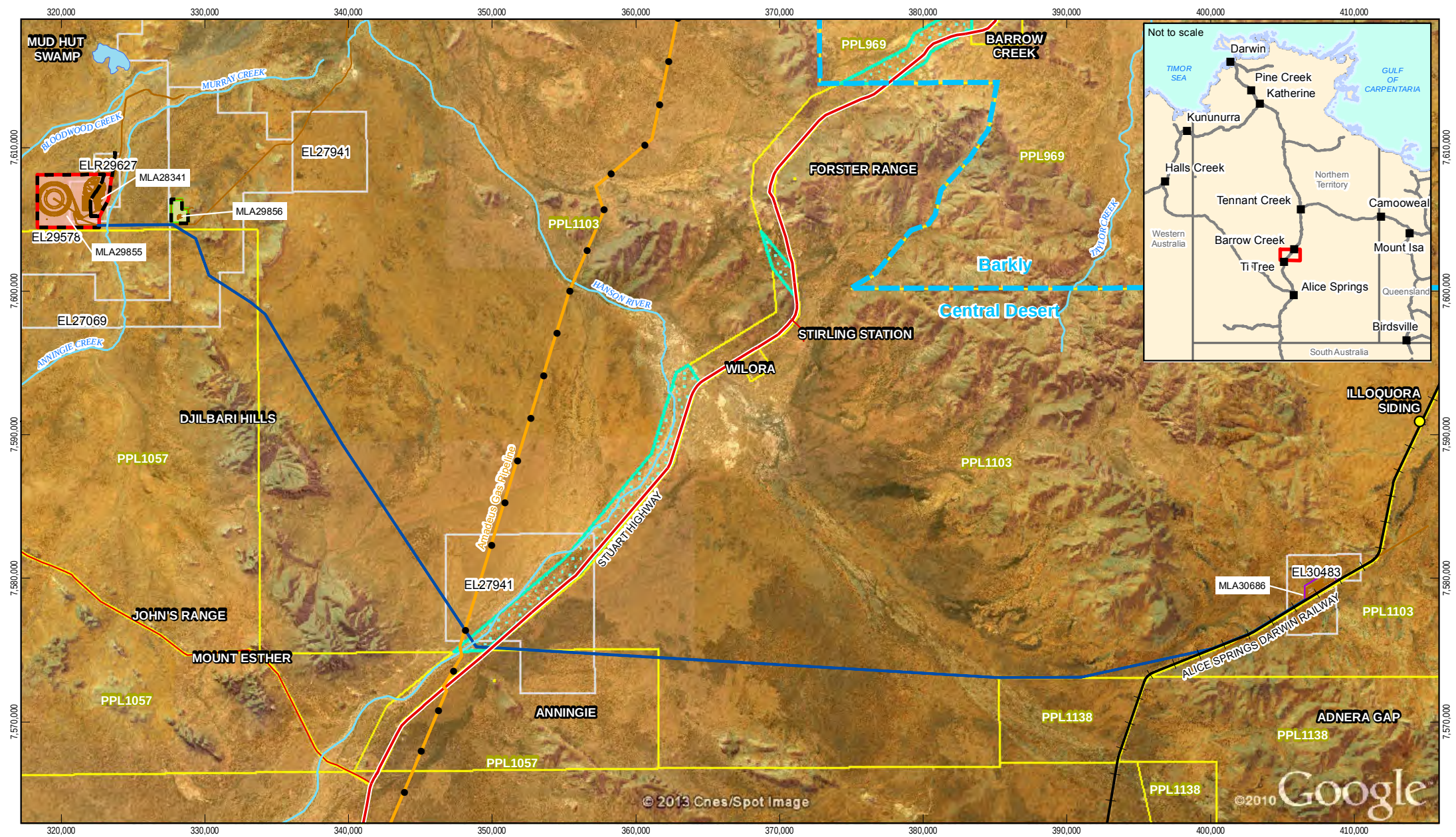
The life of mine is expected to be 19 years, including construction (2 years), mining (15 years) and closure (2 years).

1.1.2 Workforce

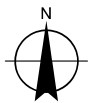
The construction and operations workforces are estimated to peak at 225 and 170 personnel respectively. The workforces will be largely fly-in fly-out due to low population numbers in the local area. The workers will fly to Ti Tree and will then be bussed to the accommodation village for the duration of their roster.

All of the workforce, when on roster, will be accommodated at a self-contained accommodation village located approximately 5 km to the east of the mine site to facilitate ease of access to the operation and crew rotations to and from the site.

An initial 40 person 'fly camp' will be established to allow for early construction works. This will consist of separate four room en-suited accommodation units together with kitchen / diner, laundry units, wet mess, and office / administration building.



Paper Size A4
0 2.5 5 7.5 10
Kilometres
Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 53



LEGEND

Illoquora Siding	Amadeus Gas Pipeline	Crown Land
Principal Road	Mine Site Facilities	Mount Peake Granted Tenements
Minor Road	Mud Hut Swamp	Mount Peake Mineral Leases
Major Watercourses	Rail Siding Loading Facility	Cadastral Boundaries
Railway	Mount Peake Mining Area	Access Road
		Local Government Area



TNG Ltd
Mount Peake EIS

Project Location
Mount Peake Project Area

Job Number 61-29057
Revision A
Date 30 Oct 2015

Figure 1-1

G:\61\29057\11 GISMaps\MXD\SA\6129057_001_Fig1ProjectLocation.mxd

239 Adelaide Terrace Perth WA 6004 Australia T 61 8 6222 8222 F 61 8 6222 8555 E permail@ghd.com.au W www.ghd.com.au

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Data source: TNG - Gas / Slurry Pipeline Study Corridor, Camp Facilities, Transport Study Corridor, Mount Peake Mining Area, Mount Peake Granted Tenements (2015). Geoscience Australia - LGA, Waterways, mainland, placename, road (2008). Google Earth Pro - Imagery (Date extracted: 13/02/2014). Created by: RB

Following early site works a permanent village will be constructed to provide housing for the main construction workforce prior to hand over for operations personnel. The village buildings will be of a modular transportable style requiring minimum on site construction labour. The village will comprise:

- Dry mess, wet mess, kitchen and cold room
- Ablutions
- Games room complete with internet and telephone connection
- Swimming pool, tennis court and gymnasium
- Laundry facilities
- Fire water protection with diesel backup
- Sewage treatment plant
- Village administration offices
- Car parking.

First aid facilities for the workforce will be provided at site.

1.1.3 Upgrade of Ti Tree airstrip

The project is expected to use the existing Ti Tree airstrip, 70 km from the mine site. This airstrip is available, and able to accommodate aircraft such as the Fokker F100 or BAE146. Negotiations with the Northern Territory Government on this facility are in progress and an upgrade of the current airstrip is anticipated to be covered by the Federal Government's Development Fund for Northern Australia.

The runway will be upgraded by increasing the width and length of seal. A concept for a small terminal has also been prepared (Figure 1-2) which would include check-in desks, baggage collection, amenities, car parking, undercover seated areas and baggage collection area.



Figure 1-2 Concept schematic for the new Ti Tree terminal

1.2 Purpose of the economic and social impact assessment

The Economic and Social Impact Assessment (ESIA) for the Mount Peake Project was prepared in accordance with the project's environmental assessment requirements.

The purpose of the ESIA was to identify the positive and negative social and economic consequences arising from Project activities and propose measures to enhance the positive impacts and avoid/minimise the negative impacts on local and regional communities. To achieve its purpose, the ESIA methodology was developed based on the following requirements, guidelines and principles:

- Terms of Reference for the Preparation of an Environmental Impact Statement: Mount Peake Project (NT EPA 2014)
- Guidelines for the Preparation of an Economic and Social Impact Assessment (NT EPA 2013)
- International Principles for Social Impact Assessment (IAIA 2003).

1.3 ESIA methodology

1.3.1 Scoping

Scoping included understanding the proposed Project activities, determining the Project's social and economic area of influence and preliminary identification of potential social and economic issues arising from Project activities.

Defining the social study area

The area of social and cultural influence of a project is determined by the project footprint and its interaction with the immediate neighbouring communities, interaction of project activities and its workforce with nearest urban localities, and interaction of project activities with the wider region. With this in mind the Project study area for the ESIA is defined as:

- Local study area – including the area under the Project footprint
- Regional study area – includes the local government (shire) boundary within which the Project is located and the key localities nearest to the Project area. The regional study area for the Mount Peake Project includes the Central Desert Shire and the key localities of Ti Tree, Wilora, Stirling Station and Anningie Station (Figure 1-1)
- Wider area of influence – includes areas from where the Project could potentially attract workforce and goods and services. In the NT this includes Alice Springs and Darwin.

Preliminary identification of potential social and economic issues

The potential socio-economic issues that were considered in this assessment included:

- Potential local and regional employment and business development opportunities
- Potential for flow on benefits to the local and regional communities
- Potential changes to the amenity and traffic safety of the local community and sensitive receivers due to Project related noise, air quality changes, landscape changes, and additional traffic in the area
- Potential demographic changes to the region due to the presence of a Project workforce and associated changes in demand for housing, accommodation, social infrastructure and changes in community lifestyle and values
- Potential impacts on the health and wellbeing of the workforce.

1.3.2 Establishing a social baseline

To understand the existing socio-economic conditions of the communities with the study area a socio-economic baseline was developed. Data and information was gathered from various sources as listed below:

- Australian Bureau of Statistics (ABS) Census 2011 data
- Websites and publications of local governments in the regional study area, territory agencies covering health, education, housing, communities and emergency services
- Real estate websites
- Media reports.

Where possible the regional baseline was supplemented with information from stakeholder consultation undertaken in March 2015.

The regional baseline describes the following community characteristics and issues (not particularly in this order):

- Community lifestyle, values and aspirations
- Demographic characteristics, including
 - Total population; population trends, growth and forecasts
 - Age and gender profile
 - Family composition
 - Cultural and ethnic composition
 - Employment and unemployment profile
 - Employment by industry and occupation profile
- Housing availability, affordability and costs
- Social and community infrastructure, including:
 - Health services and facilities
 - Community support services
 - Education and training facilities.

1.3.3 Impact identification and assessment

Social impacts are understood as something that is actually experienced by humans in a practical or perceptual sense and results directly from the social change processes that are invoked by a project (van Schooten *et al.* 2003). For example, population growth or the presence of construction and operation workers in the area, are social change processes that may lead to 'first order' social impacts experienced by the local community. Based on the scoping of issues, stakeholder consultation and review of other specialist technical studies undertaken as part of the EIS a number of potential issues arising from construction and operation activities of the proposal were identified and assessed. Studies reviewed included:

- Land use
- Noise and vibration
- Air quality
- Traffic
- Surface and groundwater resources
- Closure and rehabilitation.

Once the impacts were identified, they were categorised based on the type or nature of each impact, as follows:

- Positive impact – where the impacted stakeholders would be ‘better off’ due to the proposed development
- Neutral impacts – where there would be no change to the function of the stakeholder impacted
- Negative impacts – where the impacted stakeholders would be ‘worse off’ due to the proposed development.

The negative impacts were further assessed to determine their impact significance. The significance of negative social impacts on social receptors, systems and resources was evaluated through a likelihood and consequence matrix. The likelihood and consequence criteria are detailed in Table A1 and Table A2 in Appendix A. The impact significance matrix is shown in Table A3 in Appendix A.

1.3.4 Develop mitigation and management strategies

Management strategies are developed in response to the identified impacts, with emphasis on mitigating/managing impacts with higher order significance rating. In the first instance the mitigation/management strategies were developed using the following hierarchy:

- Avoid impacts where possible through design control measures
- Minimise impacts which cannot be avoided; for example by altering the timing of the activity that may cause the impact, reducing the duration of an activity, or reducing the footprint
- Manage impacts by improving capacity/stock of impacted entities, rehabilitating disturbed areas through restoring pasture on completion of construction or management measures such as through workforce behaviour management
- Offset or compensate impacts for example through compensation for land access.

It is acknowledged that social impacts arising from the Project can change with changes to the socio-economic and political context of the region and changes in mining technology. Given the 19 year life span of the Project, it is not possible to predict and manage social impacts over the entire life of the Project, therefore the social impact management strategies, are based on ‘adaptive’ management principles, which allow ongoing monitoring of impacts and provide flexibility to accommodate changes to social impacts.

1.4 Stakeholder consultation

Stakeholder consultation was undertaken in March 2015. The following stakeholders were consulted during one on one meetings and open information sessions:

- Central Desert Regional Council
- Central Land Council
- Alice Springs Town Council
- Wilora community
- Ti Tree community
- Stirling Station
- Anningie Station
- Mount Skinner Station

- Ti Tree Police Station
- Ti Tree School
- Royal Flying Doctor Service – Alice Springs Base
- Aboriginal Areas Protection Authority
- Local business owner in Alice Springs.

2. Regional Social Baseline

2.1 Introduction to the Regional Study Area

As defined in the regional study area in Section 1.3.1 this baseline describes community characteristics for the Central Desert LGA with a focus on the key localities of Ti Tree State Suburb (SSC) and Wilora Indigenous Location (ILOC). The wider area of influence has been considered for higher order social infrastructure and services in Section 2.3.

2.1.1 Overview of Central Desert LGA

The Central Desert LGA covers an area of approximately 282,000 square kilometres and is located in Central Australia (Central Desert Regional Council 2015b). The Council area spans from the Western Australian border to the Queensland border and has nine major communities- Atitjere (Harts Range), Engawala, Lajamanu, Laramba, Nyirripi, Ti Tree, Yuelamu, Yuendumu and Willowra with a number of occupied outstations (Central Desert Regional Council 2015b).

Ti Tree State Suburb (SSC)

Ti Tree is a small community located on the Stuart Highway 194 km north of Alice Springs by road (Central Desert Regional Council 2015b). Ti Tree is identified in the Regional Council Plan (2015a) as a service delivery centre, while Ti-Tree Roadhouse and Ti Tree Homestead are identified as key locations. Ti Tree is the closest settlement to Central Mount Stuart, the geographical centre of Australia. A Council office is located in the Ti Tree town and services Ti Tree and the communities of Pmara Jutunta, 6 Mile, Alyuen and Wilora, collectively referred to as Anmatjere (Central Desert Regional Council 2015b).

Wilora Indigenous Location (ILOC)

Wilora is an Aboriginal community located 245 km north of Alice Springs, a short distance off the Stuart Highway.

Nearby Stations

The Mount Peak Project is predominantly located on Stirling Station. A small portion of the adjacent Anningie Station may also be impacted depending on the final alignment of the access road.

Stirling Station and Anningie Station are both cattle stations. Both stations are identified as outstations and pastoral properties in the regional council plan (Central Desert Regional Council 2015a). Anningie station is one of the southernmost homesteads in the Northern Territory with the closest major settlement being Ti Tree.

2.1.2 Key Opportunities and Challenges

Table 2-1 identifies the existing opportunities and challenges facing the Central Desert LGA. These are based on a review of planning and policy documents including *Central Desert Regional Council Plan 2015/2016*, *Appendix 1- Strategic Plan 2015-2020* and *Appendix 9- Community Plans*.

The opportunities and challenges within the LGA are also generally applicable for the communities of Ti Tree SSC and Wilora ILOC.

Table 2-1 Existing opportunities and challenges in the Central Desert LGA

Opportunities	Challenges
Employment opportunities for local communities. Ability to draw on skilled internal resources to undertake work/ training previously outsourced. Continued improvement in community infrastructure and facilities. Strong community, culture Economic development. Ability to capitalise on available grants and programs. Regional alliances and collaborations.	Remoteness of communities, limited transport and access difficulties. Poor condition of Council assets. Insufficiencies in infrastructure - community services that are not accessible. Environment conditions. Safety. Funding. Workforce impacts from several proposed projects in the region- loss of skilled workforce to mining projects for local Government agencies and businesses - may result in rising salary costs.

Source: Central Desert Regional Council 2015a & b

2.2 Community Characteristics

2.2.1 Population

At the time of Census 2011 the estimated resident population of Ti Tree SSC was 123 persons (Table 2-2). Of this number, approximately half identified themselves as being of Aboriginal and/or Torres Strait Islander (Indigenous) origin or both. Census 2011 data also reported that the resident population of the Indigenous community of Wilora ILOC was 111 persons, an increase of 16 persons from 2001 to 2011. For Central Desert LGA the total population was 3,720 persons with Indigenous persons making up 80% of the population. It is clear from the data that a high percentage of the population of the study area is Indigenous, particularly compared to the Northern Territory where 26.8% of the population was Indigenous.

Table 2-2 Estimated resident population in regional study area (2001, 2006 and 2011)

LGA / state suburb	Year					
	2001		2006		2011	
	Total	Indigenous	Total	Indigenous	Total	Indigenous
Ti Tree SSC	-	-	-	-	123	61
Wilora Aboriginal Community	95	95	-	-	111	111
Central Desert LGA	-	-	-	-	3,720	2,975
Northern Territory	202,729	50,785	192,898	53,662	211,945	56,776

Source: ABS 2011(c, d, e)

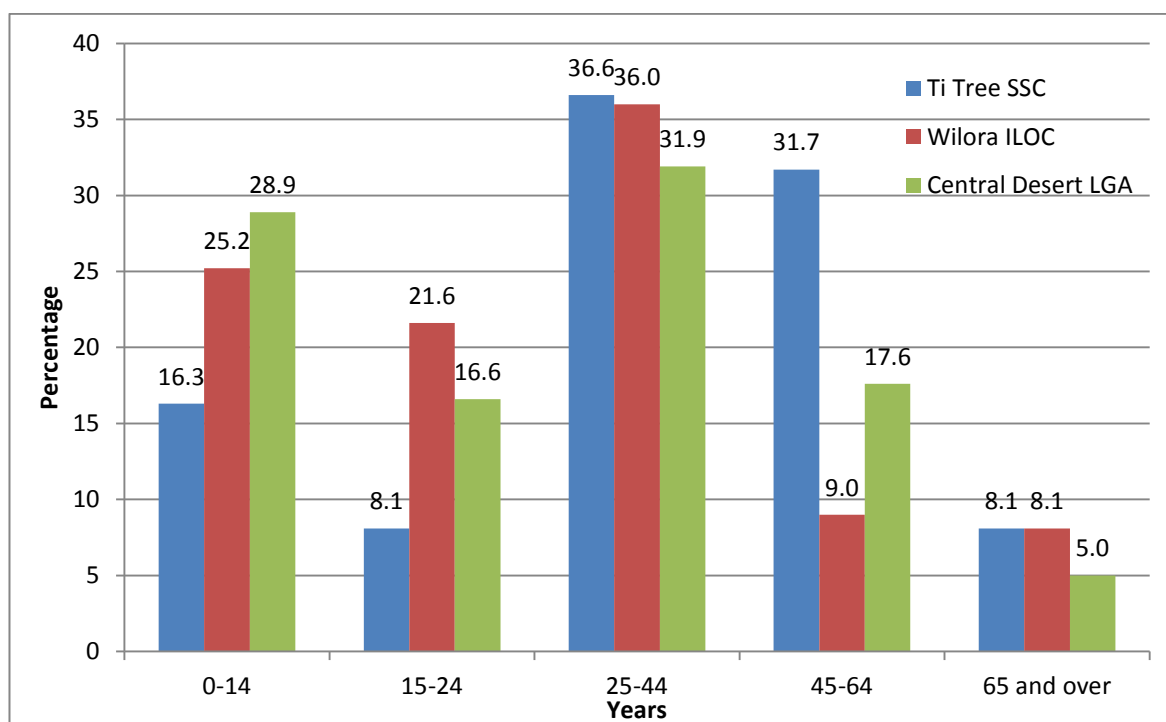
The 2015 Central Desert Regional Council Plan estimates the total resident population of Ti Tree at 143 persons as at April 2014. A population of 129 persons is recorded for Wilora and a total of 4,331 persons for Central Desert LGA (Central Desert Regional Council 2015a). All figures indicate an increase in population for all areas from 2011 to 2014.

Population data was not available for 2001 for Ti Tree SSC or Central Desert LGA or 2006 for any location. As a result, there is no indication of population change for the study area.

2.2.2 Age and Gender

According to Census 2011 data, the age profile of the study area was characterised by the following features (Figure 2-1):

- The median age in Ti Tree was 39 years, 26 years in Wilora and 27 years in Central Desert (including median age of 23 years for the Indigenous population and 40 years for the non-Indigenous population) (ABS 2011 a, d, e)
- The largest percentage of the population was in the 25-44 year age group for all locations
- For all locations the smallest percentage of the population was in the 65 years and over category
- Wilora and Central Desert had similar age profiles, while Ti Tree varied slightly with a considerably larger proportion of the population in the 45-64 years age bracket. This contributed to the higher median age of 39 years in Ti Tree.



Source: ABS 2011(b, f, h)

Figure 2-1 Population by age group – Ti Tree, Wilora and Central Desert, 2011

2.2.3 Family Composition and Household Structure

The family composition and household structure helps to understand the social fabric of the community. According to the Census 2011 data, 'couple family with children' was the dominant group in all locations accounting for 44.4% in Ti Tree SSC, 47.6% in Wilora ILOC, and 61.8% in Central Desert LGA (Table 2-3). The proportion of 'couple family without children' and 'one-parent family' was equal in Ti Tree and Wilora. In Central Desert LGA, 'one-parent family' was more dominant than 'couple family without children'.

Average household numbers ranged from 2.5 people per household in Ti Tree to 4.3 in Central Desert and 4.4 in Wilora (ABS 2011b, f, h).

Table 2-3 Family composition in regional study area, 2011

Locality	Couple family without children		Couple family with children		One-parent family		Total*
	No.	%	No.	%	No.	%	No.
Ti Tree SSC	6	22.2	12	44.4	6	22.2	27
Wilora ILOC**	4	19.0	10	47.6	4	19.0	21
Central Desert LGA	381	13.1	1,799	61.8	679	23.3	2,910

*does not include other family

** Wilora also had 3 multiple family households contributing to the total of 21

Source: ABS 2011 (b, f, h)

2.2.4 Cultural and Ethnic Characteristics

An understanding of the cultural diversity in the population is necessary from the point of view of understanding community cohesion issues and any need for special support services for people from different backgrounds.

As discussed in section 2.2.1 the indigenous population of Ti Tree SSC accounted for 49.6% of the population in 2011 (ABS 2011g). This compared with 80.0% of the population of Central Desert LGA (ABS 2011f). The entire population of Wilora was indigenous with no persons born outside Australia (ABS 2011b).

2.2.5 Education and Training

Table 2-4 shows the highest level of schooling completed in Ti Tree, Wilora and Central Desert. Year 12 or equivalent ranked the highest year of schooling for almost a third of the population of Ti Tree and Wilora. All locations had a high percentage of the population that did not go to school compared to the Northern Territory as a whole which reported 1.5% (ABS 2011g).

Table 2-4 Highest year of school completed in the regional study area, 2011

	Ti Tree SSC		Wilora ILOC		Central Desert LGA	
	No.	%	No.	%	No.	%
Year 12 or equivalent	28	27.2	25	29.1	494	19.2
Year 11 or equivalent	15	14.6	4	4.7	171	6.6
Year 10 or equivalent	12	11.7	16	18.6	479	18.6
Year 9 or equivalent	15	14.6	8	9.3	268	10.4
Year 8 or below	9	8.7	12	14.0	545	21.2
Did not go to school	15	14.6	12	14.0	193	7.5
Highest year of school not stated	9	8.7	9	10.5	425	16.5
Total number of persons	103		86		2,575	

Source: ABS 2011(b, f, h)

2.2.6 Labour Force, Employment and Unemployment

Unemployment

Unemployment data from ABS 2011 shows an unemployment rate of 35.7% in Wilora ILOC (Table 2-5). The unemployment rate in the whole of Central Desert LGA was 14.5% which is around half the unemployment rate for the Indigenous population of Central Desert LGA which was 26.3%. There was no unemployment reported in Ti Tree SSC.

According to ABS statistics for Central Desert, there were a total of 20 businesses in 2011. Of these businesses, 8 were employing businesses with 5 or more employees, 4 were employing businesses with 1 to 4 employees and 8 were non-employing businesses.

Table 2-5 Labour force and unemployment in the regional study area, 2011

SSC/ILOC/LGA	Unemployed (number)	Labour force (number)	Unemployment rate (%)
Ti Tree SSC	0	61	0.0
Wilora ILOC	10	28	35.7
Central Desert LGA	166	1,142	14.5
Central Desert LGA - Indigenous	163	620	26.3

Source: ABS 2011(a, b, f, h)

Labour force by industry and occupation

Table 2-6 indicates the proportion of employment by industry in both Ti Tree and Central Desert, with the largest industries of employment for each locality indicated by the dark grey cells. This data was not available for Wilora ILOC. As shown in the table, the main industries of employment in Ti Tree SSC in 2011 were public administration and safety with 38.8% (22 persons) and retail trade with 32.3% (21 persons). There were 13 industries that did not contribute to the Ti Tree industry profile.

Public administration and safety was also the dominant industry of employment in Central Desert LGA with 28.3% (276 persons). This was followed by mining with 19.6% (191 persons).

Table 2-6 Proportion of employment by industry in the regional study area, 2011

	Ti Tree SSC	Central Desert LGA
Agriculture, forestry and fishing	9.2	8.0
Mining	4.6	19.6
Manufacturing	6.2	1.1
Electricity, gas, water and waste services	0.0	0.0
Construction	0.0	0.5
Wholesale trade	0.0	0.6
Retail trade	32.3	7.0
Accommodation and food services	0.0	1.5
Transport, postal and warehousing	0.0	0.9
Information media and telecommunications	0.0	0.0
Financial and insurance services	0.0	0.0
Rental, hiring and real estate services	0.0	0.0
Professional, scientific and technical services	0.0	0.3
Administrative and support services	0.0	1.5
Public administration and safety	38.8	28.3
Education and training	9.2	9.9
Health care and social assistance	4.6	7.0
Arts and recreation services	0.0	2.8
Other services	0.0	7.4
Inadequately described / not stated	0.0	3.5

Source: ABS 2011(f, h)

The main occupations in Ti Tree SSC were labourers with 23.8%, followed by managers, professionals, community and personal service workers, and clerical and administrative workers each having a contribution of 14.3% to the occupation profile (refer to Table 2-7).

Central Desert LGA reported professional as the largest occupation group (17.9%), followed by labourers (16.7%), community and personal service workers (15.6 %) and technicians and trades workers (12.2%).

Occupation data was not available for Wilora ILOC.

Table 2-7 Proportion of employment by occupation in the regional study area, 2011

	Ti Tree SSC	Central Desert LGA
Managers	14.3	9.9
Professionals	14.3	17.9
Technicians and trades workers	4.8	12.2
Community and personal service workers	14.3	15.6
Clerical and administrative workers	14.3	6.4
Sales workers	0.0	3.2
Machinery operators and drivers	4.8	9.8
Labourers	23.8	16.7
Inadequately described / not stated	9.5	8.3

Source: ABS 2011(f, h)

Income

Table 2-8 provides average total personal, family and household weekly incomes. Total personal incomes were highest for the non-Indigenous persons of Central Desert LGA. This was also reflected in the total household income of Central Desert LGA non-Indigenous persons.

Table 2-8 Median weekly incomes in the regional study area

Locality	Median total personal income	Median total family income	Median total household income
Ti Tree SSC	\$690	\$1,468	\$1,281
Ti Tree SSC- Indigenous	-	-	\$1,406
Wilora ILOC	\$263	-	\$716
Central Desert LGA	\$272	\$625	\$1,063
Central Desert LGA- non-indigenous persons/ other households	\$1,227	-	\$1,490
Central Desert LGA- Indigenous persons / households with Indigenous persons	\$243	-	\$806

Source: ABS 2011(a, b, f, h)

2.2.7 Housing and Accommodation

Table 2-9 shows dwellings by tenure type for Ti Tree SSC, Wilora Aboriginal Community and the total population as well as Indigenous population of Central Desert LGA in 2011. The data shows that Ti Tree had a higher proportion of fully owned properties, with 10.0%, when compared with the Central Desert LGA total of 3.2%.

The data for the Indigenous population of Central Desert shows that there was a higher proportion of properties being rented at 94.1 compared with 86.9% for the Central Desert LGA. All properties in Wilora ILOC were being rented.

Table 2-9 Dwellings by tenure type in the regional study area

Locality	Fully Owned		Being Purchased		Rented		Total
	No.	%	No.	%	No.	%	No.
Ti Tree SSC	4	10.0	0	0.0	27	67.5	40
Wilora ILOC	0	0.0	0	0.0	20	100.0	20
Central Desert LGA	21	3.2	6	0.9	579	86.9	666
Central Desert LGA- Indigenous	0	0.0	3	0.6	447	94.1	475

This table does not include other tenure type(s) which includes dwellings being occupied under a life tenure scheme and tenure type not stated. Data was not available for Ti Tree's Indigenous population.

Source: ABS 2011(a, b, f, h)

The majority of houses in both Ti Tree and Central Desert were separate houses. All houses in Wilora were separate houses. The main accommodation types for people in Ti Tree were separate houses accommodating 53 persons, and improvised home, tent, sleepers out accommodating 26 persons.

It is important to note that 30.5% of dwellings in Central Desert were unoccupied and 18.0% of dwellings in Ti Tree were unoccupied. These percentages are quite high compared with the NT which recorded unoccupied dwellings of 12.4%.

2.3 Social Infrastructure

Table 2-10 identifies social infrastructure within Ti Tree and Wilora and the wider area of influence, where applicable. The wider area of influence is included as it is the area from where the Project will potentially attract workforce and goods and services. This information has been drawn from planning and policy documents and supported by stakeholder consultation.

Table 2-10 Social infrastructure in regional study area

Social infrastructure	Ti Tree SSC and Wilora ILOC (and Central Desert LGA and the wider area of influence where applicable)
Education facilities	The Council delivers a range of employment related training activities in several communities including Ti Tree and Wilora through Remote Jobs and Communities Program (RJCP). Stirling station school and pre-school. Ti Tree school and pre-school. School nutrition programs run in Wilora school.
Community cultural and recreational facilities	One library in Ti Tree. Council's Youth, Sport and Recreation program's - a combination of after school, vacation care, youth, sport, recreation, art and cultural activities are delivered by the team in several communities including the Anmatjere communities of Ti Tree and Wilora and others. Several art galleries in the region.

Health and wellbeing facilities	The Council's Aged Services continue to grow and mature into a program that can meet the needs of the aged and disabled older people as identified across the communities including Ti-Tree and Wilora. Hospital in Alice Springs. Remote Health Alice Springs will be responsible for coordinating the Royal Flying Doctor Service to site (stakeholder consultations, 24 & 25 March, 2015). Remote health centre- Ti Tree. Family mediation and domestic violence support services in the LGA. Health centre and separate aged care centre in Wilora.
Other major facilities and services	Centrelink services in all communities in the LGA. Wilora - 2 night patrol services - a men's and a woman's. CDRC - has 9 Service Delivery centres with one located in Ti Tree. The Ti Tree police station has fire response and roadside recovery capability (stakeholder consultations, 24 & 25 March, 2015). Ti Tree police district v Wilaura Police District – Ti Tree station would be likely to respond to an incident at the site given their closer access (stakeholder consultations, 24 & 25 March, 2015). The Ti Tree office of the Central Desert Regional Council has a fire vehicle (stakeholder consultations, 24 & 25 March, 2015). Power station in Wilora. There may be an option to use the existing Ti Tree air strip for emergency evacuation plus FIFO workforce (stakeholder consultations, 24 & 25 March, 2015). Note that this will now be the case. Ti Tree roadhouse and caravan park. There is one ranger located in Ti Tree.

Source: Central Desert Regional Council 2015a & b

The Central Desert Regional Council Plan (2015a) states that a key aim of the Council is to *balance the desire for continual improvement in community infrastructure and facilities with the need to adequately manage and preserve what it already has.*

2.4 Summary of Key findings

The key findings of this social baseline based on interpretation of the demographic characteristics of the regional study area are as follows:

- There is a large Indigenous population within the study area - 80% in the LGA, almost 50% in Ti Tree SSC and the entire Wilora ILOC community
- Population data indicates an increase in the population of all areas from 2011 to 2014
- Generally younger population, particularly in areas with a higher Indigenous population, with 25-44 year age group holding the largest percentage of the population in all locations
- Communities within the study area were made up mostly of 'couple families with children'

- High level of unemployment in Wilora (35.7%) and the Indigenous population of Central Desert LGA (26.3%) compared to the whole of the LGA (14.5%) and Ti Tree SSC which reported no unemployment
- Public administration and safety was the largest industry of employment in both Ti Tree SSC and Central Desert LGA
- The majority of dwellings in the study area were being rented and a high percentage of dwellings were unoccupied compared to the territory
- Basic social infrastructure is located within the communities with higher order services provided within the wider area of influence.

3. Social Impact Identification and Assessment

3.1 Introduction

This Section identifies, describes and assesses the potential social impacts arising from the construction and operation of the Project on the regional communities, with particular focus on stakeholders that may be directly affected by the impact. The impact assessment is carried out by determining the nature of impact and then applying the likelihood and consequences framework (Section 1.3.3) to determine the significance of each impact. Mitigation measures and management strategies for potential negative social impacts are described in Section 4.

3.2 Economic opportunities

Business opportunities

The Mount Peake Project has an estimated capital expenditure of \$310 million during construction and a total operational expenditure of \$2,000 million over the life of the Project. This will bring economic benefits to the region, territory and even nationally. It is expected that through the sourcing of goods and services the Project will generate business opportunities in the regional study area and the wider area of influence, and potentially also from Alice Springs. Where possible the project will source goods and services from local suppliers in nearby communities, however there are limited opportunities to do so.

Employment opportunities and flow on benefits

The Project is expected to generate up to 225 construction and 170 operational jobs. The workforce will be primarily fly-in/fly-out (FIFO) from Alice Springs, Darwin and potentially interstate, depending on the availability of required skills.

It is anticipated that, depending on the available skill base, a small proportion of the Project workforce may be recruited locally for activities such as environmental works (monitoring, reporting, rehabilitation), road construction, plant / machinery operation, bus drivers, camp staff and administration staff. However, stakeholder consultation has revealed that due to the small labour pool available in the regional communities recruiting local workers may be challenging.

TNG is committed to long term employment, skills training and mentoring of Aboriginal people for the Mount Peake Project. Through their Indigenous Relations Policy, TNG will maintain ongoing communication with the local Indigenous communities to optimise Project related opportunities.

It is anticipated that local and regional employment and business opportunities will generate some further demand for goods and services creating additional local jobs.

Workforce draw from other industries

The regional communities, including Alice Springs, have a relatively small population and labour force. Stakeholder consultation identified that employment opportunities generated by potential resource projects in the region may lead to skilled workers in existing jobs taking up these opportunities, creating workforce shortfalls in existing industries.

3.3 Demographic change and impacts on community values and lifestyle

The majority of the Project workforce is anticipated to be FIFO. The workers will fly to Ti Tree and will then be bussed to the accommodation village at the mine site, for the duration of their roster. Due to the remote location of the mine site and the self-contained nature of the accommodation village, it is highly unlikely that the workers will visit Ti Tree or other regional centres during their roster. Due to the minimal potential for workers to interact with the local communities, the Project will not change local demographics and is unlikely to impact on local community values and lifestyle.

3.4 Impacts on housing and social infrastructure

Impacts on housing and accommodation and other community services

The majority of the Project workforce will be FIFO and when on roster will be housed at the mine accommodation village. The Project is therefore unlikely to generate any demand for local accommodation, housing or community services.

Health Services

The Project will maintain an on-site medical facility and ambulance to service the workforce. Local medical and health services are not expected to be accessed by the Project workforce. In the event that personnel need to be medically evacuated they will be conveyed to Ti Tree for airlift by the RFDS.

Emergency Services - Fire and Rescue Services and Police

The Project will develop and implement safety protocols, incident management and emergency procedures. A Health and Safety Plan and Emergency Response Plan will be in place. These plans will consider among other things fire prevention and firefighting equipment and security. It is unlikely that the Project will increase demand for local police services and impact on their ability to cater to the local community.

3.5 Impacts on property

Access within the properties

Concern was raised on the potential for the transport corridor to impact access to strategic areas of Stirling Station, particularly bores and gates, and areas of the station to the east.

Stakeholders also expressed safety concerns with the potential for cattle to wander onto the access road.

The Project has incorporated these concerns into the design of the transport corridor, including:

- Locating the corridor largely along the southern boundary of Stirling Station to minimise disruption to the operation of the property
- Fencing of the corridor to exclude cattle.

Any additional requirements in relation to the maintenance of access will be discussed with the Station owner.

Property viability

Anningie Station has organic certification and Stirling Station is considering applying for it. Concerns were raised by the station owners on the potential for the Project to impact this certification.

The Project is not expected to affect the organic certification due to the following:

- No chemicals are used in the production of the magnetite concentrate
- The magnetite concentrate product is benign
- Small amounts of ammonium nitrate will be used in blasting with any impact confined to the area of the pit
- All hazardous materials (primarily diesel) will be transported and stored in compliance with regulations. Diesel will be stored in self-bunding tanks
- All waste will be appropriately treated and disposed of
- Chemicals are not proposed to be used for dust suppression
- The mine site and access road will be fenced.

3.6 Amenity impacts

The closest sensitive receptor to the Project will be the accommodation village located 5 km to the east of the mine site. Stirling Station homestead is located 50 km to the east of the mine site and 22 km north of the transport corridor. Anningie Station homestead is located 30 km south west of the mine site. The Wilora Aboriginal Community is located 20 km to the north of the transport corridor.

Air, noise and vibration modelling indicates that no sensitive receptors will be impacted by the Project.

3.7 Traffic and safety impacts

Concern was raised on the potential for trucks carrying magnetite concentrate to pose a safety issue when crossing Stuart Highway. Project design now incorporates an underpass of Stuart Highway to avoid the potential for traffic conflict.

An at-grade intersection will be provided between the Stuart Highway and the access road to allow vehicle movement to and from the mine site. The design of the intersection will be in consultation with the NT Department of Transport. This will include the design of acceleration and deceleration lanes and the incorporation of appropriate signposting to avoid or minimise any impact on other road users.

During construction the Project is expected to generate up to 30 one-way light vehicle movements, six one-way bus movements and 30 one-way heavy (truck) vehicle movements per day. During operations the Project is expected to generate up to 20 one-way light vehicle movements, five one-way bus movements and five one-way heavy (truck) vehicle movements per day. A traffic assessment indicates that the Project will contribute to a small increase in vehicle numbers on Stuart Highway, and is not likely to impact on the capacity of the highway with the highway operating at around 3% of its design capacity.

3.8 Summary of social impacts and assessment

Table 3-1 summarises the issues and potential impacts discussed in Sections 3.2 to 3.7 and assesses the impacts in line with the likelihood and consequence framework described in Section 1.3.3.

Table 3-1 Summary and assessment of economic and social impacts

Impact description	Project phase	Nature of impact	Likelihood	Consequence	Impact significance
Business development opportunities, employment opportunities and flow on benefits experienced in the regional study area and wider area of influence.	Construction Operation	Positive	Almost certain	Significant	High
Upgrade of Ti Tree airport	Construction	Positive	Almost certain	Significant	High
Potential draw of existing workers into better paying resource jobs leading to shortfalls in other industries.	Construction Operation	Negative	Possible	Moderate	Medium
The remote location of the mine and with the workforce housed at the accommodation village, no impact to local community values, lifestyle and amenity are expected.	Construction Operation	Neutral	-	-	-
Due to the remote location of the mine, the medical facilities available on site, and with the workforce housed at the accommodation village, no impacts to local housing and social infrastructure services are expected.	Construction Operation	Neutral	-	-	-
Potential impacts from the transport corridor have been avoided by Project design elements which will maintain continued access to and within the station.	Operation	Neutral	-	-	-
Potential risk to the organic certification of Anningie and Stirling stations is unlikely due to Project design features.	Construction Operation	Neutral	-	-	-
No amenity impacts on surrounding sensitive receptors are predicted	Construction Operation	Neutral	-	-	-
Impact from traffic is unlikely due to fencing of the transport corridor, underpass of Stuart Highway, appropriate intersection design and low vehicle numbers.	Construction Operation	Neutral	-	-	-

4. Impact Mitigation and Management Strategies

4.1 Introduction

As assessed in Table 3-1 the Mount Peake Project is not expected to generate any significant negative social impacts.

4.2 Stakeholder engagement and grievance management

TNG is committed to continued and ongoing engagement with stakeholders throughout the planning, development and operation phases of the Project. The objectives of ongoing engagement are to:

- Maintain an open dialogue regarding Project timing and activities as approvals are secured
- Encourage stakeholders to continue to raise concerns and queries directly with TNG for response or resolution throughout the Project planning, development and operation phases.

Consultation will continue throughout the life of the Project to ensure the consideration of all relevant and appropriate opportunities and concerns. TNG values all stakeholder comments and feedback, and will assess all stakeholder concerns or issues about the Project and take appropriate action as required.

TNG will have in place a *Grievance Management Procedure* that is communicated to all relevant staff members. All community enquiries and complaints will be responded to promptly in accordance with the protocol. This will involve the following steps:

- Capture enquiry or complaint and record details, including time and date the call/email is received, contact name, phone number, and nature of enquiry/complaint and any response provided
- Assess and investigate enquiry/complaint by the relevant business unit and escalate if unable to be resolved
- Where a complaint involves a reportable incident, notify the relevant regulatory authorities as required
- Where possible, provide the enquirer/complainant a timeframe for responding to them or resolving the issue, and keep them updated on progress
- Close out complaint/enquiry and record all communication actions and responses.

4.3 Opportunities for Indigenous communities

TNG will continue to engage with the traditional owners and maintain community relations with Indigenous communities and Land Councils relevant to the Mount Peake Project. In consultations with the Land Council TNG has negotiated an Indigenous Land Use Agreement with the traditional owners of the Mount Peake Project area.

Through the cultural heritage management plan and native title processes TNG will continue to work with traditional owners to further develop and agree on Indigenous business and employment opportunities. Through the implementation of its Indigenous Relations Policy, TNG will ensure that mutual benefits from mining activities, such as employment and training, are shared with local communities.

4.4 Workforce management

TNG will have in place a Workforce Management Plan (WMP) to manage the Project workforce, maximise benefits for local employment and manage cumulative impacts on demand for local workers.

A number of specialist contractors will be engaged through the construction and operations phases of the Project. It will be the responsibility of the contractors to recruit and manage the workforce that they require. Through the terms and conditions of engagement the contractors will be responsible for implementing the WMP.

The WMP will include:

- Details on project workforce numbers, project timing, rosters, and travel arrangements
- Preference for local recruitment for direct as well as contractor employment opportunities, through advertising with local recruitment agencies
- Engagement with local Indigenous and non-Indigenous local recruitment agencies to maximise local employment on the Project
- Opportunities for flexible and family friendly rosters
- Equal employment opportunities
- A Workers Health and Safety Management Plan including access to first aid, medical and occupational therapy services
- Access to counselling services and other resources relating to personal and family issues
- A workers Code of Conduct will be applicable to all construction and operations employees, contractors, subcontractors and consultants working on the Project, at all times when on duty and/or attending work related functions. The Code of Conduct will be linked to employee contract conditions and will require employees to:
 - Comply with relevant Territory and Commonwealth laws
 - Abstain from any illegal drug use
 - Maintain behavioural standards at all times including the prohibition of alcohol and drugs ('zero tolerance' for drug and alcohol abuse) whilst working and limiting its use at other times in a manner that is consistent with maintaining appropriate standards of behaviour. This will be monitored through mandatory drug and alcohol testing; Workforce behavioural standards will be incorporated into employment conditions. Clear consequences for workers not adhering to behavioural standards will be set out, including dismissal for serious non-conformances or repeated offences
 - Be respectful of the communities within which they work and visit and refrain from any behaviour which could be harmful and/or result in negative impacts on the communities in which they work
 - Use work vehicles appropriately and in accordance with the company's policies regarding transportation to and from the site
- Workers induction and education programs that include education and awareness on:
 - Workers Code of Conduct
 - Workers Health and Safety Management Plan to encourage workers to access health services at early signs of illness, fatigue management, education on financial planning and investment

- Training and Up-skilling – To provide long term career pathways and ensure that an appropriately skilled workforce is employed, TNG will develop suitable training and apprenticeship programs in consultation with local training institutions.

4.5 Community benefit fund

As the Project will not result in any significant negative social impacts, no impact mitigation strategies are recommended in this ESIA. However as part of the long term relationship with the regional communities TNG would consider establishment of a community benefit fund to provide support for social infrastructure or other suitable development activities in the regional study area. The details of community benefit fund will be developed by TNG in consultation with the Central Desert Shire Council and other key stakeholders.

4.6 Monitoring and Review

It is possible that changes to the Project and the socio-economic and political context of the region may bring changes to the impacts identified and assessed as part of this ESIA. To accommodate changes over time, TNG would continue to monitor impacts through the ongoing stakeholder engagement and grievance management mechanisms. Reporting on social indicators would be included in TNG's annual internal reporting process.

The ESIA and the community benefit fund arrangements will be reviewed annually during construction and every five years during operations.

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Appendices

Appendix A – Risk Assessment Tables

Table A1 Likelihood criteria

Rating	Likelihood	Definitions
5	Almost certain	The event is expected to occur in most circumstances (the event is likely to occur once per year).
4	Likely	The event will probably occur in most circumstances (the event is likely to occur once every 1 – 2 years).
3	Possible	The event might occur at some time (the event is likely to occur once every 2 – 5 years).
2	Unlikely	The event could occur at some time (the event is likely to occur once every 5 – 10 years).
1	Rare	The event may occur only in exceptional circumstances (the event is unlikely to occur in any 10 year period).

Table A2 Consequence criteria

Rating	Consequence	Environment (including heritage)	Socio-economic and regulatory (including health and safety)
5	Critical	Extensive long term environmental harm or harm that is very widespread. Could include extensive pollutant discharges. Impacts permanent or unlikely to be reversible within 10 years. Unsalvageable and permanent damage to sensitive historic structures or sites of cultural significance. Substantial regional habitat modification and / or lifecycle disruption for a listed species. Moderate or substantial regional decrease in size of population(s) of listed species. Irreversible and / or extensive impact to soils. Chemical concentrations >10 times the ecological investigation levels (EILs). Widespread, permanent exceedance of background and applicable Water Quality guidelines.	Loss of life / fatality or long term or permanent disabling effects on human health (> one person). Increase of >10 annual non-fatal vehicle accidents. Fatal vehicle accident. Community condemnation and irreconcilable community loss of confidence. Public or media attention of national to international scale. Continuous exceedance of air quality or noise standards leading to respiratory or health impacts, or permanent loss of hearing. Irreversible changes to social characteristics and values of the communities of interest or community has no capacity to adapt and cope with change. Extensive flooding of critical mining infrastructure or third party property. Recovery unlikely. Severe action / prosecution by agencies such as NT EPA, DME, AAPA and NT WorkSafe. Major litigation or prosecution. >\$10m impact on company or stakeholders.
4	Major	Major or widespread, unplanned environmental impact on or off-site. Could include substantial pollutant discharges. Significant resources required to respond and rehabilitate. Major damage or infringement to sensitive historic structures or sites of cultural significance. Moderate regional habitat modification and / or lifecycle disruption for a listed species. Substantial local decrease in size of population(s) of listed species. Widespread and / or long term impact to soils. Chemical concentrations 5-10	Injuries requiring hospitalisation. Serious long term or permanent disabling effects on human health (one person). Increase of 5-10 annual nonfatal vehicle accidents. Prolonged community condemnation or annoyance and / or loss of confidence and local media attention. Regular exceedance of air quality or noise standards leading to regular complaints and / or temporary and reversible health complaints. A long-term recoverable change to social characteristics and values of the communities of interest or community has limited capacity to adapt and cope with change.

Rating	Consequence	Environment (including heritage)	Socio-economic and regulatory (including health and safety)
		times EILs. Local, permanent or widespread, long-term exceedance of background and applicable Water Quality guidelines.	Long-term opportunities emanating from the project. Extensive flooding of mining infrastructure or third party property. Repairs take more than 6 months. Major regulatory restrictions or orders – substantial prosecution. \$5m-\$10m impact on company or stakeholders.
3	Significant	Significant, unplanned environmental impact contained on-site or minor impact that is off-site. Considerable damage or infringement to sensitive historic structures or sites of cultural significance. Substantial local habitat modification and / or lifecycle disruption for a listed species. Moderate local decrease in size of population(s) of listed species. Localised long term or widespread short term soil impact. Chemical concentrations 2-5 times EILs. Local long-term or widespread short-term exceedance of background and applicable Water Quality guidelines.	Injury or illness requiring medical treatment. Short term or reversible disabling effect (impairment) to human health. Increase of 2-5 annual nonfatal vehicle accidents. Limited and localised loss of confidence by the community. Occasional exceedance of air quality or noise standards leading to nuisance impacts. Medium-term recoverable changes to social characteristics and values of the communities of interest or community has some capacity to adapt and cope with change. Medium term opportunities emanating from the project. Long term flooding of mining infrastructure or third party property. Repairs take 1-6 months. Significant breach of regulations. Direction to operate under limited regulatory restrictions or orders. \$2m-\$5m impact on company or stakeholders.
2	Moderate	Moderate, unplanned localised environmental impact (may be of a temporary nature) or discharge contained on-site or with negligible off-site impact. Moderate but repairable damage to important historic structures or sites of cultural importance. Moderate local habitat modification and / or lifecycle disruption for a listed species. Minor local decrease in size of population(s) of listed species. Localised soil impact. Low level <2 times exceedance of EILs. Local short-term minor exceedance of background and applicable Water Quality guidelines.	Injuries requiring first aid treatment. Minor short term inconvenience or symptoms to human health. Increase of <2 annual nonfatal vehicle accidents. Localised community impacts and concerns. No exceedance of air quality or noise standards but some amenity impacts / complaints. A short-term recoverable change to social characteristics and values of the communities of interest or community has substantial capacity to adapt and cope with change. Short-term opportunities emanating from the project. Short term flooding of mining infrastructure or third party property. Repairs, if needed, take 1 week to 1 month. Some regulatory restrictions, associated with breach of regulation with investigation or report to authority necessary. \$100k-\$2m impact on company or stakeholders.
1	Minor	Minor environmental impact. Impacts are contained on-site and short term in nature. No detrimental effect on the environment. Minor repairable damage to common historic structures or sites. No disturbance of cultural heritage sites. Minor local habitat modification and / or lifecycle disruption for a listed	Incident with or without minor injury. No impact on human health or very minor short term inconvenience or symptoms. No increase in vehicle accidents. Isolated community or individual issue-based concern and complaints. No exceedance of air quality or noise standards. Local, small-scale, easily reversible change on social

Rating	Consequence	Environment (including heritage)	Socio-economic and regulatory (including health and safety)
		species. No loss of individuals of listed species. Negligible soil impact. Chemical concentrations are above background but below EILs. No detectable change to background water quality. No exceedance of background and applicable Water Quality guidelines.	characteristics or values of the communities of interest or communities can easily adapt or cope with change. Local small-scale opportunities emanating from the project that the community can readily pursue and capitalise on. Minor flooding of mining infrastructure or third party property. Repairs, if needed, take <1 week. Minor issues around non-compliance. <\$100k impact on company or stakeholders.

Table A3 Impact significance matrix

	Severity of Consequence					
		Critical (5)	Major (4)	Significant (3)	Moderate (2)	Minor (1)
Likelihood of Consequence	Almost Certain (5)	Extreme	Extreme	High	High	Medium
	Likely (4)	Extreme	High	High	Medium	Medium
	Possible (3)	Extreme	High	Medium	Medium	Low
	Unlikely (2)	High	Medium	Medium	Low	Very Low
	Rare (1)	Medium	Medium	Low	Low	Very Low

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Document Status

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0	P. Mandke	I. McCardle				27/11/2015

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Appendix M

Conceptual Mine Closure Plan





TNG Limited

Mount Peake Project

Conceptual Mine Closure Plan

December 2015

Limitations

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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 TNG Limited 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.

Please cross reference page numbers from the Mine Closure Plan where appropriate, and provide comments or reasons for No (N) or Not Applicable (NA) answers.

Q No	Mine Closure Plan (MCP) checklist	Y/N/NA	Page No.	Comments
1	Has the Checklist been endorsed by a senior representative within the tenement holder/operating company? (See bottom of checklist.)			
Public Availability				
2	Are you aware that from 2015 all MCPs will be made publicly available?			
3	Is there any information in this MCP that should not be publicly available?			
4	If "Yes" to Q3, has confidential information been submitted in a separate document/section?			
Cover Page, Table of Contents				
5	Does the MCP cover page include: • Project Title • Company Name • Contact Details (including telephone numbers and email addresses) • Document ID and version number • Date of submission (needs to match the date of this checklist)			
Scope and Purpose				
6	State why the MCP is submitted (e.g. as part of a Mining Proposal, a reviewed MCP or to fulfil other legal requirements)			
Project Overview				
7	Does the project summary include: • Land ownership details (include any land management agency responsible for the land / reserve and the purpose for which the land / reserve [including surrounding land] is being managed) • Location of the project; • Comprehensive site plan(s); • Background information on the history and status of the project.			
Legal Obligations and Commitments				
8	Does the MCP include a consolidated summary or register of closure obligations and commitments?			
Stakeholder Engagement				
9	Have all stakeholders involved in closure been identified?			
10	Does the MCP include a summary or register of historic stakeholder engagement with details on who has been consulted and the outcomes?			
11	Does the MCP include a stakeholder consultation strategy to be implemented in the future?			
Post Mining land use and Closure Objectives				
12	Does the MCP include agreed post-mining land use(s), closure objectives and conceptual landform design diagram?			
13	Does the MCP identify all potential (or pre-existing) environmental legacies, which may restrict the post mining land use (including contaminated sites)?			
14	Has any soil or groundwater contamination that occurred, or is suspected to have occurred, during the			

Q No	Mine Closure Plan (MCP) checklist	Y/N/NA	Page No.	Comments
	operation of the mine, been reported to DER as required under the Contaminated Sites Act 2003?			
Development of Completion Criteria				
15	Does the MCP include an appropriate set of specific completion criteria and closure performance indicators?			
Collection and Analysis of Closure Data				
16	Does the MCP include baseline data (including pre-mining studies and environmental data)?			
17	Has materials characterisation been carried out consistent with applicable standards and guidelines (e.g. GARD Guide)?			
18	Does the MCP identify applicable closure learnings from benchmarking against other comparable mine sites?			
19	Does the MCP identify all key issues impacting mine closure objectives and outcomes (including potential contamination impacts)?			
20	Does the MCP include information relevant to mine closure for each domain or feature?			
Identification and Management of Closure Issues				
21	Does the MCP include a gap analysis/risk assessment to determine if further information is required in relation to closure of each domain or feature?			
22	Does the MCP include the process, methodology, and has the rationale been provided to justify identification and management of the issues?			
Closure Implementation				
23	Does the MCP include a summary of closure implementation strategies and activities for the proposed operations or for the whole site?			
24	Does the MCP include a closure work program for each domain or feature?			
25	Does the MCP contain site layout plans to clearly show each type of disturbance as defined in Schedule 1 of the MRF Regulations?			
26	Does the MCP contain a schedule of research and trial activities?			
27	Does the MCP contain a schedule of progressive rehabilitation activities?			
28	Does the MCP include details of how unexpected closure and care and maintenance will be handled?			
29	Does the MCP contain a schedule of decommissioning activities?			
30	Does the MCP contain a schedule of closure performance monitoring and maintenance activities?			
Closure Monitoring and Maintenance				
31	Does the MCP contain a framework, including methodology, quality control and remedial strategy for closure performance monitoring including post-closure monitoring and maintenance?			
Financial Provisioning for Closure				
32	Does the MCP include costing methodology, assumptions and financial provision to resource closure implementation and monitoring?			
33	Does the MCP include a process for regular review of the financial provision?			

Q No	Mine Closure Plan (MCP) checklist	Y/N/NA	Page No.	Comments
Management of Information and Data				
34	Does the MCP contain a description of management strategies including systems and processes for the retention of mine records?			

Corporate Endorsement:

I hereby certify that to the best of my knowledge, the information within this Mine Closure Plan and checklist is true and correct and addresses all the requirements of the Guidelines for the Preparation of a Mine Closure Plan approved by the Director General of the Department of Mines and Petroleum.

Name: _____ **Signed:** _____

Position: _____ **Date:** _____

(NB: The corporate endorsement must be given by tenement holder(s) or a senior representative authorised by the tenement holder(s), such as a Registered Manager or Company Director)

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Appendices

Appendix A – Closure data

Appendix B – Risk Assessment

1. Introduction

1.1 Project History

The Proponent for this project is TNG Limited (TNG), an Australian resource company focussed on exploration, evaluation and the development of a multi-commodity resource portfolio in the NT and Western Australia.

The Proponent submitted a Notice of Intent (NOI) for the project to the Northern Territory Environment Protection Authority (NT EPA) on 4 July 2013 for consideration under the NT *Environmental Assessment Act 1982* (EA Act).

On 13 November 2013 the NT EPA decided that the project required assessment under the Act at the level of an Environmental Impact Statement (EIS). The NT EPA released its Terms of Reference (ToR) for the Preparation of an Environmental Impact Statement in March 2014.

The Proponent also referred the project to the Commonwealth Department of the Environment (DotE) for consideration under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). On 13 November the project was determined to be a Controlled Action under the EPBC Act due to the potential for significant impacts to listed threatened species and communities (Sections 18 & 18A).

The project assessment as an EIS complies with the Bilateral Agreement provisions between the Commonwealth of Australia and the Northern Territory relating to environmental assessment, which allows the Commonwealth Minister for the Environment to rely on specified environmental impact assessment processes of the Northern Territory in assessing actions under the EPBC Act.

The ToR detailed a number of matters to be addressed in the EIS document, one of which is Mine Rehabilitation and Closure. A key requirement is the preparation of a conceptual Mine Closure Plan (MCP) and a Care and Maintenance Plan should temporary closure of the Project be required. A final MCP will be prepared and submitted as a component of the Mining Management Plan to be submitted to the NT Department of Mines and Energy.

The ToR require the MCP to be prepared consistent with a Guidance document jointly released by the Western Australian (WA) Department of Mines and Petroleum (DMP) and Environmental Protection Authority (EPA) in 2011 titled *Guidelines for preparing mine closure plans*. The WA DMP/EPA released a revised version of this Guideline in May 2015.

This document has been prepared consistent with the 2015 version of the WA mine closure plan guidelines.

1.2 Terms of Reference

Table 1 lists the relevant requirements in the NT EPA (2014) terms of reference for the project EIS that relate to mine closure. The table also provides a cross reference to sections in the MCP where each requirement is addressed.

Table 1 Terms of Reference details related to closure

ToR (2014) details related to closure	Reference
3.3.12 Closure and rehabilitation	
Discuss the various aspects of proposed progressive and final rehabilitation of disturbed areas, including: - proposed staging/timing; - soil profile reconstruction; - final landform design and any voids or landscape depressions to be left at cessation of mining; - rehabilitation techniques to be used and the final topographic and drainage morphology; - the proposed revegetation program, with selection and collection of local native species (e.g. native grasses and other vegetation); - other preparations required for successful rehabilitation (seed harvesting, seedling generation, etc.); and - closure plans for individual Project components including the WRD, TSF, Pit(s), pipelines, corridors, roads, etc.	10.3 10.4, 10.5 3.6 10.5; 10.6 Table 9 7.2
Describe mine closure plans including: - plans for unexpected or forced closure; - removal of plant, equipment, structures, hardstand and concrete footings, buildings, water storages, and methods proposed for stabilisation of affected areas; - reinstatement of creeks where diversion of creeks is proposed during operations; and - future land tenure arrangements.	10.1 10.2 10.4 6
5.6 Rehabilitation and Mine Closure	
Key Risks - following closure and rehabilitation, potential for the mine to negatively impact the environment and/or associated communities; and - risk that the Project will create an ongoing environmental, social and/or economic legacy if operations are required to cease ahead of schedule due to unforeseen circumstances, prior to the planned closure and rehabilitation of the site.	9 10.1
Assessment of Risk - identify and discuss risks associated with final rehabilitation, revegetation and closure of the Project; and - demonstrate that identified risks associated with rehabilitation, revegetation and closure from the Project will be avoided, mitigated or otherwise minimised.	9 9.2

ToR (2014) details related to closure	Reference
Environmental Objectives The EIS should include a detailed assessment to demonstrate that: - as far as practicable, rehabilitation achieves a stable and functioning landform which is compatible with the surrounding landscape and other environmental values; and - the prevention and mitigation of risks associated with closure and rehabilitation of the Project are adequately addressed.	7 9
Information Requirements - outline final rehabilitation, revegetation and closure plans for all aspects of the Project on completion of mining on site; - based upon consultation with Traditional Owners, detail how rehabilitation and closure plans incorporate recognition and consideration of traditional knowledge, cultural values, land management systems and significance of particular species and places; - based upon landscape evolution modelling, demonstrate that legacy mine structures will be stable over a geologically relevant period; and - describe standards, guidelines and legislation applicable to rehabilitation and closure of the Project, and describe how such requirements will be met.	3.6 5 8.2, 11.2.3 Not in this MCP
Mitigation Provide a conceptual, whole-of-site Mine Closure Plan (MCP) (refer to the Western Australian Department of Mines and Petroleum and Environmental Protection Authority Guidelines for Preparing Mine Closure Plans: http://www.dmp.wa.gov.au/documents/ENV-MEB-121.pdf). The MCP must provide an understanding of the issues that require management at closure and demonstrate that all relevant issues and appropriate management measures have been identified. Demonstrate that closure will be achieved in line with the industry best practice, including: - contingency procedures in the event of any unexpected or temporary closure, to facilitate the closure process ahead of schedule, including making landforms secure and non-polluting; - revegetation of the disturbed sites using local native plant species similar in type, density and abundance to those existing in adjacent areas; - stabilisation of erosion, as far as can reasonably be achieved, to a level similar to comparable landforms in surrounding undisturbed areas. Information on the use of bunding and drainage around pits should be included; - measures required to prevent contamination of groundwater, including contamination of aquifers; - weed management; and - fire management.	1.1 10.1 10.5 11.2.5 10.9, 11.2.4, 11.2.6 11.2.3 10.7

ToR (2014) details related to closure	Reference
The EIS should also include details of a Care and Maintenance Plan which is based on the Mine Closure Plan. This Care and Maintenance Plan must include measures which outline how the Proponent will maintain its environmental obligations should the Project be temporarily closed.	10.1
Monitoring Describe the post-mining monitoring and reporting used to evaluate and report on the effectiveness of rehabilitation and closure methods. The MCP should outline contingency measures that will be implemented in the event that monitoring demonstrates that rehabilitation and/or mitigation measures have not been effective.	11

1.3 Stages of closure planning

At the time of preparation of this MCP, the project is still in the feasibility stage. While some elements are well defined, others are still being reviewed and refined. For this reason, this document presents information that is current at the present moment in time. Figure 1 shows that the WA guidelines acknowledge that mine closure planning is an adaptive process that changes during the life of mine to reflect the changing status of the operation.

This document therefore represents a Conceptual Mine Closure Plan for the project. ANZMECC (2000) defines a conceptual closure plan as identifying the key objectives for mine closure to guide project development and design.

This document includes a number of commitments for future actions as additional information is obtained that have an influence on mine closure planning. Table 2 provides a consolidated list of commitments made through the document

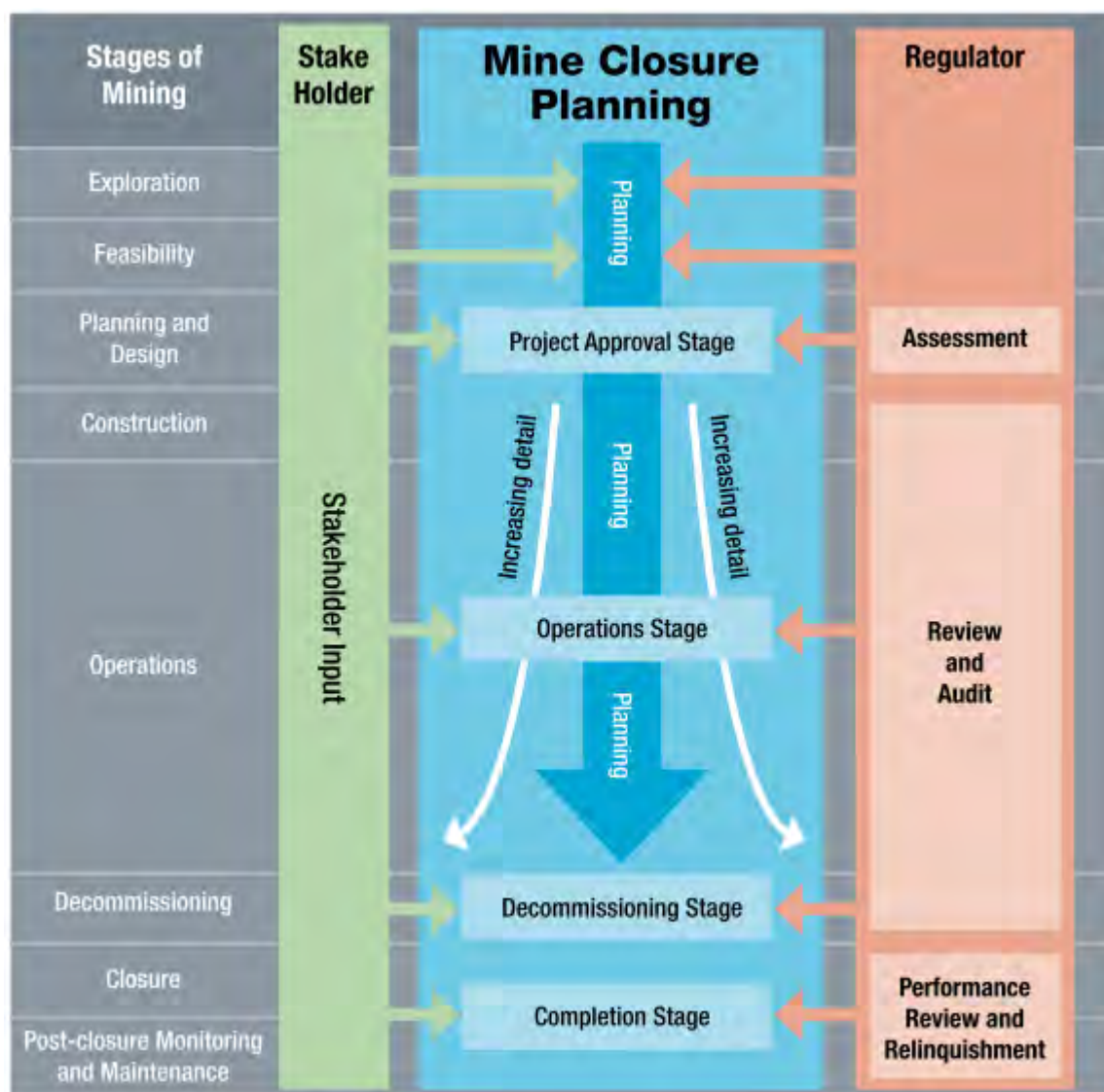


Figure 1 Stages of closure planning

Source: DMP/EPA (2015) Figure 2.

Table 2 Commitments

Commitment	Action	Page
Commitment 1	Establish and maintain a Compliance Register for the project that documents all approvals, permits and their conditions	16
Commitment 2	Establish and maintain a closure information register that records all relevant rehabilitation and closure related information for the site.	22
Commitment 3	Prior to closure, prepare a Decommissioning and Demolition Plan for infrastructure that is to be removed from site	29
Commitment 4	Establish an on-site bioremediation facility to treat hydrocarbon contaminated soil to levels that can be safely disposed to the site landfill or used in rehabilitation works	30
Commitment 5	Maintain regular communication with stakeholders during the life of mine with specific consultation on mine closure issues.	30
Commitment 6	Develop a progressive rehabilitation schedule as mine planning processes are further developed.	31
Commitment 7	Develop an initial rehabilitation species list based on baseline botanical information for use in mine rehabilitation. This list is to be reviewed and refined during the life of mine based on results of rehabilitation trials.	32
Commitment 8	Prepare a financial provision for closure and regularly update this closure cost during the life of mine to reflect the current circumstance of the mine.	38
Commitment 9	TNG will establish and maintain a document management system to store all relevant rehabilitation and closure information for the Mount Peake project	39

2. Scope and Purpose

2.1 Purpose of this report

This document constitutes the Mount Peake Mine Closure Plan (MCP), which will be submitted to the NT EPA as part of the EIS documentation for the Mount Peake project. This document is considered to be an adaptive document, to be updated by the Proponent on an as required basis and as supporting documentation to the Mining Management Plan.

This MCP document specifically satisfies requirements in the ToR (2014) sections 3.3.12 and 5.6.

2.2 Document Scope

This MCP provides a framework for TNG to plan rehabilitation and mine closure in an integrated manner. The aim of the MCP is to:

- describe the legislative framework within which this plan operates;
- document previous work undertaken related to facility closure and rehabilitation;
- identify closure domains relevant to the site;
- identify closure strategies for these domains which consider the current status of the facilities, manage the risks and satisfy closure objectives;
- support protection of the environment and public health and safety through safe and responsible closure practices;
- describe criteria for effective post-closure monitoring and management;
- indicate gaps in the existing work where further studies, trials and research are recommended and prioritise these tasks using a risk management approach; and
- provide a pathway to relinquishment of the site and conforming to or exceeding current industry standards for closure.

3. Project Overview

3.1 Ownership Details

The proponent for the project is TNG, an Australian resource company focussed on exploration, evaluation and the development of a multi-commodity resource portfolio in the NT and Western Australia.

Contact details for TNG are:

Paul Burton

Managing Director

PO Box 1126, Subiaco, WA 6904, Australia

ABN 12 000 817 023

Phone 9327 0900

Email peb@tngltd.com.au

3.2 Location

The Mount Peak Project is located approximately 235 km north-northwest of Alice Springs and approximately 50 km west of the Stuart Highway. The site will be accessed via a restricted, unsealed road from the highway.

3.3 Land Tenure

The mine pit will be located on Mining Lease Application (MLA) 28341 with processing facilities, waste rock dump, tailings storage facility and ancillary infrastructure on MLA 29855. The accommodation village will be located within MLA 29856, 5 km to the east of the mining area and the Adnera Loadout Facility on MLA 30686.

A proposed transport corridor for site access and product haulage runs 100 km south-east and then east from the mining area to the proposed load-out facility.

All tenements lie within the Stirling and Anningie perpetual pastoral leases aside from a portion of crown land adjacent to the Stuart Highway that is intersected by the transport corridor.

3.4 Land Use

Land use immediately adjacent to the Mount Peake project area is pastoral (cattle grazing).

The nearest sensitive receptor to the mining area is Anningie Station homestead approximately 30 km to the south west of the mining area.

3.5 Operations Summary

The Mount Peak Project will comprise:

- the mining of a polymetallic ore body through an open-pit truck and shovel operation;
- processing of the ore to produce a magnetite concentrate;
- road haulage of the concentrate to a new railway siding and loadout facility on the Alice Springs to Darwin railway near Adnera; and
- rail transport of the concentrate to TNG's proposed Darwin Refinery located at Middle Arm, Darwin.

The life of mine is expected to be 17 years, excluding closure and rehabilitation activities.

Mining will occur at a rate of up to 8.4 million tonnes per annum (Mtpa). Some 139 million tonnes (Mt) of material is expected to be extracted over the life of the mine, comprising approximately 78 Mt of ore and 61 Mt of waste.

Ore processing involves crushing, grinding and magnetic separation to produce a magnetite concentrate. Plant throughput will be 3 Mtpa initially, doubling to 6 Mtpa in year 5. Up to 1.8 Mtpa of concentrate will be produced. This will be stockpiled in a concentrate storage area. The plant will produce up to 4.2 Mtpa of tailings.

The concentrate will be trucked via the access road to a new rail siding and loadout facility at Adnera. Trucks will side dump concentrate to a stockpile adjacent to the rail siding. The stockpile will have storage capacity of up to 150,000 tonnes.

Train loading will occur using up to four front-end loaders directly loading rail wagons. The train will have a total length of 1.5 km and consist of 60 wagons with a total capacity of around 5,500 tonnes. Around one train movement per day is expected.

The Project will require approximately 2.6 Gigalitres per annum (GLpa) of water for mining, processing, dust suppression and potable use. A borefield will be established within the alluvial aquifer of the Hanson River. Around 12 supply and standby bores will be installed. A water supply pipeline will be constructed between the borefield and the site, a distance of approximately 49 km.

At full production the site is expected to require 24 MW of electricity. During the first four years this will be supplied by 16 x 1,400 kVA gas fired turbines, with an additional 12 turbines added from year five. Emergency backup will be provided from 3 x 1,250 kVA diesel generators. Gas will be provided from the Amadeus Gas Pipeline via a hot tap. Road train tankers will commute between the pipeline and the mine site along the access road.

An accommodation village will be established to the east of the mine site. The construction and operation workforces are estimated to peak at 225 and 170 personnel respectively. The workforces will be largely fly-in fly-out due to low population numbers in the local area. Workers will fly to Ti Tree and will then be bussed to site.

The project will therefore consist of the following main features:

- one open pit;
- one waste rock dump (WRD) with up to 70 Mt capacity;
- one thickened tailings storage facility (TSF) with up to 63.4 Mt capacity;
- temporary ore stockpile facility – four stockpiles of up to 4 Mt each;
- one beneficiating processing plant including a Run of Mine (ROM) pad and product (concentrate) stockpiles;
- one gas fired power station;
- one main access road from the mine to the Stuart Highway and rail siding;
- one rail siding;
- water supply bore field; and
- ancillary infrastructure - accommodation village, access tracks, power lines, site roads etc

3.6 Closure Domains

The project area has been divided into 9 domains. Figure 2 and Figure 3 show these domains.

1. open pit
2. waste rock dump (WRD) and Run of Mine (ROM) pad
3. tailings storage facility (TSF)
4. processing plant and power station
5. rail siding
6. access road
7. bore field
8. pipelines and power lines
9. ancillary infrastructure, hardstand areas, site roads etc.

Note: The four temporary ore stockpiles are expected to be reclaimed and processed during the life of mine. Only a bare hardstand area is expected to remain at mine closure.

3.6.1 Open pit

The open pit will cover approximately 77 ha and be approximately 2,000 m long, 600 m wide and 125 m deep.

3.6.2 Waste rock dump and Run of Mine (ROM) pad

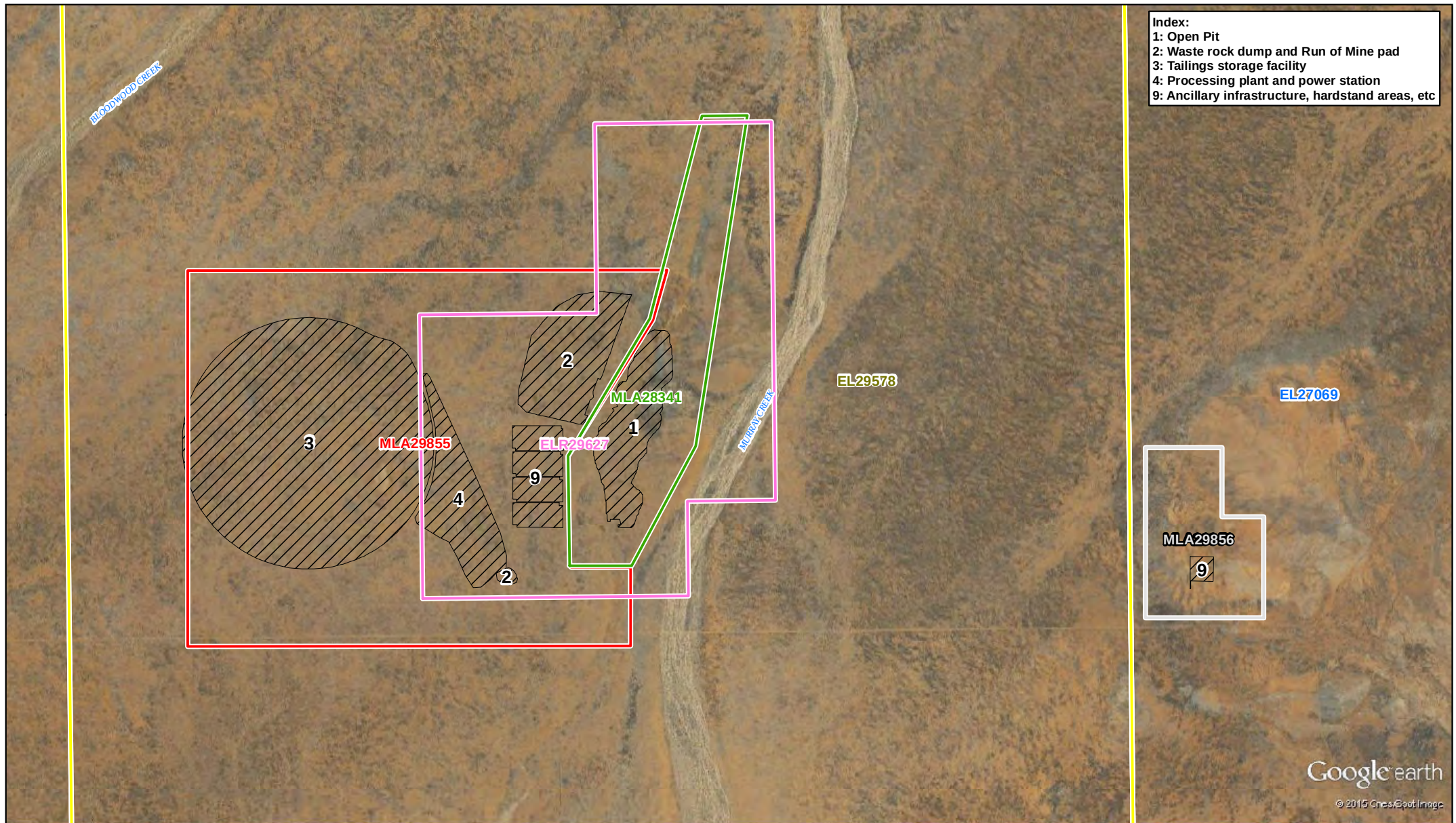
This domain includes the main mine WRD and the ROM pad near the process plant. The latter has been included in this domain as the structure itself is usually made from mine waste. At closure, rehabilitation principles of the WRD are similar to those of the ROM pad.

The WRD will have an ultimate height of 40 m and a footprint of 90 ha with capacity to store up to 70 Mt of mine waste. It will be constructed in 10 m lifts.

3.6.3 Tailings storage facility

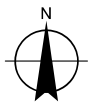
Tailings will be produced from the magnetic separation of the crushed and screened ore and will consist of non-magnetic silt and sand. Central Thickened Discharge was selected for tailings disposal based on balancing water recovery, environmental risk, the relatively flat nature of the site, ease of closure, and construction and operating costs. Beach slopes have shallow slope angles (about 3%). The storage area is bounded with a low perimeter embankment (nominal height of 2 m) which reduces the likelihood of any instability and failure.

The TSF is designed as a circular structure with a diameter of approximately 2.1 kilometres, a maximum height at the central cone of 32 m and total area inclusive of drainage works and a perimeter bund of approximately 475 hectares.



Index:
 1: Open Pit
 2: Waste rock dump and Run of Mine pad
 3: Tailings storage facility
 4: Processing plant and power station
 9: Ancillary infrastructure, hardstand areas, etc

Paper Size A4
 0 0.5 1 1.5
 Kilometres
 Map Projection: Transverse Mercator
 Horizontal Datum: GDA 1994
 Grid: GDA 1994 MGA Zone 53



LEGEND

Domain
 ELR29627
 MLA29856
 EL29578
 MLA28341
 EL27069
 MLA29855



TNG Ltd
 Mount Peake EIS

Job Number	61-29057
Revision	A
Date	23 Oct 2015

Domains - Mine Site

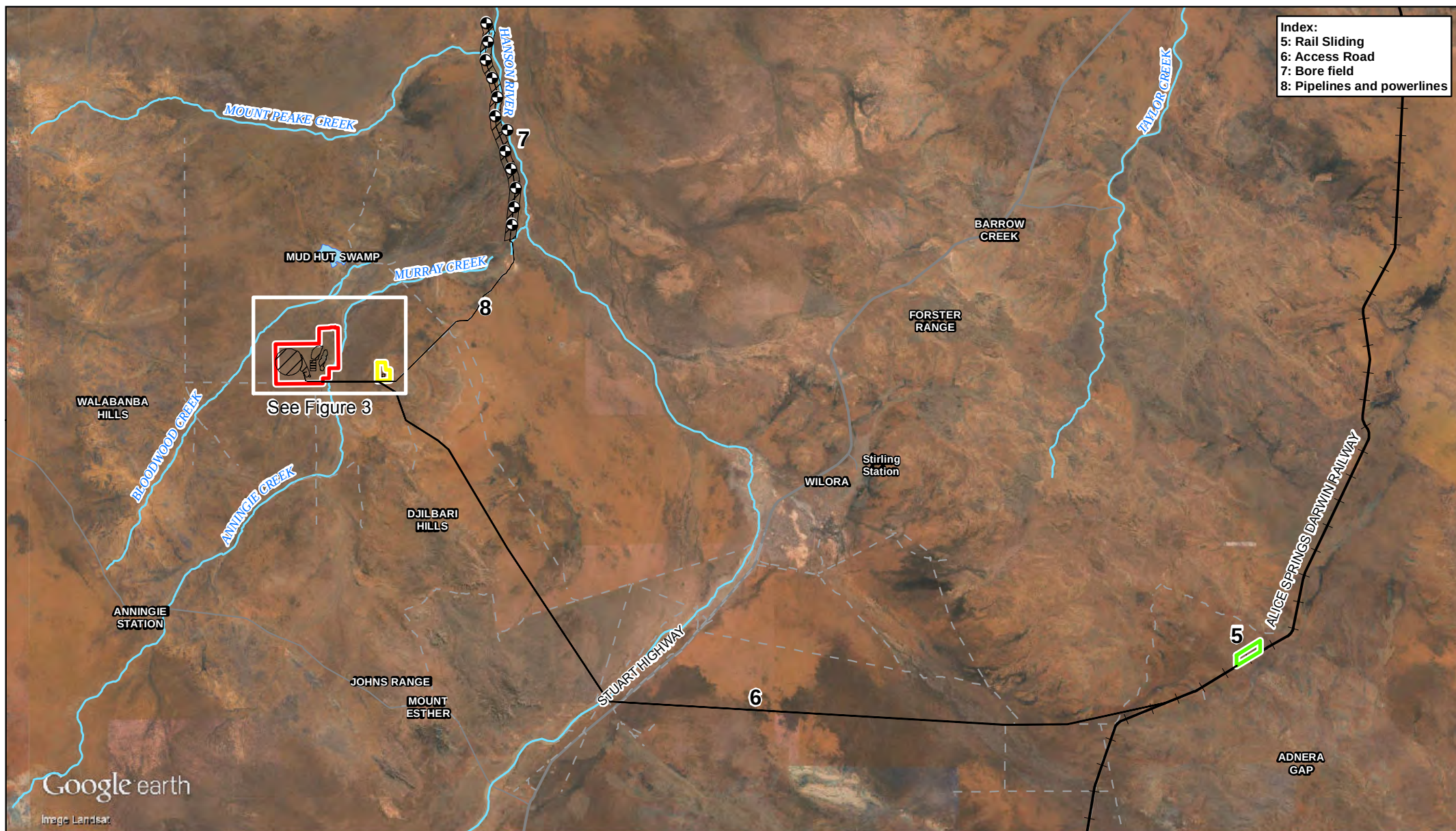
Figure 2

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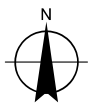
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Data source: Google Imagery - 20151021; TNG Ltd: Tenure - 20151021; GHD: Domains - 20151021. Created by: RB



Paper Size A4
 0 5 10 15
 Kilometres
 Map Projection: Transverse Mercator
 Horizontal Datum: GDA 1994
 Grid: GDA 1994 MGA Zone 53



LEGEND

- Potential Borefield
- Mount Peake Mining Area
- Railway
- Principal Road
- Camp Facilities
- Rail Siding Loading Facility
- Tracks (Unverified)
- Major Watercourses
- Minor Road
- Access Road Corridor



TNG Ltd
 Mount Peake EIS

Job Number | 61-29057
 Revision | A
 Date | 23 Oct 2015

Domains - Wider Project Area

Figure 3

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239 Adelaide Terrace Perth WA 6004 Australia T 61 8 6222 8222 F 61 8 6222 8555 E permail@ghd.com.au W www.ghd.com.au

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Data source: Google: Imagery - 20151021; TNG Ltd: Borefield, Tenure - 20151021; GHD: Domains - 20151021; GA: Railway, road, watercourse - 2008. Created by: RB

3.6.4 Processing plant and power station

This domain includes the main power generation and ore processing infrastructure on site. Figure 5 provides shows a concept design of the plant. The processing plant includes the plant site, water storage dams, power station, product stockpile storage and load-out area.

Power needs for mining and processing is estimated at 24 Megawatt (MW). Power is to be supplied by an on-site gas fired power station. Gas will be supplied from the nearby Amadeus Natural Gas Pipeline.

3.6.1 Rail siding

Road train trucks will transport the magnetite concentrate approximately 100 kilometres from the mine site to the Adnera rail siding located on the main Darwin-Adelaide rail line. Figure 4 shows the layout of infrastructure at the siding. Ore will be handled by front end loaders, loading directly from the product stockpile into rail wagons.

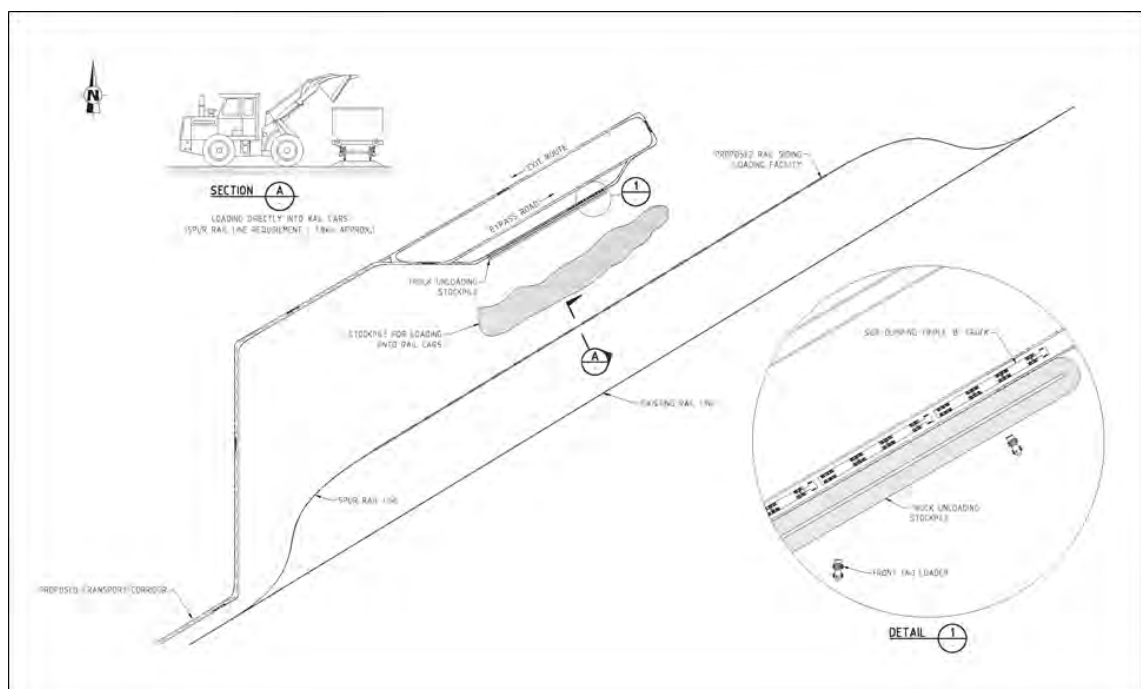


Figure 4 Rail siding layout

3.6.1 Access road

This domain includes the main site access road which also doubles as the product haul road.

3.6.2 Bore field

This domain includes the bore field with around 12 production and standby bores, and diesel generators and fuel storage tanks.

3.6.3 Pipelines and power lines

Like haul roads and access roads, pipelines and power lines are linear infrastructure. However, due to the specific nature of their infrastructure, they have been placed in a separate domain rather than include them with access roads.

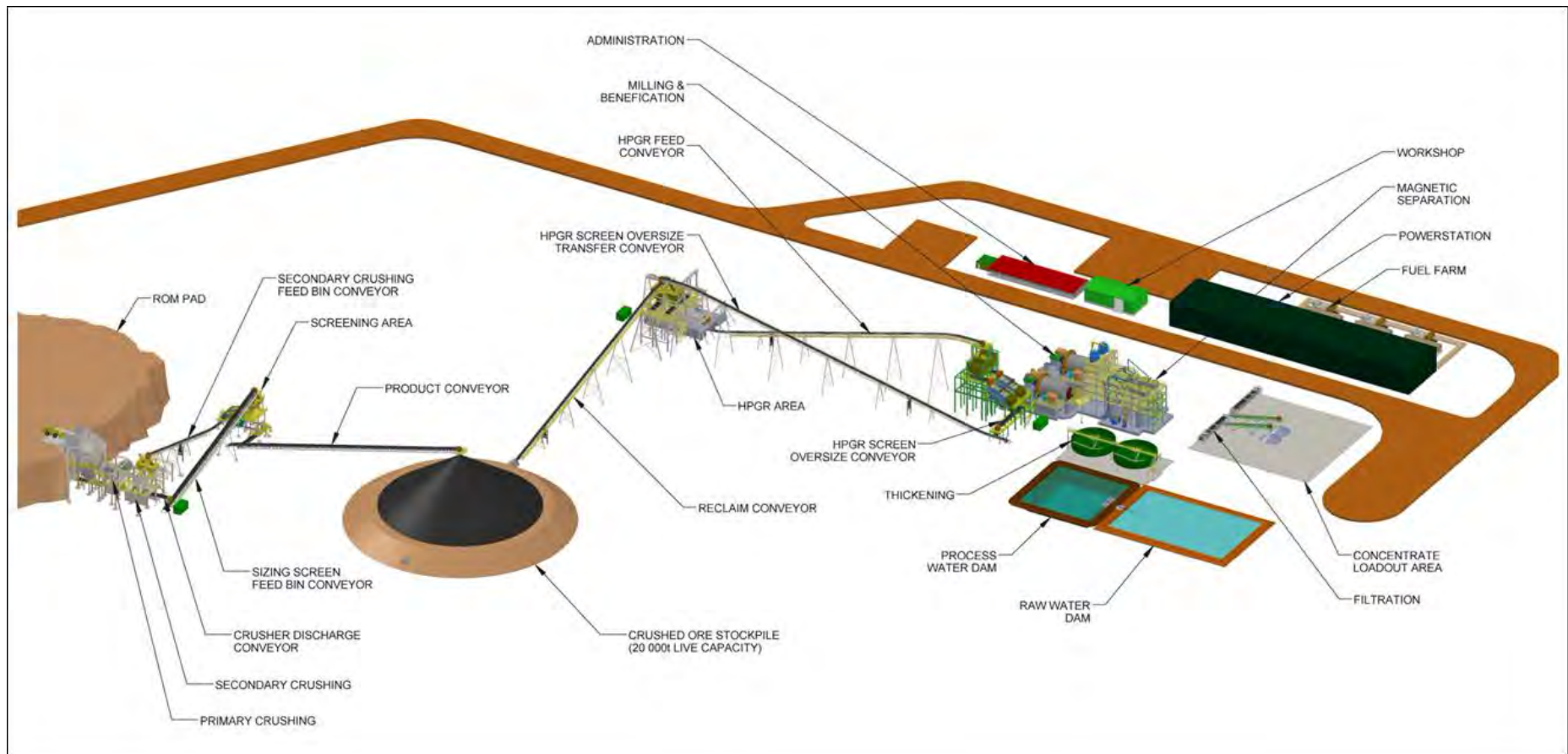


Figure 5 Process Plant Concept Design

3.6.4 Ancillary infrastructure

This domain includes a range of infrastructure that is not otherwise in another domain. It comprises the accommodation village, water storage dams, administration area, workshops, wash down bay, laydown yards, explosives magazine, fuel storage tanks and site roads.

3.7 Rehabilitation Status

As the project is still in the assessment phase, TNG does not yet have a Mining Authorisation, granted under the Mining Management Act (MMA). No mining disturbance has yet occurred.

In 2013 the Northern Territory Government implemented changes to the MMA. A key component of this was the introduction of an annual levy on mining securities. This is a non-refundable annual levy of 1% on the total calculated rehabilitation cost applied to each mining operation authorised under the MMA

Section 43A of the MMA provides that the Minister is to calculate the amount of security to be provided by an operator by reference to the level of disturbance likely to be caused by the mining activities.

These provisions have significant similarities to the WA Mining Rehabilitation Fund (MRF) that was introduced in WA in 2013. This also requires an annual, non-refundable levy of 1% on the total rehabilitation cost estimate, based on area of disturbances for different mine features. The MRF divides rehabilitation into three categories:

- Disturbed land - which has not been rehabilitated;
- Land under rehabilitation - where rehabilitation has been undertaken in accordance with the NOI / MP; and
- Rehabilitated land - that has achieved completion criteria and been signed off by the DMP.

A reduced levy rate applies for land under rehabilitation.

The purpose of including the above information in this section is to document that the Mining Authorisation, when obtained, will likely include a requirement for an annual levy payment. The quantum of the levy will be determined by the area of disturbance and reduced by the area of disturbed land that is progressively rehabilitated during the life of mine.

Future versions of the MCP need to document the disturbed area and rehabilitated area of the mine for annual levy payments.

4. Compliance Register

TNG will establish a Compliance Register for the Mount Peake project. At this point in time, key approvals/authorisations have not been finalised, so the specifics of approval conditions are not yet known.

Commitment 1: Establish and maintain a Compliance Register for the project that documents all approvals, permits and their conditions

The Compliance Register includes a 'summary dashboard' that allows the Company to track compliance with tenement and approval conditions and documents when annual reports are due. Future versions of the MCP will include the current status of the summary dashboard.

5. Stakeholder Engagement

Stakeholder engagement is a key tool in understanding community and stakeholder perceptions of mine closure and how mine closure may affect the surrounding communities. It can also help to optimise outcomes of mine closure planning. TNG understands that stakeholder engagement is important for building relationships with stakeholders and generating a sense of trust that the views and concerns of stakeholders will be addressed in the event of mine closure.

TNG is committed to stakeholder engagement for its Mount Peaks operation and has put in place a stakeholder engagement process for mine closure planning that aims to:

- identify relevant stakeholders;
- understand stakeholder concerns and issues as they relate to mine closure;
- identify potential impacts of change during and after mine closure, together with appropriate mitigation measures; and
- invite stakeholders to participate in consultation activities, so feedback can be used to inform mine closure decision making on post-mining land use and relevant closure criteria.

An overview of the stakeholders identified is shown in Table 3

Table 3 Key Stakeholders

Stakeholder group	Closure Issues
Government	Ensure that TNG meets relevant regulatory and legislative requirements. Able to identify and resolve issues related to mine closure early in the process.
Local community	The closure of a mine has the potential to impact upon local businesses and service providers, landowners and the local community, non-government organisations and community groups.
Internal stakeholders	Employees directly affected by employment continuity must be engaged with, and supported through the mine closure process. Management team needs to be engaged in order to promote continuity of corporate knowledge and support those responsible for implementing the closure plan. Shareholders may also need to be informed of obligations for closure.

Table 4 provides a summary of the consultation register. As the site is still in the regulatory approval stage, no specific closure consultation has yet occurred. As the project commences, records of engagement with stakeholders on mine closure issues will be included in Table 4. This will include what issues were raised during consultation with stakeholders and where the issue has been addressed in the Mine Closure Plan.

Table 4 Consultation Register

Date	Type	Parties Involved	Discussion and Outcome

6. Post Mining Land Use

The existing land use is pastoral (cattle) grazing. The majority of the Mount Peake project is located on the Stirling pastoral station. A small component of the transport corridor may be located on the Anningie pastoral station.

TNG considers the post mining land use will revert back to pastoral use.

At mine closure, the following mine features will remain as major landform features, essentially in perpetuity:

- one open pit mine void;
- one WRD; and
- one TSF.

Mine features that are restricted to surface disturbance only include the processing plant, roads, accommodation village and other ancillary infrastructure. These will have the infrastructure removed and the surface topography rehabilitated at closure.

7. Closure Objectives and Completion Criteria

Closure objectives define the closure outcomes for the project and should be realistic and achievable. The closure objectives defined in Section 7.1 and Table 5 have been developed to provide a clear indication to Government and the community on what TNG commits to achieve at closure.

7.1 General Closure Objectives

The following overall closure objectives have been developed by TNG for mine features associated with the project. The general mine closure objectives for decommissioning and closure are that:

- all hazardous chemicals are removed from site and disposed of appropriately. Hazardous material not able to be removed is encapsulated or otherwise contained on site so that no off-site environmental impact occurs;
- all infrastructure not subject to relinquishment agreements is either reused, recycled, disposed to site landfill or removed from site and disposed of appropriately;
- all rubbish is disposed to onsite landfill;
- areas disturbed by mining activities are stable, have vegetation communities that are representative of the region and provide habitat for local fauna; and
- any contaminated sites will be identified, remediated or appropriately managed.

7.2 Completion Criteria

Completion criteria are necessary to provide the basis on which successful rehabilitation and mine closure, and achievements of closure objectives are determined. Completion criteria have been developed from the closure objectives, in order to provide distinct and measurable criteria for successful rehabilitation of the Mount Peake operation.

Completion criteria allow for verification of environmental outcomes for the project area as well as each features final design and rehabilitation. Verification methods include monitoring results, management audits, design sign-off and comparison against reference documents.

At the current early stage of the mine's life, it is unrealistic to establish final completion criteria. Results of progressive rehabilitation and monitoring of other mine features is required before the proponent can be confident that the stated criteria can be achieved. Therefore, interim completion criteria have been proposed. Target (final) completion criteria have also been documented. Future versions of the MCP will review these criteria against the developing body of closure knowledge and revise the criteria if considered necessary.

Table 5 outlines the closure issues (risks), objectives and completion criteria for each major mine feature. Some completion criteria can be applied to common features across the site. Measurement tools have been selected to allow quantitative assessment of rehabilitation performance. Completion criteria may be refined during the life of mine as stakeholder consultation continues, further monitoring is undertaken and more information becomes available. Any changes will be incorporated into subsequent versions of the MCP.

Table 5 Closure objectives and criteria

Domain No.	Mine Feature	Closure Objectives	Interim Completion Criteria	Target Completion Criteria	Measurement Tools / Performance indicators
All	General / site wide:	Hazardous material is remediated, encapsulated or contained to prevent off-site environmental impact. No infrastructure that is not subject to relinquishment agreements remains onsite. No rubbish remains onsite. Rehabilitated land is comparable to analogue sites. Contaminated sites are appropriately remediated.	Hazardous materials confined to prevent off site environmental impact. Infrastructure removed. Disturbed areas rehabilitated.	Contaminated sites remediated in-situ where possible. Contaminated sites not able to be remediated or removed are properly defined and registered. All infrastructure not subject to a sequential use agreement is removed. Disturbed areas rehabilitated.	Contaminated sites audit. Decommissioning audit. Audit by TNG to confirm initial rehabilitation works have been constructed according to design. Completion of audit inspection checklist (to be prepared by TNG). Rehabilitation monitoring results.
1	Open pit	Entry into open pit is restricted by the presence of landforms and abandonment bunds. Abandonment bund constructed to required specifications. Clean water catchments are excluded from the open pit.	Abandonment bund effectively restricts access to open pit. Abandonment bund is constructed in accordance with the Safety Bund Walls around Abandoned Open Pit Mines Guidelines (DoIR, 1997).	Vehicle access prevented to abandoned open pits.	Visual inspections and completed checklist. Decommissioning audit. Audit by TNG to confirm initial rehabilitation works have been constructed according to design. Completion of audit inspection checklist (to be prepared by TNG).
2	Waste rock dump (WRD) and Run of Mine (ROM) pad	Final landform is geotechnically stable and safe. Surface and outer slopes of the waste rock dumps resist erosion. Drainage from the WRD and ROM pad does not cause significant contamination of local surface waters or harm to local vegetation.	The landform is stable and safe. There are no mass vegetation deaths caused by AMD or salt in the vicinity of the landform.	Landform is safe, stable and rehabilitated. Rehabilitation monitoring results trending upward or above minimum analogue values.	Stability assessment undertaken in accordance with defined procedures. Visual inspections and completed checklist. Decommissioning audit. Audit by TNG to confirm initial rehabilitation works have been constructed according to design. Completion of audit inspection checklist (to be prepared by TNG). Rehabilitation monitoring results
3	Tailings storage facility (TSF)	Final landform is stable and safe. Surface of the TSF resists erosion. Drainage or seepage from the TSF does not cause significant contamination of local surface waters or harm to local vegetation.	The landform is stable and safe. Erosion of any waste rock cap does not liberate tailings material. Stability assessment undertaken in accordance with defined procedures or standards. Water quality parameters in groundwater monitoring bores do not exceed values representative of analogue sites and/or baseline data. There are no mass vegetation deaths in the vicinity of the landform.	TSF safe, stable, capped and rehabilitated. Groundwater monitoring results within agreed closure criteria. Rehabilitation monitoring results trending upward or above minimum analogue values.	Stability assessment undertaken in accordance with defined procedures or standards. TSF monitoring register to be maintained Visual inspections and completed checklist. Water quality monitoring results. Water quality records of local surface and ground water. Rehabilitation monitoring results
4	Process plant and power station	All infrastructure that is not subject to a sequential use agreement is removed from site. Hazardous material is remediated, encapsulated or contained to prevent off-site environmental impact. No rubbish remains onsite. Contaminated sites are appropriately remediated.	Hazardous materials confined to prevent off site environmental impact. Infrastructure removed. Disturbed areas rehabilitated.	Contaminated sites remediated in-situ where possible. Contaminated sites not able to be remediated or removed are properly defined and registered. All infrastructure not subject to a sequential use agreement is removed. Disturbed areas rehabilitated.	Contaminated sites audit. Decommissioning audit. Audit by TNG to confirm initial rehabilitation works have been constructed according to design. Completion of audit inspection checklist (to be prepared by TNG). Rehabilitation monitoring results.
5	Rail siding	No infrastructure that is not subject to a sequential use agreement remains onsite.	All infrastructure not subject to a sequential use agreement is removed. Disturbed areas rehabilitated.	Infrastructure removed. Disturbed areas rehabilitated.	Decommissioning audit. Audit by TNG to confirm initial rehabilitation works have been constructed according to design. Completion of audit inspection checklist (to be prepared by TNG). Rehabilitation monitoring results.

Domain No.	Mine Feature	Closure Objectives	Interim Completion Criteria	Target Completion Criteria	Measurement Tools / Performance indicators
6	Access road	The access road, if beneficial to the community, government agencies or landowners, will be left in place, otherwise it will be removed. Natural drainage lines re-instated. Vehicular access required for monitoring purposes is maintained. Rehabilitated road areas are stable and non-eroding.	Roads are reshaped in order to re-instate natural drainage lines and waters are not impounded. Roads required for monitoring and maintenance are in useable condition. Rehabilitated road areas are stable and non-eroding.	Surface infrastructure not disrupting natural drainage lines. Disturbed areas rehabilitated.	Visual inspections and completed checklist. Decommissioning audit. Audit by TNG to confirm initial rehabilitation works have been constructed according to design. Completion of audit inspection checklist (to be prepared by TNG). Rehabilitation monitoring results
7	Bore field	All pumps, pump stations and pipeline control infrastructure are removed and recycled if feasible or disposed of to an appropriate landfill. Disturbed areas rehabilitated.	All infrastructure removed. Rehabilitated areas are stable and non-eroding.	All infrastructure removed. Disturbed areas rehabilitated.	Visual inspections and completed checklist. Decommissioning audit. Audit by TNG to confirm initial rehabilitation works have been constructed according to design. Completion of audit inspection checklist (to be prepared by TNG).
8	Pipelines and power lines	Above ground pipelines are removed, recycled if feasible, or disposed of to an appropriate landfill. Below ground pipelines are grouted at openings and any surface obtrusions are buried more than 600 mm below the surface. All power infrastructure and power controls are recycled if feasible or disposed of to an appropriate landfill. Underground services are left in situ and any surface obtrusions are removed or buried at least 600 mm below the surface	Above ground pipelines, pumping and power infrastructure are removed. Buried pipelines are flushed, emptied, grouted at either end and buried at least 600 mm below the surface.	All infrastructure not subject to a sequential use agreement is removed.	Decommissioning audit. Audit by TNG to confirm initial rehabilitation works have been constructed according to design. Completion of audit inspection checklist (to be prepared by TNG).
9	Ancillary infrastructure areas	Infrastructure that is beneficial to sequential land users will be transferred to the new owner via a sequential use agreement. All mobile plant, transportable structures and consumables are reused, recycled, removed or disposed of appropriately. Permanent structures are demolished and recycled if economically feasible, disposed of to an onsite landfill, or removed from site and disposed of appropriately. All concrete pads and footings are broken up and buried at least 1 m below the surface or disposed of to landfill.	All infrastructure, mobile plant, transportable structures and consumables are removed. Concrete is buried to a depth of at least 1 m below ground level.	All infrastructure not subject to a sequential use agreement is removed.	Decommissioning audit. Audit by TNG to confirm initial rehabilitation works have been constructed according to design. Completion of audit inspection checklist (to be prepared by TNG).

8. Closure Data

8.1 Baseline Data

The EIS includes baseline information on the following environmental factors:

- soils and geology
- surface water
- groundwater
- air quality;
- noise;
- flora and vegetation;
- fauna;
- social environment; and
- heritage

8.2 Closure Related Data

As the project has not yet commenced, no specific closure related data and information has yet been produced.

In addition to the baseline information presented in Section 8.1 it is important that collection of environmental data continues through the project's life to include data from scheduled monitoring, progressive rehabilitation, field trials and studies. The objective is to build a library of information during the life of mine relevant to closure of mine features or infrastructure. The contents of this library are to be collated in a 'Closure Information Register'. Relevant information includes:

- monitoring data collected during the life of mine;
- spatial datasets and databases;
- as constructed designs of landforms and voids;
- availability of key materials required for rehabilitation such as competent waste rock, subsoil and topsoil;
- seed mixes used in rehabilitation and any information gathered from trials; and
- computer models that predict long term erosion performance.

Commitment 2: Establish and maintain a closure information register that records all relevant rehabilitation and closure related information for the site.

8.3 Knowledge Gaps

Analysis of collected data is a critical element in understanding the issues affecting mine closure and identifying knowledge gaps. Knowledge gaps and the methods proposed to address these issues are identified in Table 6. This table will be reviewed through the life of mine and updated in subsequent revisions of the MCP.

Table 6 Knowledge Gaps

Knowledge gap	Future studies	Proposed timeline for action	Intended outcome
Lack of monitoring data on rehabilitation performance against completion criteria	Monitor analogue sites and rehabilitation areas against erosion and vegetation establishment parameters	TBA	Monitoring data over time confirming successful establishment of rehabilitation
Ability to salvage sufficient quantity of seed for rehabilitation in the local area	Undertake initial seed collection programs to gauge availability of seed for rehabilitation in the local area	TBA	Confirm the sufficient seed can be collected locally
Insufficient material for rehabilitation (topsoil, armour rock etc)	Undertake a materials balance inventory to quantify the material required for mine closure	TBA	Confirm that sufficient material is available for rehabilitation

9. Closure Issues

9.1 Risk Identification

Environmental management of impacts is based on the risk management framework. The main objectives of environmental management are:

- identify activities that could result in significant environmental impacts to key factors;
- quantify the relative level of inherent risk from the activity (without control measures applied);
- develop control measures to reduce the inherent risk to an acceptable level (residual risk);
- document these measures so they become part of the Company's environmental management requirements; and
- monitor the effectiveness of implementing these control measures.

The Australian and New Zealand Standard on Risk Management (AS/NZS 4360) defines risk as the product of the likelihood of an event occurring and the consequence of that event. A key outcome of risk management is to rank impacts and risks, so specific management measures can be developed for high risk impacts, to reduce the risk to as low as practicable. TNG adopts the mitigation sequence for environmental management. The mitigation sequence is:

- Avoid avoid the impact altogether
- Minimise limit the severity of the impact
- Rectify rehabilitate affected site as soon as possible
- Reduce eliminate impact over time
- Offset if significant residual impacts remain to critical value assets

A risk matrix based on AS/NZS 4360:2004 has been developed to assess the level of risk from activities undertaken in this project (Table 7). To maximise the benefit of environmental management, it is important that manpower and other resources are allocated to issues on a priority basis. It is normally accepted that the highest risk issues receive the highest priority. Each cell in the risk matrix is therefore assigned a priority number. Table 8 shows the management action ranking outcome from the risk matrix table. This documents senior management is required to be involved in high and extreme residual risk events, whereas low risks can usually be adequately managed by operational staff using procedures and checklists.

A desktop risk assessment has been undertaken for this project. The assessment is based on experience of similar features in other mining operations and available information on the Mount Peake project. Appendix B provides the risk assessment tables and detailed worksheet.

Table 7 Risk matrix

	Consequence				
Likelihood	Insignificant (1)	Minor (2)	Moderate (3)	Major (4)	Critical (5)
Almost Certain (A)	8 - Medium	16 - High	18 - High	22 - Extreme	25 - Extreme
Likely (B)	7 - Medium	10 - Medium	17 - High	21 - Extreme	24 - Extreme
Possible (C)	3 - Low	9 - Medium	12 - Medium	19 - High	23 - Extreme
Infrequent (D)	2 - Low	5 - Low	11 - Medium	14 - Medium	20 - High
Rare (E)	1 - Low	4 - Low	6 - Low	13 - Medium	15 - Medium

Table 8 Risk Ranking

Risk Level	Priority	Example Action
Extreme	1	Managed by senior site management / General Manager (GM).
High	2	Managed by department manager. Reported/monitored to the GM quarterly
Medium	3	Managed by section supervisors
Low	4	Managed by operators and staff

The priority risk ranking from this assessment shows a number of activities with an inherent risk level of Extreme and High but by implemented control measures, residual risks are reduced to a Medium or Low ranking. It is considered that this outcome is consistent with the nature and scale of the project, which includes factors such as:

- the process does not require input of significant quantities of hazardous chemicals;
- there is no AMD potential from the WRD and TSF removing long-term liability issues;
- potential impacts from poor rehabilitation establishment are likely to be mitigated through the life of mine with increased knowledge on rehabilitation performance gained from progressive rehabilitation;
- potential impacts have only a localised affect, usually confined to the mine boundary. In most cases these can be readily controlled or remediated;
- no critical value environmental assets are unique to the project area (e.g. populations of rare flora or fauna), eliminating the risk of catastrophic or major consequences to specific environmental factors; and
- the project in an isolated location with significant buffer distances to sensitive receptors.

9.2 High Risk Outcomes

Table 9 provides a summary table of hazards/events with an inherent extreme and high risk ranking. In all cases, control measures can be implemented that reduce these hazards to an acceptable level (medium or low).

Table 9 High risk hazards

Area or Category	Closure Issue	Cause	Inherent Risk			Control methods	Residual Risk		
			Likelihood	Consequence	Risk Level (H, M, L)		Likelihood	Consequence	Risk Level (H, M, L)
Site Wide	No long term vegetative establishment with self-sustaining ability	Keystone species not returning in rehabilitated areas via returned topsoil. Diversity of species either absent or not germinating.	B	4	E21	Further investigation of rehabilitation, to identify indices with which to evaluate successful establishment of keystone species. Rehabilitation monitoring	D	3	M11
Site Wide	Inadequate closure provision	Company not regularly reviewing closure cost liability	B	3	H17	Annual closure cost estimation review. Third party audits.	D	3	M11
Site Wide	Unable to achieve lease relinquishment in a timely manner	Lack of Regulator acceptance of closure outcomes.	B	3	H17	AER submissions. Mine closure plan reviews. Stakeholder consultation. Rehabilitation trials. Progressive rehabilitation and closure	C	3	M12
Site Wide	Rehabilitation establishment	Insufficient topsoil/growth medium available. Dilution with 'sterile' subsoils.	B	3	H17	Clearing and topsoil procedures. Reconciliation of topsoil stockpile quantity.	C	3	M12
Site Wide	Rehabilitation establishment	Unable to establish adequate flora cover on rehabilitated areas.	B	3	H17	Seed collection planned. Rehabilitation trials.	D	3	M11
Site Wide	Rehabilitation establishment	Rehabilitation not reaching target species diversity values due to insufficient quantities of restock seeds.	B	3	H17	Seed collection planned. Seed Storage and Inventory Procedures. Rehabilitation Monitoring.	D	3	M11
Open pit	Public injury	Geotechnical stability - Pit wall failure.	C	4	H17	Abandonment bunds to be installed	E	4	M13
TSF	Failure to relinquish. Failure of vegetation to stabilise the site.	Vegetation regrowth (biodiversity) - 'Created' soil profile and properties with no natural analogue.	B	4	E21	Further investigation of rehabilitation, to identify indices with which to evaluate successful establishment of keystone species. Rehabilitation Monitoring.	C	3	M12
TSF	Air pollution. Excessive dust from the surface of the TSF	Dust accumulating on surrounding vegetation.	B	4	E21	Reshaping of the TSF and rehabilitation by covering the top surface with mine waste and topsoil.	D	2	L7
TSF	Surface water impacts. Soil contamination.	Seepage from the TSF increasing standing water level (SWL). Contamination of soil and groundwater.	A	3	H18	Continual monitoring of the SWL during operation. Construction of seepage recovery trench for use during operations. Monitoring bores to be sampled post-closure (for up to five years). TSF to be capped with mine waste.	A	1	L5
Infrastructure (Plant site, village, workshops, fuel facilities)	Public safety. Soil and water contamination. Aesthetics.	Infrastructure remains post-closure.	C	4	H19	Legal requirement is that ALL mine infrastructure that does not have a sequential use agreement in place at the time of closure is to be demolished and removed.	D	2	L7
Surface disturbance: Access Road Rail Siding	Failure to identify all areas for rehabilitation	Poor closure planning and inventory of disturbed sites.	B	3	H17	Inspections of rehabilitated areas. AER submission.	D	2	L7

10. Implementation

Closure implementation will be conducted as per the strategies outlined in Section 10.2 to 10.8.

10.1 Unexpected or Temporary Closure

DMP/EPA (2015) Section 4.12.3 requires MCPs to include details on planning for temporary suspension or closure of the mine.

Unexpected or temporary closure may occur due to local and external factors. For the purposes of this MCP, temporary closure is assumed to be for a period of up to 5 years while unexpected closure relates to the sudden cessation of mining operation and permanent closure of the facility. In the event of permanent closure, the current mine closure plan will apply.

If an unexpected or temporary closure occurs, all relevant legal obligations will be complied with. The Company will ensure that the Department of Mines and Energy is notified before any action is taken.

In the event of temporary closure, the functionality of the site for future mining operations must be maintained while making the site safe, limiting access for unauthorised persons and minimising environmental impacts. Tasks required to be implemented in the event of temporary closure are presented below:

- remove all fuel, oils, hazardous materials, chemicals and consumables that are not required for care and maintenance activities;
- empty all tanks not required for care and maintenance and dispose of contents appropriately;
- remove redundant infrastructure, mobile plant, unnecessary equipment and any rubbish from site;
- clean and decontaminate all workshops, sheds, fuel bays, tanks and any facilities used for storage of chemicals;
- secure site facilities to limit access from unauthorised persons;
- electrically isolate plant not required for care and maintenance;
- construct vehicular access barriers and abandonment bunds;
- reshape borrow pits to minimise the risk of falls;
- backfill costeans and other disturbances to the land surface caused by exploration;
- cap all exploration drill holes;
- ongoing monitoring commitments for groundwater, surface water, stability, rehabilitation, public safety and seepage to be conducted as per Section 11; and
- water management infrastructure including diversions and culverts to be inspected and maintained.

Circumstances may eventuate that require a temporary suspension of mine operation, where the site enters into a period of Care and Maintenance (C&M). Provisions in the Western Australian *Mines Safety and Inspection Regulations Act 1995* govern care and maintenance periods. The provisions in the Regulations (in part below) would form the basis of a suspension plan to be implemented in such a situation. These provisions are equally relevant for this project in the Northern Territory.

Notification of the suspension of mining operations at a mine must, in addition to the details set out in regulation 3.12, include the following details -

- a) The reason for the suspension and the planned duration of the suspension;
- b) Whether the closure is total or whether access to underground and/or pit workings is to be maintained;
- c) If underground and/or open pit access is to be maintained, details of the arrangements that have been made for the provision of regular services and emergency services to ensure the safety of employees engaged in maintaining the mine;
- d) The measures that have been taken to prevent unauthorised access or entry to the mine;
- e) The precautions that have been taken to protect underground equipment and service installations; and
- f) Any plans required to be prepared under section 88 of the Act.

Section 88 of the *Mines Safety and Inspection Act (1994)* states:

Plans for abandonment or suspension.

- 1) *Where mining operations are about to be abandoned or suspended, the principal employer, or if a receiver has been appointed in respect of a principal employer, that receiver, or the manager must cause to be prepared to the satisfaction of the district inspector for the region in which the mine is situated an accurate plan or plans of the mining operations to the time of abandonment or discontinuance and must furnish that plan or those plans to the State mining engineer in accordance with the regulations before the mining operations are abandoned or suspended.*

Table 10 summarises the key closure tasks to be undertaken in the event of temporary suspension of operations.

Table 10 Temporary suspension key tasks

Key Suspension Tasks	Timeframe
Notify DME before the mining operation is suspended or abandoned.	As soon as possible but no less than one month prior to unplanned closure.
Ensure all safety obligations are met.	During unplanned closure works.
For unexpected closure - immediate review of MCP to include detailed decommissioning plan.	Within 3 months of notification to DME.
For temporary closure – prepare a detailed care and maintenance plan.	Within 3 months of notification to DME.

10.2 Decommissioning Plan

DMP/EPA (2015) Section 4.12.4 requires MCP's in the later stage of the mine's life to include a decommissioning plan.

This project is still in the early phase of the mine's life, so many of these aspects are still being developed. This version of the MCP provides the framework of a decommissioning plan that will be prepared in a subsequent version of the MCP.

Commitment 3: Prior to closure, prepare a Decommissioning and Demolition Plan for infrastructure that is to be removed from site

The following major tasks need to be addressed in a decommissioning plan.

- demolition and decommissioning of plant and infrastructure;
- construction of final landforms and drainage structures;
- completion of rehabilitation;
- identification and remediation of contaminated areas;
- monitoring against completion criteria;
- consultation with stakeholders;
- handover of agreed infrastructure to other parties; and
- finalise post closure monitoring and maintenance programs.

10.2.1 Demolition and decommissioning of plant and infrastructure

TNG will establish and maintain an asset register of plant and equipment on the site. Prior to closure, TNG will prepare a Decommissioning and Demolition Plan for infrastructure on site.

10.2.2 Construction of final landforms and drainage structures

At the present time, no mining has commenced and no mine landforms are in place. The MCP assumes that in the future, mine features depicted in Figure 2 will be constructed. Construction of final landforms includes rehabilitation of the WRD, ROM pad and TSF, complete abandonment bunds to isolate the open pit from vehicle access and any drainage diversion structures that need to remain in place after closure.

10.2.3 Completion of rehabilitation

The area of mine related disturbance that requires rehabilitation is a dynamic variable that will change during the life of mine. Annual levy payments to government will be the mechanism that tracks disturbance area during the life of mine. Further detail on the scope of work to complete rehabilitation is included in Sections 10.3 to 10.8.

10.2.4 Identification and remediation of contaminated areas

Likely sources of contamination are at hydrocarbon storage facilities, washdown bays and sumps, workshop areas and at the location of any bulk chemicals used in the process plant.

Actions to be implemented include the following.

Hydrocarbons

- once surface infrastructure is removed (tanks, concrete work, pipework), any surface staining from hydrocarbons will be removed and taken to the bioremediation area. Surface is defined as down to 150 mm;
- workshop areas and washdown bays will also be inspected and any surface staining removed;
- photographic records will be taken at this time to confirm whether visual evidence of hydrocarbon staining is limited to the surface zone or that deeper contamination is present;

- in most cases, excavation of visually impacted soil is likely to be able to remove contamination down to visually clean soil. All excavated material will be taken to the bioremediation area;
- any visual staining from hydrocarbons beyond the surface zone will be the subject of a sampling program to quantify the likely further extent of contamination; and
- if initial sampling indicates significant contamination levels remain insitu, a remediation plan will be developed to remove or remediate the contamination.

Commitment 4: Establish an on-site bioremediation facility to treat hydrocarbon contaminated soil to levels that can be safely disposed to the site landfill or used in rehabilitation works

Other contamination

The beneficiation process to obtain the magnetite concentrate does not use bulk quantities of hazardous chemicals. The likelihood of significant contamination from this source is considered to be low.

Landfills and TSF

These facilities are managed and monitored during the life of mine. These sites will be located on survey plans of the site, to be recorded on tenement plans.

10.2.5 Monitoring against completion criteria

Further detail on the scope of monitoring work is included in Section 11. Proposed completion criteria are listed in Table 5.

10.2.6 Consultation with stakeholders

Details of stakeholder consultation are included in Section 5. TNG will maintain regular consultation with stakeholders during the post closure program of demolition and rehabilitation. Stakeholders will be informed of rehabilitation performance and closure monitoring results as they become available.

Commitment 5: Maintain regular communication with stakeholders during the life of mine with specific consultation on mine closure issues.

10.2.7 Handover of agreed infrastructure to other parties

At this point in time there are no formal requests by other parties for sequential use of mine infrastructure.

10.2.8 Finalise post closure monitoring and maintenance programs

Further detail on closure monitoring and maintenance requirements is included in Section 11 .

TNG proposes to undertake post closure monitoring for a period of 5 years. With an expected mine life of 17 years, it is considered that this period provides sufficient time to implement progressive rehabilitation over parts of the mine area and establish a sound database to refine completion criteria. Data collected over the 5 year period post closure will be compared against these completion criteria. If monitoring results show these criteria have been met, application will be made to the DME to have these criteria signed off. If further monitoring of some factor is required, a revised monitoring program may be appropriate. If so, an amended monitoring program will be agreed with the DME.

10.3 Rehabilitation Planning

A number of mine landforms will remain at the site after closure, essentially in perpetuity. These are:

- the open pit void;
- the WRD and ROM pad; and
- the TSF.

All other landforms and infrastructure is proposed to be removed.

For a number of reasons, mine closure works may need to be scheduled over a number of years rather than being undertaken as a single, uninterrupted exercise. The size and scale of demolition and rehabilitation works required, the weather (wet season) and mine features such as the TSF that may need to dry out before rehabilitation works can be undertaken are all reasons why closure and rehabilitation activities may need to be scheduled over a number of years.

This extended closure period will also require maintaining some essential infrastructure at the site post closure, to support successive campaigns by a rehabilitation contractor conducting a program of work. At a minimum, this infrastructure is likely to include:

- a portion of the accommodation village that remains connected to the WWTP;
- power generation to power the accommodation village, communications and water treatment facilities; and
- a water supply bore that allows a potable water supply to be produced.

At this stage, no schedule of progressive rehabilitation has been developed. As further project approvals are obtained and more detailed mine planning is undertaken, a rehabilitation schedule can be developed and included in subsequent versions of the MCP.

Commitment 6: Develop a progressive rehabilitation schedule as mine planning processes are further developed.

10.4 General Earthworks Strategies

The following general earthworks strategy applies to disturbed areas:

- the WRD lifts will be battered to angles consistent with the final rehabilitation design. Water control structures will be constructed according to the rehabilitation design. The WRD will be ripped on contour to a depth of approximately 500 mm;
- the TSF will be capped with approximately 0.5 m of mine waste and scarified on contour to a depth of approximately 300 mm;
- hardstand areas will be ripped using a tine to a depth of 1,000 mm where possible;
- ripping will be conducted under dry conditions to maximise ground fracture and minimise clod formation; and
- water diversion structures will be removed (where possible) so that pre-mining flow paths are reinstated.

10.5 General Rehabilitation Strategies

- a layer of topsoil will be spread evenly over disturbed areas to an approximate depth of 100 mm;
- surfaces that have been covered with topsoil and ripped will be seeded with local native species which are compatible with other species in the area;
- seeds will comprise both annual and perennial species, focussing on a diverse species assemblage while providing structural heterogeneity, landform stability and visible cover throughout the year;
- seeding will be carried out at a time that immediately precedes the main rainfall season for the area; and
- fertiliser will be applied to maximise the success of plant growth. Seed and fertiliser application will be preferably done in one pass with ripping to reduce soil compaction if hand seeding is not appropriate.

10.6 Revegetation Species Selection

The goal of rehabilitation is replication (diversity, density, structure), as far as practicable, of vegetation communities on relevant analogue sites in the local area. Species used for revegetation of disturbed areas will be selected that are native to the local area and that can be supplied by local suppliers in the region. Direct seeding will be applied at a rate to be determined in the rehabilitation plan, based on mine feature and seed composition.

Commitment 7: Develop an initial rehabilitation species list based on baseline botanical information for use in mine rehabilitation. This list is to be reviewed and refined during the life of mine based on results of rehabilitation trials.

10.7 Fire Protection

Fire in rehabilitation areas is regarded as a highly destructive event. It takes many years for rehabilitation to develop sufficiently to have re-established a sufficient seed bank in the soil, bark thickness on mature plants, rhizomes, lignotubers and other mechanisms that provide some resilience against fire damage. The general principle for mine rehabilitation is that fire will be prevented from impacting rehabilitation areas.

Fire prevention measures on site include mechanisms such as hot work permits and fire training. These management measures are designed to assess the risk of activities on the site of starting a fire and implementing control measures so that any fire is quickly put out.

Wildfires (bushfires) that start off site are also a risk. Firebreaks as buffers to rehabilitation areas will be installed to reduce the chance of fire impacting these areas.

10.8 Materials Balance

Maintain an inventory of materials required for rehabilitation. Materials required for rehabilitation include:

- topsoil. Map stockpile locations and record approximate quantity;
- mine waste suitable for TSF capping. Material for this purpose is defined as that having suitable physical and chemical properties for it to be used as cover material for the TSF. These properties include:
 - o salt levels below values that inhibit or are detrimental to vegetation;
 - o non-acid forming (NAF) characteristics; and
 - o high clay content to prevent rapid infiltration of rainfall.
- abandonment bund material. This must be competent, rocky material that is resistant to slaking and erosion.

10.9 Contaminated Sites

Options for remediation of contaminated sites may include:

- relocation of all contaminated material to a single central repository, where it can be contained and remediated; and
- remediation of contaminated material in-situ where possible. Small, localised spills of hydrocarbons will be remediated in-situ using the following actions:
 - o photograph the contaminated area and mark its position with a hand held GPS;
 - o scarify the surface to a depth of 200 mm;
 - o apply a nitrogenous fertiliser (Agran [34% N]) at a rate of 10 grams per square metre;
 - o water the area with water not exceeding 5,000 mg/L Total Dissolved Solids to wash in the fertiliser;
 - o in 3 months, relocate the site using the GPS coordinates and photograph the site; and
 - o file the pre and post treatment photographs for the next annual reporting period.

11. Monitoring and Maintenance

11.1 Monitoring Requirements

Monitoring will be undertaken to assess performance against the closure criteria identified. Results must substantially demonstrate that closure criteria identified in Section 7.2 have been met. Closure monitoring requirements for each domain are identified in Table 12.

TNG will compile all monitoring results into a report on rehabilitation performance against closure criteria. This report will form the basis of consultation with the DME on the need for further monitoring and if so, what closure criteria remain unsatisfied and what further monitoring period is required.

11.2 Monitoring Schedule

Table 11 shows the proposed frequency of monitoring events post mine closure. These are discussed in more detail in sections 11.2.1 to 11.2.6.

Table 11 Monitoring Schedule

Monitoring Type	Frequency
Public Safety	Decommissioning audit and then annually for 5 years
Decommissioning audit	At mine closure
Rehabilitation	At years 1, 3 and 5 after closure
Surface water	Opportunistic
Groundwater	Annually for 5 years
Stability	Done as part of landform monitoring
TSF seepage	Visual inspection with landform monitoring

11.2.1 Public safety

A decommissioning audit will be conducted after decommissioning of the site in order to confirm performance indicators identified in Table 5 are satisfied. Thereafter, annual inspections will be undertaken and a checklist completed to confirm that exclusion measures are maintained and that access to the pit void and other mine landforms has been effectively prevented. Any evidence of access at these sites will result in remedial work to close the access. Inspections will be conducted during scheduled monitoring events for other parameters. Inspection will be used to confirm that:

- abandonment bunds effectively restrict vehicle access to the open pit;
- necessary roads are in useable condition;
- gates, fences and signage are in fair condition; and
- surfaces are stable with no evidence of subsidence or failure.

Table 12 Monitoring requirements

Domain	Water	Stability	Seepage	Rehabilitation Performance	Public Safety	Decommissioning audit and visual inspections	Justification for monitoring parameters
Open pit	√	√			√	√	Safety (intact abandonment bund) is key factor. Gradual salinisation of pit lake also likely to occur over time.
WRD and ROM pad		√		√	√	√	Embankment erosion and rehabilitation performance.
TSF	√		√	√	√	√	Groundwater change as TSF dries and consolidates. Embankment erosion. Rehabilitation performance.
Beneficiation process plant and power station				√	√	√	Safety and public access. Rehabilitation performance.
Rail siding				√	√	√	Safety and public access. Rehabilitation performance.
Access road				√	√	√	Rehabilitation performance.
Borefield				√		√	Rehabilitation performance
Infrastructure areas				√	√	√	Safety and public access. Rehabilitation performance.
Pipelines and power lines				√	√	√	Safety and public access. Rehabilitation performance.
Ancillary infrastructure				√	√	√	Safety and public access. Rehabilitation performance.

11.2.2 Decommissioning audit

A decommissioning audit will be conducted after decommissioning of the site in order to confirm performance indicators identified in Table 5 are satisfied. These include:

- site does not contain redundant infrastructure and is free of rubbish;
- abandonment bunds are in accordance with the Safety Bund Walls around Abandoned Open Pit Mines Guidelines (DoIR, 1997);
- all costeans and other disturbances to the land surface as a result of exploration are backfilled. All surface holes drilled for exploration are capped, filled or otherwise made safe; and
- an assessment has been completed for suspected or known contaminated areas.

11.2.3 Rehabilitation monitoring results

Monitoring of progressive rehabilitation will be undertaken at scheduled intervals during the life of mine. It is expected that this information will provide an adequate benchmark for rehabilitation monitoring that is undertaken at the end of the mine life.

After mine closure, monitoring will continue in years 1, 3 and 5, to provide trend information against the existing benchmark data.

Photographic Monitoring

Photographic monitoring will be used to provide a record of short and long-term changes to the vegetation, and provides a valuable record of rehabilitation performance over time.

Colour photographs will be taken in conjunction with vegetation monitoring. The photographs will be taken at the same location, with the same direction, angle and camera settings as the previous year to ensure that vegetation in each photograph is uniformly positioned to enable comparison of photographs.

11.2.4 Water monitoring

Surface Water Run-Off Monitoring

As the site is in an arid environment, surface water monitoring is only possible on an opportunistic basis, immediately after significant rainfall events.

No regular surface water monitoring is proposed to be conducted after mine closure.

Groundwater Monitoring

Monitoring is proposed to be conducted annually for 5 years. If the results show compliance with defined targets, it is proposed that the groundwater closure objectives are deemed to have been met.

11.2.5 Stability monitoring

Erosion (rill assessment) of the WRD and TSF will be conducted at the same time as rehabilitation monitoring to provide a stability index for the landform over time. Ecosystem Function Analysis (EFA) and Landscape Function Analysis (LFA) is one monitoring methodology that can be used to assess landform stability. Other methods can also be used. At this time TNG has not determined what methodology it will adopt.

11.2.6 TSF seepage

At this time no toe drain interception trenches or seepage recovery bores have been planned. The dry stacking tailings disposal method greatly reduces the volume of water disposed to the TSF during the life of mine.

In the absence of the TSF developing a seepage or groundwater contamination plume during the life of mine, it is not intended to conduct any specific seepage monitoring program post closure. Visual monitored of the TSF will occur as part of other site inspections undertaken post closure

11.3 Maintenance and Remedial Actions

Should visual inspections or monitoring results indicate the need for maintenance works or remedial action to be undertaken, TNG will mobilise contractors to site to undertake these works. Such maintenance works may include:

11.3.1 Vegetation

If rehabilitation is failing, additional application of fertiliser, additional seeding or planting may be required. Also, control of weeds listed as 'pest plants' will be implemented if required.

11.3.2 Erosion

If significant embankment erosion on the TSF, WRD or ROM pad is identified or rehabilitation is not progressing towards a self-sustaining community, the following remedial actions may be considered:

- construct, improve, or repair drainage control measures to reduce water movement down outer slopes of the landform; and
- areas of deep erosion and/or instability may need to be remediated with appropriate material.

11.3.3 Access

Remedial works will be required if access prevention measures fail to restrict unauthorised access.

11.4 Reporting Requirements

It is anticipated that an annual report of closure performance will be required by DME. All monitoring data is to be recorded electronically. A register of all inspections, monitoring results and remedial actions (if taken) will be maintained and reported to the DME.

12. Financial Provision for Closure

The objective of financial provisioning for closure is to ensure that adequate funds are available at the time of closure so that the community is not left with an unacceptable liability. To that end, it is essential that the cost of closure be estimated as early as possible and a provision established by the Company to cover this cost.

Government recognises that providing verifiable closure cost estimates at the early stages of a mine's life is subject to many assumptions and unforeseen events. The financial provisioning process and methodology has to be transparent and verifiable, assumptions and uncertainties have to be clearly documented, and they have to be based on reasonable, site-specific information and data throughout the life of the project.

The closure cost estimates will be regularly reviewed to reflect changing circumstances and levels of risk. This will ensure that the accuracy of closure costs is refined and improved with time.

Developing the financial provision will include the following components:

- decommissioning and removal of infrastructure;
- earthmoving and landscape forming;
- management of problematic materials where relevant;
- surface water drainage;
- remediation of contamination;
- final rehabilitation (residual remaining after progressive rehabilitation);
- post-closure monitoring and maintenance programs;
- ongoing stakeholder engagement process;
- closure project management costs; and
- legal requirements.

Commitment 8: Prepare a financial provision for closure and regularly update this closure cost during the life of mine to reflect the current circumstance of the mine.

13. Data Management

Maintaining an effective data management system is essential to ensure rehabilitation and closure related information is stored and maintained during the life of mine.

Commitment 9: TNG will establish and maintain a document management system to store all relevant rehabilitation and closure information for the Mount Peake project

Appendices

Appendix A – Closure data

To be completed in subsequent versions of this document

Appendix B – Risk Assessment

Likelihood of event occurring

Descriptor	Details	Frequency of occurrence	Likelihood of occurring each year
Almost Certain	Very high likelihood to occur. Factors increasing likelihood may include: - No internal controls implemented - No treatment plan developed to prevent risk from occurring - No resources provided to develop controls or treatment plan - Risk has not previously been identified in project plan and is likely to impact project outcome or lead to project failure - Risk has not previously been identified impacting delivery of strategic and/or core objectives	Once per week	Greater than 90%
Likely	High likelihood to occur. Factors increasing likelihood may include: - Internal controls and treatment plan are inadequate to prevent risk from occurring and require prompt attention and review - Insufficient management oversight of risk and implementation of controls - Risk has not been given sufficient priority in project plan - Risk could impact achievement of business objectives	Once per month	50% to 90%
Possible	Moderate likelihood to occur. Factors decreasing likelihood may include: - Internal controls and treatment plan are implemented and will be regularly reviewed to ensure their robustness - Impact upon achieving business objectives is considered minimal	Once per year	10% to 50%
Infrequent	Low likelihood to occur. Factors decreasing likelihood may include: - Internal controls and treatment plan are robust and fully implemented - Circumstances in which risk is likely to eventuate are considered remote - Unlikely to impact on achieving business objectives	Once per 10 years	2% to 10%
Rare	Low likelihood to occur. Factors decreasing likelihood may include: - Internal controls and treatment plan are robust and fully implemented - Circumstances in which risk is likely to eventuate are considered remote - Unlikely to impact on achieving business objectives	Once per 100 years	Less than 2%

Consequence of event occurring

Level	Descriptor	Environment
5	Critical	Widespread irreversible environmental harm
4	Major	Widespread environmental impact, not immediately contained
3	Moderate	Reversible environmental harm extending beyond site boundary, immediately contained
2	Minor	Reversible environmental impact, immediately contained
1	Insignificant	Very low environmental impact (localised spill)

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Document Status

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0	P Rokich	I McCardle		I McCardle		22/10/2015

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Appendix N

Environmental Management Plan





TNG Limited

Mount Peake Environmental Management Plan

December 2015

Document Status

Version	Author(s)	Reviewer	Approved by	Date	Status
	I. McCardle A. Koscielski	I. McCardle	I. McCardle		

Amendments

Section	Details

Audit Summary

Section	Details

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Appendices

Appendix A – Environmental Policy

Appendix B – Air and Dust Management Plan

Appendix C – Biodiversity Management Plan

Appendix D – Cultural Heritage Management Plan

Appendix E – Fire Management Plan

Appendix F – Hazardous Substances Management Plan

Appendix G – Non-mineralised Waste Management Plan

Appendix H – Water Management Plan

Appendix I – Weed Management Plan

Appendix J – Emergency Response Plan

Appendix K – Drainage, Erosion and Sediment Control Plan

Abbreviations

Abbreviation	Details
AAPA	Aboriginal Areas Protection Authority
ANZECC	Australian and New Zealand Environment Conservation Council
AHD	Australian Height Datum
AMD	Acid Metalliferous Drainage
ARD	Acid Rock Drainage
ADMP	Air and Dust Management Plan
BMP	Biodiversity Management Plan
BOM	Bureau of Meteorology
CHMP	Cultural Heritage Management Plan
CLC	Central Land Council
DEIS	Draft Environmental Impact Statement
DME	Department of Mines and Energy
EAA	<i>Environmental Assessment Act</i> (NT)
EIS	Environmental Impact Statement
EMP	Environmental Management Plan
EMS	Environmental Management Systems
EPBC Act	Environment Protection and Biodiversity Conservation Act (Commonwealth)
ERP	Emergency Response Plan
FMP	Fire Management Plan
GDA	Geocentric Datum of Australia
GEMIS	Global Emission Model for Integrated Systems
HSMP	Hazardous Substance Management Plan
IUCN	International Union for the Conservation of Nature
LOM	Life of Mine
MCP	Mine Closure Plan
MGA94	Map Grid of Australia 1994
MMA	<i>Mining Management Act</i> (NT)
MMP	Mining Management Plan
MSDS	Material Safety Data Sheets
NAF	Non Acid Forming
NWMP	Non-mineralised Waste Management Plan
NRETAS	Department of Natural Resources, Environment the Arts & Sport (now NT EPA)
NT EPA	Northern Territory Environmental Protection Authority
PAF	Potentially Acid Forming
PER	Public Environment Report
RL	Reduced Level (based on AHD)
SEWPaC	Department of Sustainability, Environment, Water, Population and Communities
TSF	Tailings Storage Facility
WMP	Water Management Plan
WeMP	Weed Management Plan
WRD	Waste Rock Dump

1. Introduction

1.1 Purpose

This Environmental Management Plan (EMP) has been prepared by GHD for the Mount Peake Project (Project) on behalf of TNG Limited (TNG). The EMP has been developed in unison with EIS technical studies to establish specific safeguards and controls to be employed at the Project. It provides an environmental management system for the site to operate within and assigns responsibilities to proposed site personnel roles.

The EMP has been established as a strategic document which will be modified and updated prior to implementation at the Project. Updates are likely to be undertaken as following:

- Formal review of the Draft Environmental Impact Statement (DEIS) by the Northern Territory Environmental Protection Authority (NT EPA)
- Provision of an NT EPA Assessment Report of the DEIS and Supplementary providing Recommendations
- Throughout mine site authorisation processes with the Department of Mines and Energy (DME).

1.2 Objectives

The EMP has been produced to manage potential environmental risks pertaining the development and operation of the Mount Peake Project. The document has been designed to be utilised as a standalone document with reference to technical studies. The main objectives of the EMP are to:

- Summarise the Project description, statutory and non-statutory requirements, site conditions and Project risks
- Outline an Environmental Management System (EMS) including structure, roles and responsibilities, environmental training and education and summarise sub-environmental management plans
- Establish sub-environmental management plans for key risk areas including:
 - Air and Dust Management
 - Biodiversity Management
 - Cultural Heritage Management
 - Fire Management
 - Hazardous Substances Management
 - Non-mineralised Waste Management
 - Water Management
 - Weed Management
 - Drainage, Erosion and Sediment Control Plan.
- Summarise previous period performance including internal reporting, external reporting, internal auditing, complaints register and a summary of sub-environmental management plan performances.

1.3 Structure

The EMP has been structured to be utilised and revised throughout the Project. It includes:

- Section 2 Project Description
Summary of the Project details including operator details, title details, location, project activities during construction and operation.
- Section 3 Site Conditions
Summary of site conditions from previous assessments undertaken at the Project including the physical, cultural and socio-economic environment.
- Section 4 Project Risk Summary
Provides an outline of risk identified at the Project in relation to the environment.
- Section 5 Approval and Legislative Requirements
Outlines environmental approvals, Commonwealth and Northern Territory legislation and relevance to the Project.
- Section 6 Environmental Management System
Outlines the environmental management system, attributes responsibilities, internal and external reporting requirements and the management of non-conformance and complaints.
- Section 7 Environmental Management Plans
Provides a summary of the Sub-management plans including an outline of objectives, actions, monitoring and reporting and a Trigger, Action Response Plan (TARP) where relevant. The summary includes the following plans:
 - Air and Dust Management Plan
 - Biodiversity Management Plan
 - Cultural Heritage Management Plan
 - Fire Management Plan
 - Hazardous Substances Management Plan
 - Non- Mineralised Waste Management Plan
 - Water Management Plan
 - Weed Management Plan
 - Drainage, Erosion and Sediment Control Plan

1.4 Limitations

The EMP has been developed as a strategy document. The majority of information summarised within the document has been supplied from technical reports provided within the Draft Environmental Impact Statement (DEIS) appendices.

The EMP has been produced at the DEIS phase of the Mount Peake Project. It is acknowledged that the EMP requires revision prior to implementation onsite. Through the development of the EMP insufficient information pertaining to the general arrangement of infrastructure was available. The figures provided within this document are indicative locations which will to be revised through the detailed design phase.

Due to these issues the Water Management Plan and Erosion and Sediment Control Plan are strategy documents which require revision.

2. Project Description

2.1 Overview

The Mount Peak Project will comprise:

- The mining of a polymetallic ore body through an open-pit truck and shovel operation
- Processing of the ore to produce a magnetite concentrate
- Road haulage of the concentrate to a new railway siding and loadout facility on the Alice Springs to Darwin railway near Adnera
- Rail transport of the concentrate to TNG's proposed Darwin Refinery located at Middle Arm, Darwin.

2.2 Operator Details

The Project will be operated by TNG Limited (TNG). TNG is an Australian resource company which is currently in the stage of exploration across several tenements. The company has a multi-commodity resource portfolio including ferrous, non-ferrous and precious metals projects, as well as interests in projects which are prospective for iron ore, vanadium, titanium, gold, lead-zinc-silver, nickel and copper. The development of the Mount Peake Project is the company's main focus.

A summary of the operator details are provided in Table 2-1

Table 2-1 Operator Details

Company	TNG Limited
Contact	Paul Burton Managing Director
Street address	Level 1, 282 Rokeby Road, Subiaco, WA 6008
Postal address	PO Box 1126, Subiaco, WA 6904
Phone	+61 8 9327 0900
Fax	+61 8 9327 0901
Email	peb@tngltd.com.au
ABN	12 000 817 023
ASX code	TNG
Web	www.tngltd.com.au

Organisational Structure and Responsibility

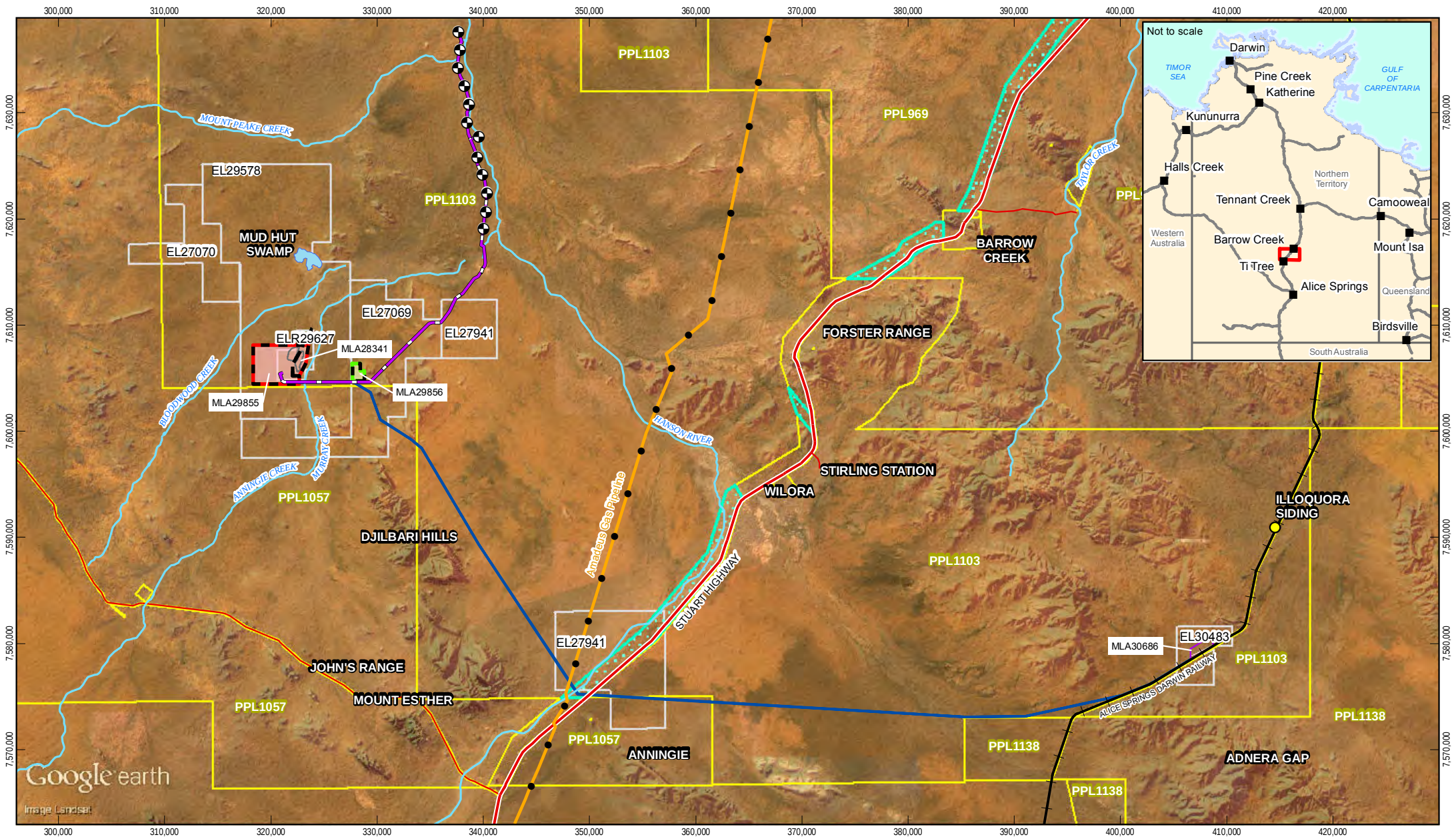
An organisational structure together with responsibilities will be included once the makeup of the site based workforce is confirmed.

2.3 Title Details

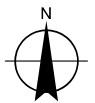
Mining and processing will occur within Mineral Lease Application (MLA) 28341 for the Mine Site and MLA 29855 for all mining facilities (Figure 2-1). The accommodation facilities will be located within MLA 29856, 5 km to the east of the Mine Site.

The access road between the Mine Site and the Adnera Loadout Facility passes from MLA 29855, through Exploration Lease (EL) 29578, EL 27069, Perpetual Pastoral Lease (PPL) 1057, EL 27941, PPL 1103 and PPL 1138.

All tenements lie within the Stirling and Anningie PPLs aside from a portion of crown land adjacent to the Stuart Highway.



Paper Size A4
0 2.5 5 7.5 10 12.5 15
Kilometres
Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 53



LEGEND

- Illoquora Siding - Potential Borefield - Borefield Delivery Pipeline - Principal Road - Minor Road	- Major Watercourses - Railway - Amadeus Gas Pipeline - Mine Site Facilities - Mud Hut Swamp	- Rail Siding Loading Facility - Mount Peake Mining Area - Crown Land - Mount Peake Granted Tenements - Mount Peake Mineral Leases	- Cadastral Boundaries - Access Road - Camp Facilities



TNG Ltd
Mount Peake EIS

Project Location
Mount Peake Project Area

Job Number	61-29057
Revision	A
Date	29 Oct 2015

Figure 2-1

G:\61\29057\11 GIS\Maps\MXD\EIS_MDS\6129057_001_ProjectLocation.mxd

239 Adelaide Terrace Perth WA 6004 Australia T 61 8 6222 8222 F 61 8 6222 8555 E permail@ghd.com.au W www.ghd.com.au

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Data source: TNG - Gas / Slurry Pipeline Study Corridor, Camp Facilities, Borefield Infrastructure, Transport Study Corridor, Mount Peake Mining Area, Mount Peake Granted Tenements (2015). Geoscience Australia - Waterways, mainland, placename, road (2008). Google Earth Pro - Imagery (Date extracted: 13/02/2014). Created by: RB

2.4 Location

The Project is situated approximately 235 km north-northwest of Alice Springs. The closest community is Wilora, situated approximately 47 km east of the Mine Site and 43 km west of the loadout facility. The location and general arrangement of the Mount Peake Project is provided in Figure 2-1.

2.5 Project Activities

2.5.1 Project Schedule

TNG proposes to commence construction in the late 2016 with mining commencing in late 2018. The life of the project is expected to be 19 years inclusive of construction (2 years), mining and production (15 years) and closure and rehabilitation (2 years).

2.5.2 Construction Activities

All site infrastructures required for the operation needs to be constructed. A summary of the main construction requirements for Project are provided in Table 2-2.

Table 2-2 Summary of Construction Requirements

Mine Site	Access Road	Adnera Loadout Facility
ROM pad Crusher infrastructure Crushed ore stockpile pad Conveyor belts Process plant (milling, magnetite separation and beneficiation) Thickener tanks Process and raw water dams Concentrate loadout pad Fuel farm Workshop and stores Administration buildings Concrete batch plant Weighbridge Sewage pump station Sewerage treatment plant Water treatment plant Landfill Explosives magazine Tailings Storage Facility Diesel generators (construction phase) Stormwater ponds Fencing Monitoring bores	100 km long road - disturbance of up to 25 m with a constructed width 13 m including drainage Unsealed road construction Stuart Highway underpass Stuart Highway intersections Table drains Floodways across Hanson River, Murray Creek and other minor creeks Culverts Borrow pits 4 production bores Fencing	1.8 km rail siding Site office and facilities Septic tank Diesel generator Fuel farm Stockpile pad (hardstand) Stormwater ponds Fencing
Borefield	Mine Camp	Power Station
Raised construction pads to provide flood immunity 12 production bores Diesel generators Monitoring bores Supply pipeline Access track	225 person construction camp (converted to a 170 person camp to support the operations workforce) Dry mess, wet mess, kitchen and cold room Ablutions and laundry facilities Swimming pool, tennis court and gymnasium Sewerage pump station	16 x 1,400 kVA gas fired generating sets initially with an additional 12 generating sets added from year five 3 x 1,250 kVA backup diesel generators

2.5.3 Mining Activities

Mining

The ultimate pit shell will be reached through five intermediate but overlapping stages. These stages have been developed to minimise waste movement and haulage distances. Once mining is complete the pit will be approximately 2,000 m long and 600 m wide with a maximum depth of 125 m.

Pit design and construction follows standard industry design techniques.

The production schedule over the 15 year mine life is provided in Table 2-3. There is a pre-production year that will occur during the second year of construction and will involve pre-stripping of waste material. Some 138.84 Mt of material is expected to be extracted over the life of the mine, comprising around 77.84 Mt of ore and 61 Mt of waste. The largest amount of material mined occurs during mining years 7 and 8 (11.85 Mt).

Table 2-3 Annual mine production schedule

Mining year	Total ore mined	Total waste mined	Total tonnes mined	Strip ratio (waste to ore)
	Million tonnes (rounded)			
Pre-production	0.06	4.82	4.88	82.20
1	5.80	5.84	11.64	1.01
2	4.62	7.02	11.64	1.52
3	3.79	7.85	11.64	2.07
4	5.31	6.26	11.57	1.18
5	6.12	5.37	11.49	0.88
6	5.65	5.93	11.58	1.05
7	5.87	5.98	11.85	1.02
8	6.23	5.62	11.85	0.90
9	6.57	5.27	11.84	0.80
10	8.39	0.55	8.94	0.07
11	6.83	0.26	7.09	0.04
12	4.30	0.18	4.48	0.04
13	4.44	0.05	4.49	0.01
14	2.26	0.00	2.26	0.01
15	1.60	0.00	1.60	0.00
Total	77.84	61.00	138.84	0.78

It is expected that mining operations during years 1 – 4 will be a single 12 hour shift, 7 days per week. This will increase to two 12 hour shifts during years 5 - 15.

Mining will commence with a “starter pit” accessing high grade and low strip ratio ore. Drilling and blasting, to loosen rock ahead of mining, will be undertaken to produce rock sizes that conform to processing requirements.

Extracted high grade ore will be transported by haul truck from the pit to the ROM pad and directly fed into the process plant.

Four long-term stockpiles will be established according to grade. The higher grade stockpile will be used to balance the mining and processing rates and will be of similar quality to the direct feed material. Medium and low grade stockpiles will be depleted towards the end of the mine life with the higher grade material used first.

Testing of the orebody produced limited volumes of groundwater. It is proposed to use in-pit sump pumps to remove any water accumulating in the pit due to seepage and direct rainfall.

Waste Rock

Waste material will be trucked to the WRD that will progressively develop to the west of the pit (Figure 2-2). The dump will have an ultimate height of 40 m and a footprint of 90 ha with capacity to store up to 70 Mt of waste. It is proposed to use up to 5 Mt of waste from pre-production for project construction requirements.

The parameters used for waste dump design are:

- Batter height: 10 m
- Ramp width: 27 m
- Ramp gradient: 1 in 10.

There are no specific strategies to manage waste placement in the dump as the waste rock is benign.

2.5.4 Processing Activities

Processing involves crushing, grinding and magnetic separation to produce a magnetite concentrate. A layout of the processing facilities is shown in Figure 2-3 and a simplified process diagram is shown in Figure 2-4.

Throughput of the plant will be 3 Mtpa initially, doubling to 6 Mtpa in year 5. The plant will operate 24/7.

Crushing

A front end loader will feed ore onto a static grizzly above the ROM bin. Screened oversize material (+500 mm) will be broken by a mobile rock crusher and re-fed into the grizzly.

The ROM bin material will be fed to a vibrating grizzly. Screened oversize material (+150 mm) will be crushed in a primary jaw crusher with crushed product mixed with -150 mm material and conveyed to a primary screen bin feed. The +30 mm material will be conveyed to a secondary cone crusher, then recombined with screened undersize (-30 mm) material and conveyed to a High Pressure Grinding Rolls (HPGR) stockpile.

Grinding

The HPGR stockpile will have a live capacity of 20,000 tonnes. Material will be reclaimed from beneath the stockpile and sent to the HPGR feed bin.

Tertiary crushing will be achieved using an HPGR. The grinding elements of the HPGR are two counter-rotating rolls, between which the material is crushed.

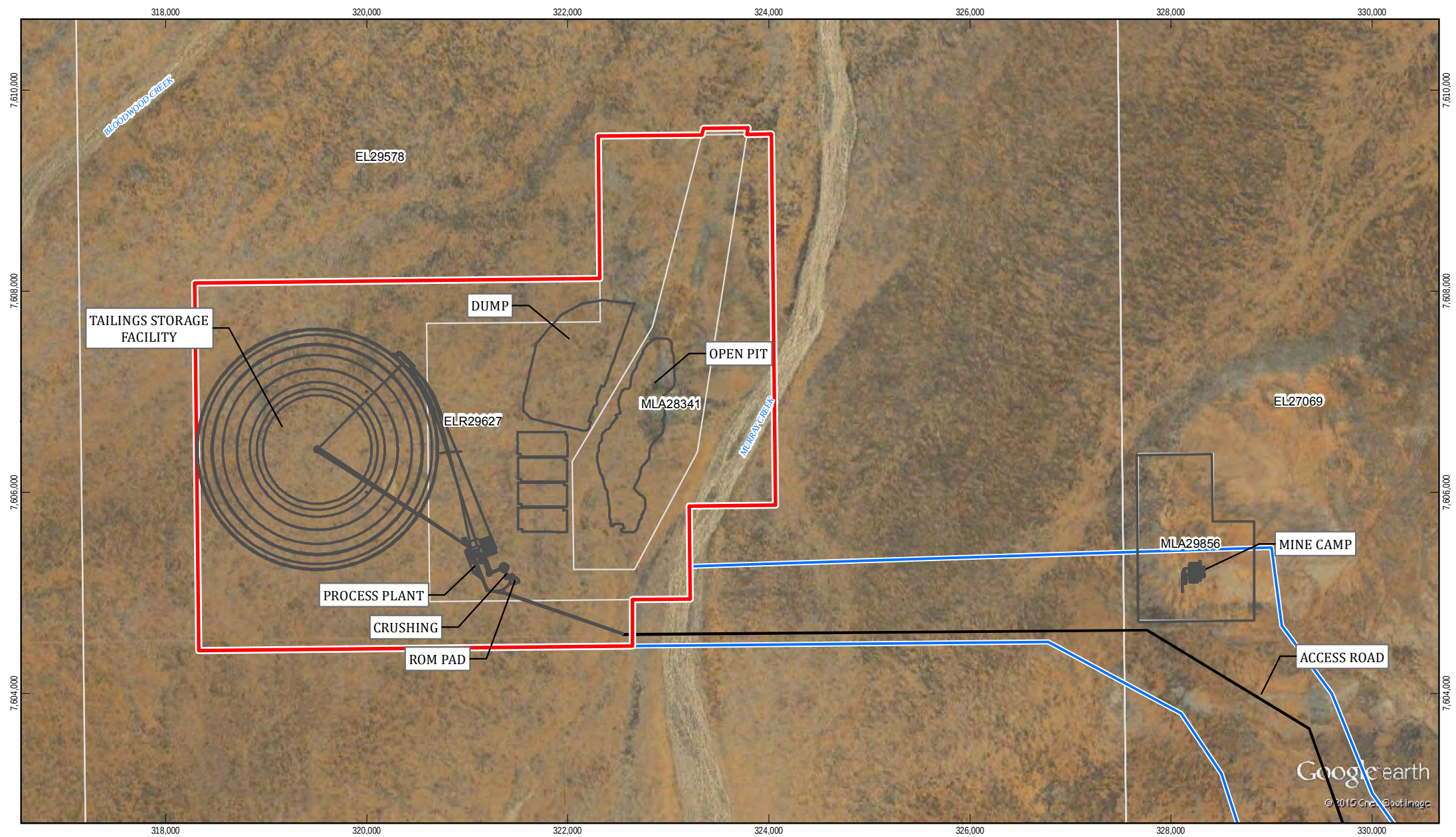
HPGR product will be conveyed to the HPGR screen feed bin. Screening of the HPGR product will be a wet process. Screen oversize (+2.8 mm) will be returned to the HPGR feed bin with undersize either sent to a secondary ball mill for further milling or fed directly to cyclones.

Cyclone overflow (<90 µm) gravitates to the magnetic separation circuit with underflow returned to the ball mill for further grinding.

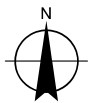
Magnetic separation

Cyclone overflow gravitates to a bank of Rougher Magnetic Separators (RMS) to remove entrained highly magnetic material (magnetite). The RMS concentrate then gravitates to bank of Cleaner Magnetic Separators (CMS) to lift the final concentrate grade by providing a high degree of selectivity in the separation. The CMS concentrate gravitates into the Magnetite stock feed tank.

Non-magnetic tailings streams will be pumped to a tailings thickener where the solids density is increased to approximately 65 %. Overflow from the thickener will gravitate to the process water dam whilst underflow will be pumped to the TSF for storage.



Paper Size A4
0 0.5 1 1.5
Kilometres
Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 53



LEGEND

- Mine Site Facilities
- Mount Peake Granted Tenements
- Mount Peake Mining Area
- Access Road
- Transport Study Corridor



TNG Ltd
Mount Peake EIS

Job Number	61-29057
Revision	A
Date	29 Oct 2015

Mine Site Detail
Mount Peake Project Area

Figure 2-2

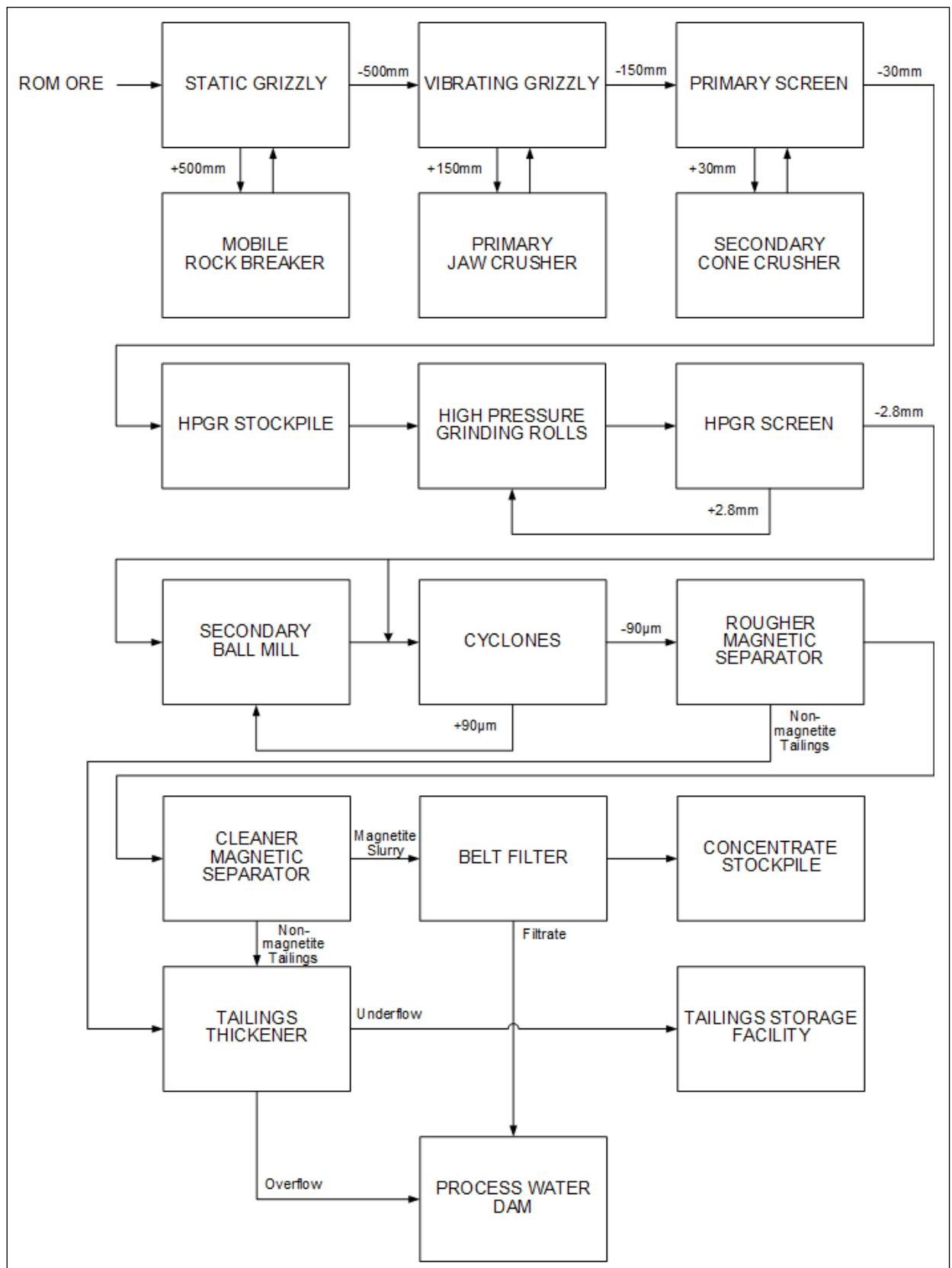


Figure 2-4 Simplified Process Diagram

Magnetite concentration

The magnetite slurry is filtered to achieve a moisture content of 10% w/w which is required to minimise the transport and shipping costs. Filter cake is then stockpiled in a concentrate storage area.

Tailings Storage Facility

Tailings will be produced following the magnetic separation of the crushed and screened ore and will consist of non-magnetic silts and sands. Tailings disposal will be via Central Thickened Discharge.

The initial processing rate of 3 Mtpa will double to 6 Mtpa from year five. The tailings thickener and the tailings discharge system will be duplicated in year five in line with the duplication of the process plant.

The TSF will be located west of the process plant and its location is provided in Figure 2-2.

The tailings disposal system comprises:

- Cone tailings thickener
- Tailings pumps;
- Tailings delivery pipeline
- Access ramp to a central discharge area;
- Perimeter earth-filled embankment
- Surface water drainage and seepage recovery systems
- Recovery water pond
- Emergency spillway
- Monitoring wells.

The key parameters of the TSF are:

- Maximum height of the CTD cone: 32 m
- CTD cone slope: 3%
- Maximum diameter of the CTD cone: 2,134 m
- Maximum TSF footprint area: 357 ha
- Maximum TSF storage capacity: 63.41 Mt (38.13 Mm³).

Water Storage

A 1.5 ha Raw Water Dam will be constructed adjacent to the process plant to manage project water supply. Total storage will be around 21 ML, sufficient for three days supply.

A 0.9 ha Process Water Dam will be constructed adjacent to the process plant to provide process water and to receive recovered water from the plant and tailings storage facility. Total storage will be around 7 ML, sufficient for 2 days supply.

2.5.5 Haulage Activities

Access Road

The Access Road is an unsealed road which connects the Mine Site to the Adnera Loadout Facility (approximately 100 km). Initial construction disturbance will be up to 25 m with the road having an ultimate footprint of 13 m. An underpass of Stuart Highway will be constructed and four single lane unsealed roads will connect the access road to the Stuart Highway. The access road will be fenced.

Adnera Loadout Facility

The proposed layout for the Adnera Loadout Facility is shown in Figure 2-5.

Road trains will side dump concentrate to a stockpile adjacent to the rail siding. The stockpile will have capacity for storage of up to 150,000 tonnes, sufficient for four weeks.

Train loading will occur directly by up to four front-end loaders. The train will have a length of 1.5 km and consist of 60 hopper wagons with a total capacity of around 5,500 tonnes. Around one train movement per day is expected.

Infrastructure located at Adnera will include:

- 1.8 km rail siding with signalling
- site office with potable water tank, toilet, washroom and shower connected to a septic tank
- generator and lighting
- bunded diesel storage tank
- hardstand.

Potable water and diesel will be trucked from the mine site as required.

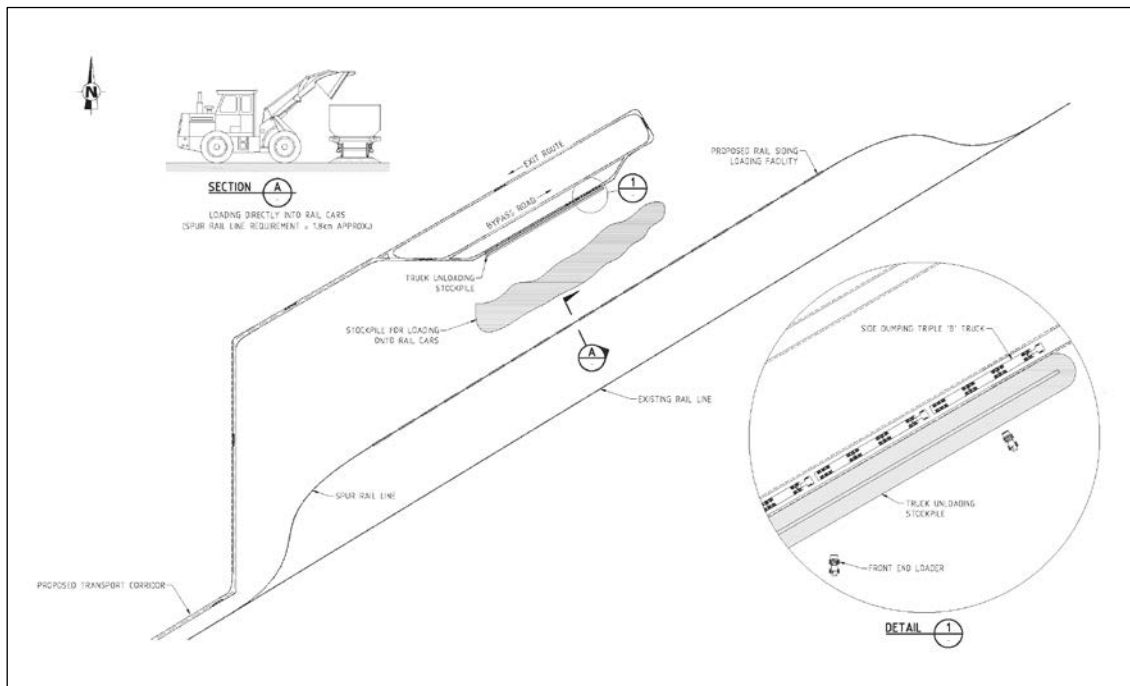


Figure 2-5 Adnera loadout facility

2.6 Closure Plan

A conceptual mine closure plan has been prepared. The plan included contingency measures for unplanned early closure. This plan will be regularly updated as a component of the Mine Management Plan.

3. Site Conditions

3.1 Physical Environment

3.1.1 Climate

The Bureau of Meteorology (BOM) Territory Grape Farm Station is situated approximately 80 km south of the Mine Site (BOM Site No. 015643). The Station has collected temperature and rainfall from 1987 to 2015. The data indicates the climate of the region is arid to semi-arid with a mean annual rainfall of approximately 310 mm. Rainfall generally falls over 30 days across the year predominately between October and March. However, rainfall in the region is highly variable. The average annual mean minimum and maximum temperatures range from 21.1 to 36.3°C respectively. The higher temperatures are generally experienced from October to March (corresponding with rainfall in the region). A summary of the data is provided in Table 3-1.

Table 3-1 Mount Peak Climate Summary from 1987 to 2015 (Source: BOM, Territory Grape Farm Station No. 015643)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
Temperature													
Mean Max (°C)	37.3	36.2	34.3	30.4	25.5	22.2	22.5	25.3	30.4	33.3	35.6	36.3	30.8
Mean Min (°C)	21.9	21.7	19.5	14.5	9.5	6.2	5.1	7.0	11.9	15.6	18.8	21.1	14.4
Rainfall													
Mean (mm)	62.4	65.8	21.0	18.0	22.5	8.6	4.7	4.6	10.0	14.7	30.9	50.5	312
Decile 5 (median) (mm)	44.2	33.8	10.2	3.0	1.0	1.6	0.0	0.0	1.6	7.1	19.1	40.7	298
Mean No. Days (≥1 mm)	4.3	4.7	2.1	1.5	2.2	1.2	0.7	0.8	1.0	2.7	3.9	4.9	30

Rainfall Statistics

The BOM Intensity-Frequency-Duration (IFD) predictions are provided in Table 3-2. The rainfall depth at Mount Peake for a 100 year 72 hour event is 310 mm.

Table 3-2 Mount Peake IFD Rainfall Depth (mm) (Source: BOM IFD AR&R87 Tool)

Duration	Return Period (Years)						
	1	2	5	10	20	50	100
5 mins	5	6	9	10	12	15	17
6 mins	5	7	10	12	14	17	20
10 mins	7	10	14	16	20	24	28
20 mins	11	15	21	25	30	37	43
30 mins	14	19	27	32	38	47	55
1 hr	19	25	37	44	53	66	76
2 hrs	24	32	47	56	68	85	98
3 hrs	27	36	53	64	77	97	112
6 hrs	32	43	64	77	94	118	137
12 hrs	39	53	78	95	116	146	170
24 hrs	49	66	99	121	149	187	219
48 hrs	61	83	125	154	190	240	281
72 hrs	66	91	137	168	208	264	310

3.1.2 Landform

Topography

The Mine Site is situated between two rivers, Bloodwood Creek and Murray Creek. The site gently slopes towards Murray Creek. The majority of the Access Road is situated within low lying flood plains. However, the eastern and western sections of the Haul Road begin to enter elevated terrain. The topography and general arrangement of the Project is provided in Figure 3-1.

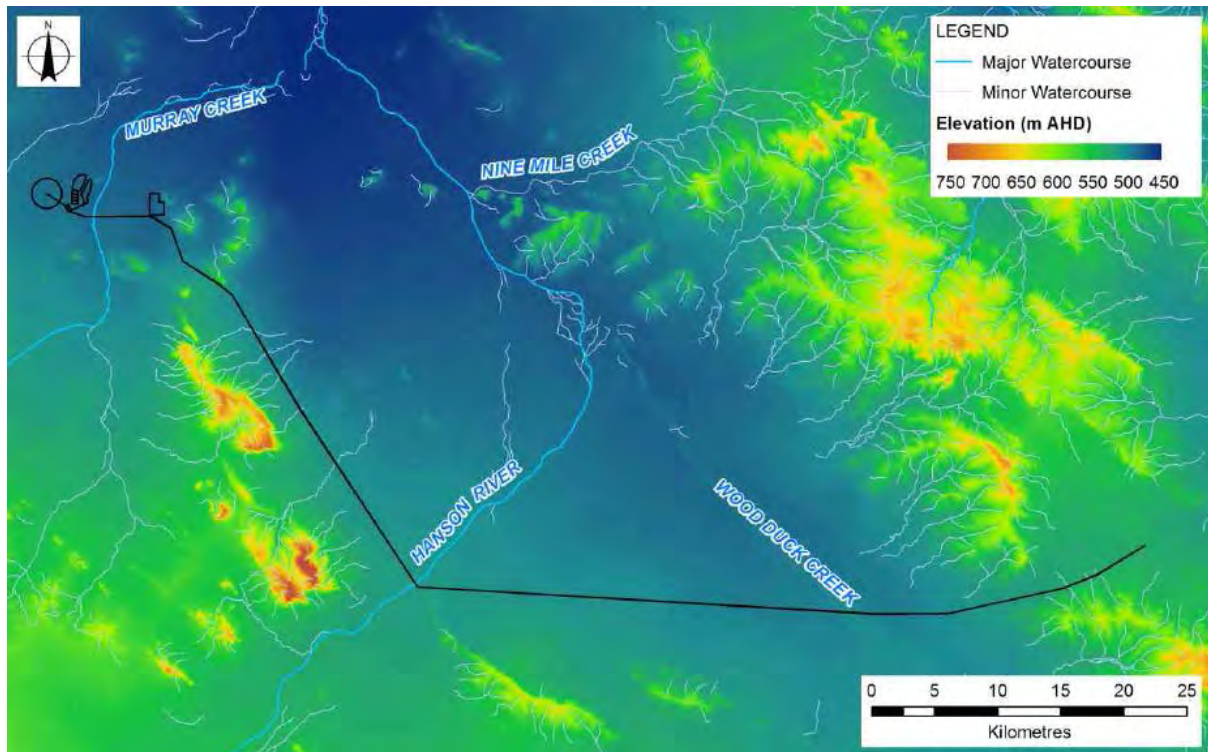


Figure 3-1 Topography and Major Drainages

Geology and Soils

Mine site

The orebody target for the mine is the mineralised Mount Peake gabbros, which are generally found concealed beneath recent Quaternary sediments. The gabbro unit is located within outliers of Neoproterozoic sediments of the Georgina Basin. The Neoproterozoic sediments rest unconformably on metasediments and granites of the Aileron Province within the Lower Proterozoic Arunta Region.

Within the immediate area of the mine site, Quaternary sediments are the dominant surface geological unit and regolith. The surficial deposits can generally be divided into two units either relating to the current cycle of weathering or erosion, or relating to earlier cycles of weathering.

Generally within the area of the mine site, the more recent unit is present comprised of red earth soil (Qr unit), with alluvial deposits present in active channels and on floodplains (Qa unit).

Immediately to the northeast of the proposed pit, a small outcrop of the Mount Stuart Formation is present forming a small rise immediately adjacent to Murray Creek. The same unit also forms the high ground east of the proposed mine camp area. The unit is described as a basal tillite, grey arkosic conglomerate, grey green calcareous pelite and minor dolomitic limestone; grey pelite, grey arkose, and reddish purple coarse feldspar-quartz sandstone. At the base of these units scree slopes and regolith are present.

Borefield

The borefield is located on the western bank of the Hanson River. The dominant surface geological unit here is the alluvial deposits of relict fluvial system largely covered by sheet sand (Qas unit) and alluvial/red soil plain deposits (Qra unit).

The thickness of the alluvial units within the borefield locations are significantly thicker in comparison to the general alluvial units found on the plains. The increased thickness relates to the incised channels of the palaeodrainages of the Hanson River.

The Hanson River alluvials are possible equivalent to the upper Ti Tree basin facies (facies 4) which have been described as reddish brown mottled sediments deposited in a fluvial environment and of Miocene age (7-20 MYA).

Access road

The access road transects various differing geologies and regolith units. The eastern half of the road alignment is predominately within the Georgina Basin, whereas the western half is within the Arunta Block. The alignment is located on the plains and therefore the surface geology and regolith is mainly comprised of alluvials. In the western area where the alignment is to the east of the ridge line formed from the Stuart Ranges, some localised scree and colluvial fan deposits are present.

In the eastern area of the alignment, the road passes through the palaeovalley associated with the Hanson River. In this location, older Cainozoic sediments are mapped, which are expected to include calcrete deposits.

Where the road alignment meets the existing rail line, the alluvial plain is relatively narrow with units of the Central Mount Stuart Formation being present both north and south of the road alignment.

3.1.3 Water

Surface Water

The Project site is located within the Wiso Surface Water Management Basin. Surface watercourses in the region are ephemeral. Watercourses generally flow north, with a number of smaller watercourses originating out of rocky outcrops into the surrounding plains.

Key water courses in the vicinity of the Project site include the Murray and Bloodwood Creeks. These are tributaries of the Hanson River, the main watercourse draining the western part of the Ti-Tree Basin (Figure 3-2).

The alluvial floodplains that separate the channels are referred to as floodouts, a term which has broad application and includes places where a drainage channel becomes subdivided, indistinct or disappears completely and water from the channel is dispersed across a plain or between dunes. Several of the water courses are considered to be joined, with shared floodouts in large flood events.

A number of minor watercourses emanate from the Djilbari Hills in the vicinity of Mistake and Gingers Bores, flowing northwards before terminating a short distance later in the sandplain.

Runoff is ephemeral and likely to be rapid in the foothills but slowing substantially on the plain.

Mud Hut Swamp, located in the floodout area of the Bloodwood Creek, Stirling Swamp (Anmatyerr North Site), an interim floodout area for the Hanson River and Wood Duck Swamp, 10 km south of the access road and outside of the Project, are listed as Sites of Conservation Significance and detailed in Figure 3-2. The channel of the Hanson River becomes ill defined, or braided, in the vicinity of Stirling Swamp, before becoming more defined again downstream.

The Hanson River rises in the Reynolds Range (also referred to as the Anmatijira Range) to the south west of the Project site, and flows north flooding out into the Tanami Desert, west of Tennant Creek. This floodout area is an important source for groundwater recharge.

Groundwater

Mine Site

Eleven exploration holes within and adjacent to the pit were airlifted in March 2014. Prior to airlifting groundwater was measured at a depth around 20 to 22 m BGL with salinity generally between 6000 and 8000 mg/L TDS. Low volumes of groundwater were able to be purged with only five holes sustaining rates of >12 L/min.

Borefield

A drilling and testing program was undertaken in March 2015 to assess the groundwater supply potential of the Hanson River palaeovalley. All drilled bores intersected a sequence of sands and gravels to varying thicknesses overlying a variable basement. In general, an upper silty unit was identified above a coarser grained sand and gravel unit (main aquifer). Groundwater levels were relatively consistent between sites at a depth of around 10 m bgl. All bores produced significant water during drilling and 150 mm wells were constructed and pump tested at all sites. Yields ranged from 3 to 8.5 L/s with electrical conductivity ranging from 8,260 to 47,300 $\mu\text{S/cm}$.

Drawdown

Maximum groundwater drawdown at the borefield at the end of mining is modelled as being up to 12 m at the location of the operating bores in the centre of the borefield. Drawdown decreases significantly with depth away from the palaeovalley. The 1 m drawdown contour extends to around 6 km south of the borefield.

The model predictions indicate that groundwater levels at the up-gradient model boundary, in the area adjacent to Stirling Swamp and outflow of the Ti Tree basin, are not impacted by abstraction from the borefield.

At the end of mining, drawdown under transient conditions reaches a maximum of around 100m within the location of the pit, and rapidly decreases with distance from the pit. The 1 m drawdown contour is predicted as being around 1 km from the pit edge, and the approximate limit of drawdown (0.05 m) a further 1 km from this. No drawdown impacts are expected at Mud Hut Swamp.

Modelling indicates that there will groundwater level impacts at some existing stock bores (Table 3-3). Existing stock bores closest to the borefield are modelled as having a groundwater level reduction by up to around 3 m. Such a reduction in groundwater levels may lead to the existing stock bore infrastructure being inadequate to provide stock water supply.

At 100 years, the groundwater levels recover in the area of the borefield, with maximum drawdown reducing to less than 5 m. However the overall extent of drawdown does increase slightly as groundwater from storage drains to the recovering borefield. Drawdown extent in the area of the mine site at 100 years increases to an extent of 3.5 km from the mine pit for 1 m drawdown. No drawdown impacts are expected at Mud Hut Swamp.

The transient simulations indicate that groundwater level recovery is slow in the palaeovalley. The slow recovery is largely related to the recharge characteristics of the model, which are conservative.

Pit Lake

Calculations indicate that a pit lake will develop post mining, with pit lake water levels stabilising after about a year (inflow becoming equal to evaporation). It is predicted that the pit lake would stabilise at around 365 mAHD, equivalent to around 10 deep at its deepest part. The pit lake will become increasingly saline as salts from groundwater, surface water and rainfall accumulate. By around 7 years post-closure a salinity of around 35,000 mg/L is predicted.

Table 3-3 Modelled drawdown at pastoral bores/wells

Bore/well	Distance from mine	Distance from borefield	Transient drawdown (17 yrs)	Transient drawdown (100 yrs)
Mudhut Bore	9	14	<0.05 m	<0.05 m
Boko Bore	11	12	<0.05 m	<0.05 m
Browns	19	2	2.4 m	3.4
Wollogolong Bore	33	2	3.2 m	2.9 m
Middle Well (inactive)	28	0	10.5 m	4.7 m
Mt Peake Creek Bore	22	9	<0.05 m	0.1 m
Mistake Bore	20	24	<0.05 m	<0.05 m
Junction Well	28	14	<0.05 m	1.1 m
Twin Soak Bore	45	15	<0.05 m	0.5 m

3.1.4 Land System Classifications

Eight broad land systems have been mapped across the Project area. The majority of the area is covered by two lands systems including the Singleton system which is characterised by spinifex sand plains and the Bushy Park system which primarily consist of mulga plains on red earths. A summary of land system classifications across the Project area provided in Table 3-4.

Table 3-4 Land Systems

Code	Land System	Landform	Soil Description	Vegetation
Bo (6)	Boen	Plains with convex interfluvies and broad shallow valleys	Red earths, lateritic in part	Mulga in groves over short grass or <i>Eragrostis eriopoda</i> (woollybutt)
Hu (47)	Huckitta	Mountain ranges with rounded foothills and spurs	Little soil	Spinifex or sparse grass
WI (65)	Woolla	Low platforms and drainage floors	Shallow sandy calcareous earths and red earths	Sparse low trees over short grass; Some plains of red clayey sands and spinifex.
Sn (78)	Singleton	Parallel, reticulate and irregular sand dunes with stable flanks	Red dune sands and red clayey sands	Spinifex
Wo (82)	Woodduck	Fans with sandy plains	Red clayey sands	Spinifex or sparse low trees over short grass
Kr (31)	Krichauff	Bold plateaux, with rocky summits and steep dissected margins	Very stony and sandy soils	Sparse shrubs and low trees over spinifex or sparse grass
Ac (18)	Alcoota	Undulating plains Erosional and alluvial slopes	Red earths Textured-contrast soils, some stony	Mulga over short grasses. Sparse low trees over short grass or <i>Eragrostis eriopoda</i> (woollybutt)
Bu (67)	Bushy Park	Plains	Red earths	<i>Acacia aneura</i> (Mulga) in groves over short grass or <i>Eragrostis eriopoda</i> (woollybutt).

3.1.5 Vegetation

Based on the fine-scale vegetation mapping and flora sampling performed by GHD, eight broad vegetation communities were identified as occurring within the Project area (Table 3-5) based on similarities in landscape position, floristics, vegetation structure and patterns.

The dominant vegetation types at the Project are Mulga shrublands, which occur on alluvial fans and plains containing clayey red earths and Triodia hummock grasslands which grow on sandy plains and undulating hills.

Vegetation across the Project is generally in good condition with little anthropologic disturbance and high species richness. In more fertile riparian areas and associated floodplains there is clear evidence of impacts associated with cattle grazing including weed invasion, reduction in ground cover species and soil erosion. In particular there is a high abundance of the invasive grass *Cenchrus ciliaris* (Buffel Grass).

Table 3-5 Vegetation Types Communities

Veg. Code	Vegetation Type	NVIS Description (Level III Broad Floristic Formation)	Area (ha)
VT 1	Low open Eucalyptus woodland on limestone	Triodia hummock grassland	775
VT 2	Mulga shrubland on sandy red earths	Acacia shrubland	11,885
VT 3	Riparian woodland along watercourses and drainage channels	Eucalyptus open woodland	554
VT 4	Low Corymbia woodland on loamy alluvial plains	Tussock grassland	675
VT 5	Floodplains dominated by <i>Eucalyptus victrix</i>	Eucalyptus open woodland	609
VT 6	Triodia grassland on sandy plains	Triodia hummock grassland	8,115
VT 7	Low Acacia shrubland on rocky slopes	Triodia hummock grassland	441
VT 8	Tall Acacia shrubland on stony quartz	Acacia shrubland	223

3.1.6 Flora

The NT Government flora records for the Project area (plus a 20 km buffer) contain 1,392 records of 494 species. These records include one threatened flora species (*Eleocharis papillosa*) listed as vulnerable under both the Territory Parks and Wildlife Conservation Act (TPWC Act) and the Environment Protection and Biodiversity Conservation Act (EPBC Act).

Database records for the locality included 7 near threatened species, 6 endemic species and 14 species recorded as being data deficient. A total of 16 exotic species have also been recorded within the locality.

A site survey identified 238 flora species (233 native and five introduced) within the Project area. No threatened flora species were recorded during the survey, although there is potential habitat for the threatened species the Dwarf Desert Spike Rush (*Eleocharis papillosa*) within the Project area.

The survey identified four environmental weeds including Buffel Grass (*Cenchrus ciliaris*), Bitter Melon (*Citrullus lanatus*), Elastic Grass (*Eragrostis tenuifolia*) and Mimosa Bush (*Vachellia farnesiana*) and one NT Weeds Management Act Class B/C weed (Caltrop – *Tribulus terrestris*).

3.1.7 Fauna

The DLRM Fauna Atlas and the PMST results identified 22 threatened vertebrate fauna species (15 mammals, 6 birds and one reptile) for the Project Area. Twenty of these are listed under the EPBC Act and all are listed under NT legislation (TPWC Act). Some of the species (all mammals) are considered extinct in the Northern Territory, and others are predicted to occur but have never before been recorded within the Burt Plains Bioregion.

Sixteen threatened or near-threatened species (6 mammals, 6 birds, 3 reptiles and 1 frog) are considered likely to occur within the Project Area, either as residents or visitors. Most of these are expected to be rare or very rare. Seven of these species were detected during the fauna survey:

- Brush-tailed Mulgara (*Dasycercus blythi*)
- Bilby (*Macrotis lagotis*)
- Grey Falcon (*Falco hypoleucos*)
- Emu (*Dromaius novaehollandiae*)
- Australian Bustard (*Ardeotis australis*)
- Woma Python (*Aspidites ramsayi*)
- King Brown Snake (*Pseudechis australis*).

The survey identified indicators that the Brush-tailed Mulgara and Bilby are likely to be present within the area but were not observed.

3.2 Sacred, Archaeological and Heritage Sites

3.2.1 Archaeological

A targeted archaeological survey of the Mount Peake area confirmed the presence of sixteen previously unidentified Aboriginal stone artefact sites. These sites, comprising both surface scatters and isolated finds, were located across natural riverbank and foothill landforms, in close proximity to watercourses, significant landscape features and natural resources. Although stone artefact deposits are currently only visible on the sparsely vegetated, partially deflated banks of the Hanson River and ephemeral creeks, it is likely that a large portion of these identified sites extend, with good integrity, as subsurface archaeological deposits.

There is no potential for impact to Aboriginal archaeological sites or areas of archaeological sensitivity associated with construction of the mine, camp and rail loadout, and no historic heritage constraints on the proposed access road. No further assessment is required prior to commencement of construction on the proposed works.

Construction of the access road is likely to directly impact two artefact scatters and may indirectly impact one scatter and one isolated find as indicated on Figure 3-3.

The management of archaeological sites will be undertaken in accordance with the Cultural Heritage Management Plan.

3.2.2 Sacred Sites

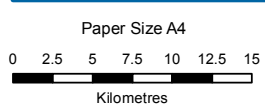
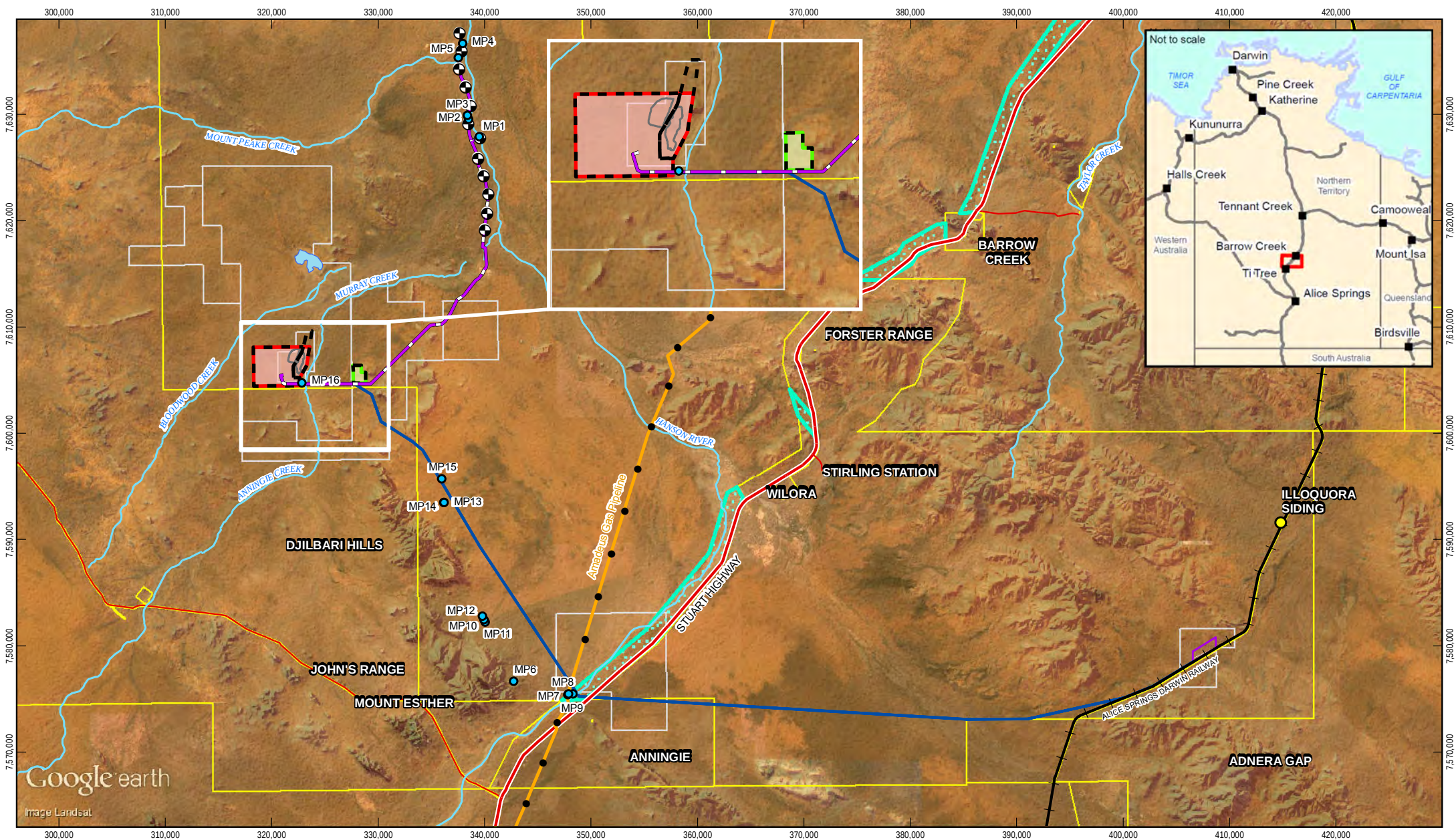
The Mount Peake Exploration Leases (EL23074, EL23271, EL27070, EL27069, EL27706 and EL27787) have been surveyed by the Central Land Council (CLC) and Aboriginal Owners and custodians consulted. The CLC has produced a Clearance Certificate (2015-034) for all works associated with the construction and operation of a mine and associated infrastructure on these exploration leases.

A copy of the certificate is provided in Appendix A of the Cultural Heritage Management Plan.

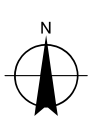
The management of sacred sites will be undertaken in accordance with the Cultural Heritage Management Plan.

3.2.3 Heritage Sites

There are no heritage sites in the Project area.



Horizontal Datum: GDA 1994
Grid: GCS GDA 1994



LEGEND

Illoquora Siding	Major Watercourses	Rail Siding Loading Facility	Cadastral Boundaries
Potential Borefield	Railway	Mount Peake Mining Area	Access Road
Borefield Delivery Pipeline	Amadeus Gas Pipeline	Crown Land	Camp Facilities
Principal Road	Mine Site Facilities	Mount Peake Granted Tenements	Archaeological Site
Minor Road	Mud Hut Swamp	Mount Peake Mineral Leases	



TNG Ltd
Mount Peake EIS

Job Number 61-29057
Revision A
Date 22 Feb 2016

Cultural Heritage Locations

Figure 3-3

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239 Adelaide Terrace Perth WA 6004 Australia T 61 8 6222 8222 F 61 8 6222 8555 E permail@ghd.com.au W www.ghd.com.au

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Data source: TNG - Gas / Slurry Pipeline Study Corridor, Camp Facilities, Borefield Infrastructure, Transport Study Corridor, Mount Peake Mining Area, Mount Peake Granted Tenements (2015), Geoscience Australia - Waterways, mainland, placename, road (2008), Google Earth Pro - Imagery (Date extracted: 13/02/2014), AMC: Archaeological Sites - 20151203. Created by: RB

3.3 Socio-economic Environment

3.3.1 Current Land Use

The Project is predominately location on the Stirling Station Pastoral Lease (PPL 1103) with a small area of the transport corridor potentially located on the Anningie Station Pastoral Lease (PPL 1057). The Pastoral Lease boundaries are shown on Figure 2-1. The closest community is Wilora, situated approximately 47 km east of the Mine Site and 43 km west of the Adnera Loadout Facility.

3.3.2 Identified Stakeholders

A summary of key stakeholders is provided in Table 3-6.

Table 3-6 Key Project Stakeholders

Stakeholder	Contact ID	Contact Details
Land Holders		
Stirling Pastoral Lease	Matthew and Anita McCarthy	08 8956 9751
Anningie Pastoral Lease	Steven and Belinda Fogarty	08 8956 9748
Communities / Towns		
Wilora	n/a	n/a
Barrow Creek	n/a	n/a
Ti Tree	n/a	n/a
Alice Springs	n/a	n/a
Other		
NT Department of Mines and Energy (DME)	Philip Hausler Executive Director Mines	08 8999 6528 mineral.info@nt.gov.au
NT Environmental Protection Authority	Pollution Hotline	1800 064 567 pollution@nt.gov.au
NT Work Safe	n/a	1800 019 115 ntworksafe@nt.gov.au
Central Land Council (CLC)	n/a	08 8951 6211 media@clc.org.au
NT Police Service	Emergency	000
	Non-emergency	131 444
Department of the Environment (DoE)	-	02 6274 1372 compliance@environment.gov.au

Stakeholder Consultation

Stakeholder consultation was undertaken as part of the EIS process. A summary of consultation and outcomes is available within the EIS report. However, consultation generally included:

- Introductory letter provided to broader list of stakeholders
- Project Information Sheets developed for Public Information Sessions
- Advertisements of Public Information Sessions (NT News and Centralian Advocate)
- Public Information Sessions including Alice Spring, Stirling Station and Ti Tree in March 2015
- Stakeholder Database developed to track outcomes from aforementioned consultation.

Ongoing engagement with stakeholders will be undertaken throughout the Project construction and operation phase. The objectives of ongoing engagement are to:

- Maintain open dialogue regarding the Project timing and activities as approvals are secured
- Encourage stakeholders to continue to raise concerns and queries directly with TNG for response or resolution throughout the Project planning, development and operation phases.

4. Project Risk Summary

4.1.1 Risk Assessment

An environmental risk assessment was undertaken for the Project during the EIS phase. The risk assessment identified the risk source (hazard and event), receptors and potential impact. The consequence and likelihood were determined using the descriptions identified in Table 4-1 and Table 4-2 respectively. The risk matrix is provided in Table 4-3.

Table 4-1 Consequence Description

Consequence	Insignificant	Minor environmental impact. Impacts are contained on-site and short term in nature. No detrimental effect on the environment.
	1	Minor repairable damage to common historic structures or sites. No disturbance of cultural heritage sites. Minor local habitat modification and / or lifecycle disruption for a listed species. No loss of individuals of listed species. Negligible soil impact. Chemical concentrations are above background but below EILs. No detectable change to background water quality. No exceedance of background and applicable Water Quality guidelines.
	Minor	Moderate, unplanned localised environmental impact (may be of a temporary nature) or discharge contained on-site or with negligible off-site impact.
	2	Moderate but repairable damage to important historic structures or sites of cultural importance. Moderate local habitat modification and / or lifecycle disruption for a listed species. Minor local decrease in size of population(s) of listed species. Localised soil impact. Low level <2 times exceedance of EILs. Local short-term minor exceedance of background and applicable Water Quality guidelines.
	Moderate	Significant, unplanned environmental impact contained on-site or minor impact that is off-site.
	3	Considerable damage or infringement to sensitive historic structures or sites of cultural significance. Substantial local habitat modification and / or lifecycle disruption for a listed species. Moderate local decrease in size of population(s) of listed species. Localised long term or widespread short term soil impact. Chemical concentrations 2-5 times EILs. Local long-term or widespread short-term exceedance of background and applicable Water Quality guidelines.
	Major	Major or widespread, unplanned environmental impact on or off-site. Could include substantial pollutant discharges. Significant resources required to respond and rehabilitate.
	4	Major damage or infringement to sensitive historic structures or sites of cultural significance. Moderate regional habitat modification and / or lifecycle disruption for a listed species. Substantial local decrease in size of population(s) of listed species. Widespread and / or long term impact to soils. Chemical concentrations 5-10 times EILs. Local, permanent or widespread, long-term exceedance of background and applicable Water Quality guidelines.
	Critical	Extensive long term environmental harm or harm that is very widespread. Could include extensive pollutant discharges. Impacts permanent or unlikely to be reversible within 10 years.
	5	Unsalvageable and permanent damage to sensitive historic structures or sites of cultural significance. Substantial regional habitat modification and / or lifecycle disruption for a listed species. Moderate or substantial regional decrease in size of population(s) of listed species. Irreversible and / or extensive impact to soils. Chemical concentrations >10 times the ecological investigation levels (EILs). Widespread, permanent exceedance of background and applicable Water Quality guidelines.

Table 4-2 Likelihood Description

Likelihood	Rare	Unlikely	Possible	Likely	Almost Certain
	1	2	3	4	5
Description	The event may occur only in exceptional circumstances.	The event could occur at some time.	The event might occur at some time.	The event will probably occur in most circumstances.	The event is expected to occur in most circumstances.
Occurrence Intervals	>10 years	5 – 10 years	2 – 5 years	1 – 2 years	1 year

Table 4-3 Risk Matrix

			Severity of Consequence				
			Critical	Major	Significant	Moderate	Minor
			5	4	3	2	1
Likelihood of Consequence	Almost Certain	5	Extreme	Extreme	High	High	Medium
	Likely	4	Extreme	High	High	Medium	Medium
	Possible	3	Extreme	High	Medium	Medium	Low
	Unlikely	2	High	Medium	Medium	Low	Very Low
	Rare	1	Medium	Medium	Low	Low	Very Low

4.1.2 Identification of Environmental Aspects and Impacts

The EIS Environmental Risk Assessment has been utilised to summarise the key environmental risks pertaining to the Project. The Risk Assessment identified 152 environmental risks associated with the construction, operation and closure of the Project. Residual environmental risks included four high (two positive social impacts not discussed below), 67 medium, 50 low and 35 very low.

The Project environmental risk assessment will be updated annually through the EMP revision detailed in 6.2.2.

Table 4-4 Residual Environmental Risks

Aspect	Residual Environmental Risk				
	Very Low	Low	Medium	High	Extreme
Socio-economic		4	4	2	
Human Health and Safety		2	12		
Groundwater	1	3	6	1	
Surface Water	1	3	8		
Vegetation and Flora		17	14	1	
Fauna	30	7	5		
Cultural Heritage		1	3		
Air Quality		4	1		
Noise and Vibration		4			
Transport		2	2		
Waste		3	3		
Closure and Rehabilitation	3		9		
TOTAL	35	50	67	4	0

Medium Residual Risks

The residual medium risks established in the DEIS are summarised below:

- Groundwater
 - Abstraction
Abstraction of groundwater in the Borefield leading to the drawdown and potentially restricting adjacent groundwater use for livestock consumption.
 - Contamination
Seepage to groundwater from infrastructure including the TSF and WRD.
 - Liquid and solid waste disposal at the onsite landfill causing the production of leachate and localised groundwater contamination.
 - Hazardous substances leak and/or spill causing groundwater contamination.
- Surface Water
 - Retention ponds overflow impacting surface watercourses.
 - Sediments runoff from disturbed areas impacting the downstream aquatic environment.
- Vegetation and Flora
 - Clearing of 1038 ha of native vegetation and construction of Mine site and associated infrastructure causing modification, destruction, removal or isolation of habitat.
 - Introduction of weeds and to the Project and distribution across the site including Anmatyerr North (Stirling Swamp) SOCS.
 - Construction and operation activities causing a long term reduction in rare, endemic, unique plant or threatened populations or species.
- Fauna
 - Unplanned wildfire causing mortality and modifying, destroying or isolating the availability or quality of habitat to the extent that the species is likely to decline.
- Conservation Estate
 - Disturbance of Anmatyerr North (Stirling Swamp) SOCS during road construction.
- Cultural Heritage
 - Ground disturbance and land clearing impacting known and/or unidentified cultural heritage.
 - Major open pit slope failure damaging adjacent sacred site.
- Air Quality
 - Greenhouse gas emissions from Project activities.
- Waste
 - Hazardous waste and landfill causing soil contamination.
- Closure and Rehabilitation
 - Inadequate decommissioning of the Project due to limited soils, native vegetation seedbank, geotechnical stability and/or removal of infrastructure.
 - Ineffective mine closure due to inaccurate closure costing.
 - Temporary closure with inability to meet environmental obligations of landform stability, water quality management and contaminant management.

High Residual Risk

Two negative high risks were identified as a result of potential for groundwater drawdown from the borefield to impact phreatophytic vegetation. Groundwater modelling indicates the following:

- Operation (Year 17)
 - Borefield drawdown is modelled to be 12 m at the central Production Bore. The 1 m drawdown contour extends along the palaeovalley extending approximately 27 km from north to south and 8 km from west to east.
- Closure (83 years post operation)
 - Borefield drawdown is modelled to be 5 m at the central Production Bore. The 1 m drawdown contour extends along the palaeovalley extending approximately 41 km from north to south and 14 km from west to east.

The management of groundwater will be in accordance with the Water Management Plan (WMP) provided in Appendix H. However, additional surveys will be undertaken prior to the operation of the Borefield to establish presence and distribution of phreatophytic vegetation and detail a monitoring program. The Biodiversity Management Plan and WMP will be updated accordingly following the survey(s).

5. Approval and Legislative Requirements

5.1 Environmental Approvals

The Project will be assessed through several approval processes include the NT EPA, DotE and DME. A summary of environmental approvals status to date and future actions is provided in Table 5-1.

Table 5-1 Environmental Approvals

Date	Entity	Documentation	Details
04/07/13	TNG	Notice of Intent	Introduction of the Project including: - Project Location and Description - Legislation - Site Descriptions, Potential Impacts and Mitigation.
13/11/13	NT EPA	Statement of Reasons	NT EPA assessed the NOI and determined the Project required further assessment under the <i>Environmental Assessment Act</i> to the level of an Environmental Impact Statement.
14/10/13	TNG	EPBC Referral	Introduction of the Project including: - Project Location and Description - Legislation - Site Descriptions, Potential Impacts and Mitigation.
07/03/14	NT EPA	Terms of Reference for the Development of an EIS	EIS development guidelines and requirements for assessment.
09/03/15	TNG	Section 14A EA Administrative Procedures Project Variation	Project description variation including the removal of the hydrometallurgical processing plant and a gas / slurry pipeline infrastructure corridor linking the mine site with a rail siding at Adnera Loadout Facility.
11/03/15	TNG	Section 156B EPBC Act Project Variation	
<i>tbc</i>	TNG	Draft Environmental Impact Statement	Detailed assessment of the Project to address NT EPA Terms of Reference.
28 day Public and Government Review of the DEIS			
<i>tbc</i>	NT EPA	Request for Further Information	Request for additional details and provision of Public and Government Review comments
<i>tbc</i>	TNG	Supplement to the Draft Environmental Impact Statement	
<i>tbc</i>	NT EPA	Assessment Report	
<i>tbc</i>	TNG	Section 156B EPBC Act Project Variation	
<i>tbc</i>	TNG	Mining Management Plan	
<i>tbc</i>	DME	Mine Authorisation	

5.2 Commonwealth Legislation

A summary of key Commonwealth Legislation relevant to the Project is provided in Table 5-2.

Table 5-2 Commonwealth Legislation

Title	Details	Relevance
Environment Protection and Biodiversity Conservation Act	Under this Act, any development requires assessment if it has the potential to affect one or more of the following nine Matters of National Environmental Significance: - World Heritage properties - National Heritage places - Wetlands of international importance (listed under the Ramsar Convention) - Listed threatened species and ecological communities - Migratory species protected under international agreements - Commonwealth marine areas	The Mount Peake Project was determined by the DotE to be a controlled action and required assessment under the <i>EPBC Act</i> before it could proceed. The controlling provision was listed threatened species and communities (Section 18 and 18A). The DotE also determined that accredited assessment at the level of Environmental Impact Statement

Title	Details	Relevance
	- The Great Barrier Reef Marine Park - Nuclear actions (including uranium mines) - A water resource, in relation to coal seam gas development and large coal mining development.	under the <i>Northern Territory Environmental Assessment Act</i> was applicable.
Native Title Act	This Act recognises native title in lands over which Native Title is not extinguished and where persons able to establish Native Title are able to prove continuous use, occupation or other classes of behaviour and actions consistent with a traditional cultural possession of those lands. The objectives of the Act are to: - Provide for the recognition and protection of native title - Establish ways in which future dealings affecting native title may proceed and to set standards for those dealings - Establish a mechanism for determining claims to native title - Provide for, or permit, the validation of past acts, and intermediate period acts, invalidated because of the existence of native title.	Mount Peake tenements are covered by a Native Title application. Registration of Native Title Determination Application – DC11/12 Stirling and Neutral Junction NTD17/2011 was registered with the National Native Title Tribunal on 17 August 2011 under Section 190A of the <i>Native Title Act</i> . The application was accepted for registration and entered onto the Register of Native Title Claims on 19 August 2011.
Aboriginal Land Rights (Northern Territory) Act	This Act provides for the granting of freehold title to traditional Aboriginal owners of land in the Northern Territory, the establishment of Land Councils, and the establishment and management of Land Trusts to hold the Aboriginal land for the benefit of traditional owners of the land. The Act also regulates exploration and mining on Aboriginal land and sets out the processes to be followed when negotiating with Traditional Owners for access to, and leases over, Aboriginal land. An exploration licence cannot be granted in relation to Aboriginal land without the consent of the relevant Land Council (for the traditional owners) and the Minister. A mineral lease cannot be granted unless an agreement has been entered into under the Act.	TNG has exploration licences and mineral leases granted by the Central Land Council.
Aboriginal and Torres Strait Islander Heritage Protection Act	This Act makes provision for the preservation and protection from injury or desecration of areas and objects in Australia and in Australian waters, being areas and objects that are of particular significance to Aboriginal people in accordance with Aboriginal tradition.	TNG will comply with relevant provisions of this Act.
National Environment Protection Council Act (NEPC Act)	The National Environment Protection Council (NEPC) was established under the NEPC Act and corresponding legislation in the other jurisdictions. The purpose of NEPC is to ensure that: - Australians enjoy the benefit of equivalent protection from air, water or soil pollution and from noise wherever they live - Business decisions are not distorted and markets are not fragmented by variations in major environment protection initiatives between member governments. NEPC has powers to make National Environment Protection Measures (NEPMs) on: - Ambient air quality - Ambient marine, estuarine and fresh water quality - The protection of amenity in relation to noise (but only if differences in environmental requirements relating to noise would have an adverse effect on national markets for goods and services) - General guidelines for the assessment of site contamination - Environmental impacts associated with hazardous wastes - The re-use and recycling of used materials - Motor vehicle noise and emissions (in consultation with the National Transport Commission). The Air NEPM sets national standards for the six key air pollutants to which most Australians are exposed: carbon monoxide, ozone, sulfur dioxide, nitrogen dioxide, lead and particles.	Ambient Air Quality NEPM standards have been adopted for the Project. TNG will also comply with compulsory annual reporting if the projects emissions exceed thresholds outlined in the Act and supporting regulations.

Title	Details	Relevance
National Greenhouse and Energy Reporting Act (NGER Act)	The NGER Act introduced a single national framework for reporting and disseminating company information about greenhouse gas emissions, energy production, energy consumption and other information specified under NGER legislation. Facility and corporate group thresholds define which corporations are affected by the Act. Both the facility and corporate group thresholds have three components: • A greenhouse gas emissions threshold • An energy production threshold • An energy consumption threshold. If a corporation meets or exceeds one or more of the thresholds for a reporting year, they must register and report for the first year the threshold is reached and for each year thereafter that the corporation remains registered. The facility thresholds are: • 25 kilotonnes (kt) or more of greenhouse gases—carbon dioxide equivalence (CO₂-e) • Production of 100 terajoules (TJ) or more of energy or • Consumption of 100 TJ or more of energy. Corporate group thresholds are: • 50 kt or more of greenhouse gases (CO₂-e) • Production of 200 TJ or more of energy or • Consumption of 200 TJ or more of energy.	The Project will trigger both the facility and corporation reporting thresholds.

5.3 Northern Territory

A summary of key Northern Territory legislation relevant to the Project is provided in Table 5-3.

Table 5-3 Northern Territory Legislation

Title	Summary	Relevance
Environmental Assessment Act and Environmental Assessment Administrative Procedures Act	These Acts ensure that each matter affecting the environment is fully examined and taken into account in, and in relation to: • Formulation of proposals • Carrying out of works and other projects • Negotiation, operation and enforcement of agreements and arrangements (including agreements and arrangements with authorities of the commonwealth, the states and other territories) • Making of, or the participation in the making of, decisions and recommendations • Incurring of expenditure.	In June 2013, TNG submitted a Notice of Intent for the Mount Peake Project to the NT Environment Protection Authority (NT EPA). On 13 November 2013 the NT EPA determined that the Mount Peake Project required assessment under the <i>EA Act</i> at the level of an Environmental Impact Statement. Terms of Reference for the EIS were issued on 7 March 2014.
Mineral Titles Act	The objectives of this Act is to establish a framework for granting and regulating mineral titles that authorise exploration for, and extraction and processing of, minerals and extractive minerals. The act also aims to facilitate the commercialisation of activities conducted under mineral titles by authorising the creation and transfer of interests in the titles, and to authorise other activities relating to minerals or extractive minerals to be conducted without mineral titles.	TNG has established several tenures through the Act for the Mount Peake Project: • MLA25341 • MLA29855 • MLA29856 • MLA30686 • EL27069 • EL27070 • EL27941 • EL29578 • EL30483 • ELR29627.

Title	Summary	Relevance
Mining Management Act	The objectives of the MM Act are to ensure that the development of mineral resources in the Northern Territory is in accordance with the best practice health, safety and environmental standards and to protect the environment and health and safety of all persons on mining sites. Under the MM Act, an application for an authorisation to carry out mining activities must be accompanied by a Mining Management Plan. A MMP includes information relating to the description of mining activities, the management system to be implemented for the management of health, safety and environmental aspects, costing of closure activities and particulars of organisational structure. Plans of any existing or proposed mine workings and infrastructure must also be included. Under Section 29 of the MM Act the Operator must report an environmental incident or serious environmental incidents as soon as practicable. Under Section 43 of the MM Act a financial security may be required by the Minister for the purpose of securing costs and expenses in relation to the Minister causing an action to be taken to prevent, minimise or rectify environmental harm. Mine operators are expected to calculate rehabilitation costs and present these as part of the MMP. Costs are verified and reassessed when revised MMPs are submitted.	Following the acceptance of the Project through the NT EPA a MMP will be submitted to DME for approval. The MMP will include NT EPA recommendations from formal assessment and include this Environmental Management Plan. If a spill causes environmental impact with some actual or potential harm to the environment it will be reported to DME through a Section 29 Notification of Environmental Incident. A Section 29 Notification of Environmental Incident form is provided within the Hazardous Substances Management Plan and Emergency Response Plan.
Northern Territory Aboriginal Sacred Sites Act	This Act is administered by the Aboriginal Areas Protection Authority (AAPA). The Act provides for the location, recognition, description and protection of sites sacred under Aboriginal tradition. All sacred sites (even if not registered) are protected under the Act and it is an offence to enter or carry out work on a sacred site without permission or a certificate issued by the AAPA. The certificate sets out conditions under which the work may be carried out.	Consultation with the Central Land Council (CLC) has been undertaken by TNG as part of Project development activities. A number of sacred sites are present in proximity to the Project. CLC has provided TNG with sacred site clearance certificates for exploration work and certificates are being prepared covering project development activities. Data provided by the CLC has informed TNG of no-go areas for exploration works and the location of project elements. The clearance certificate is provided within the Cultural Heritage Management Plan.
Waste Management and Pollution Control Act	The purpose of this Act is to protect the environment through objectives and approvals, encouraging effective and responsible waste management and reduction and response to pollution. This Act facilitates the implementation of national environment protection measures made under the National Environment Protection Council (Northern Territory) Act, and incorporates environmental compliance plans and audits. Section 14 of the Act establishes a process for notifying the NT EPA (the administering agency for the Act) about incidents causing, or threatening to cause pollution. Schedule 2 of the Act requires environment protection / licensing for certain activities.	If an incident and/or spill occur which is likely to cause material environmental harm or serious environmental harm a Section 14 Incident Report Form will be submitted to the NT EPA within 24 hours. The Incident Report Form is provided within the Hazardous Substances Management Plan and Emergency Response Plan.
Waste Management and Pollution Control (Administration) Regulations	These regulations deal with administrative issues such as fees for licensing and approvals and payment of "on the spot fines".	Construction activities will generate waste, noise and air pollution. Specifications of the Act will be applicable to the project.

Title	Summary	Relevance
Heritage Act	This Act provides a system for the identification, assessment, protection and conservation of the NT's natural and cultural heritage. Heritage includes fossils, buildings, gardens, ruins, archaeological sites, landscapes, ecosystems, coastlines, plant and animal communities. Chapter two of the Act allows for the establishment of the NT Heritage Register. Members of the community can nominate areas, places, sites, buildings, shipwrecks and heritage objects to the register. If the Minister agrees that those features are of special significance to the heritage of the NT, the place is added to the register. The place will then be protected from accidental and deliberate damage or harm. The Act allows for processes to approve works and maintenance for a heritage place. Sections 17 and 18 of the Act declare all Aboriginal and Macassan archaeological places and objects heritage places, providing the same level of protection as places on the Heritage Register. Part 3.2 of the Act allows for applications to work on heritage places, including work on, or salvage of, Aboriginal archaeological sites. In practice, permits to salvage Aboriginal Archaeological places will be issued under conditions which include the approval of the appropriate Traditional Owner or Site Custodian for a site. Permits under the Act will also require reasonable study of each site disturbed, and appropriate curation of any artefacts salvaged. The Act includes a provision for the declaration of classes of places or objects that are known to be of significance in the NT but where not all locations are currently mapped and recorded.	There are no nominated or declared heritage places in the Mount Peake Project Area. An archaeological survey of the Project area has been undertaken and recommendations are made in relation to protection of sites.
Other Legislation:	• National Environment Protection Council (Northern Territory) Act • Heritage Act • Territory Parks and Wildlife Conservation Act • Soil Conservation and Land Utilisation Act • Weeds Management Act • Bushfires Act • Fire and Emergency Act • Dangerous Goods Act • Transport of Dangerous Goods by Road and Rail (National Uniform Legislation) Act • Traffic Act • Control of Roads Act • Crown Lands Act NT and regulations • Dangerous Goods Act and regulations • Electrical Workers and Contractors Act and regulations • Energy Pipelines Act and regulations • Fisheries Act and regulations • Litter Act • Local Government Act • Marine Pollution Act and regulations • Minerals (Acquisition) Act • Mineral Royalty Act • Mineral Titles Act and regulations • Weeds Management Act • Work Health and Safety (National Uniform Legislation) Act.	-

6. Environmental Management System

6.1 Environmental Policy

The TNG Environmental Policy provided in Appendix A.

6.2 Environmental Management Structure

The Environmental Management Framework outlines the mechanisms used to deliver commitments made within the DEIS. The EMP has been designed to cover the construction and operation phase. It will form part of the Mining Management Plan (MMP) for the site. The EMP includes ten Sub-management Plans to assist in providing transparent, effective and accountable means of managing Project risks. An overview of the EMP and Sub-management Plans is provided in Figure 6-1.

6.2.1 EMP Initiation and Approval

The EMP will be updated be modified and updated prior to implementation at the Project. The updates will include:

- Formal review of the DEIS by the Northern Territory Environmental Protection Authority (NT EPA)
- Provision of an NT EPA Assessment Report of the DEIS and Supplementary providing Recommendations
- Throughout mine site authorisation processes with the Department of Mines and Energy (DME).

A summary of the EMP initiation process prior to being implemented is provided in Table 6-1.

Table 6-1 Summary of EMP Initiation

Submission	Assessment Body	Approvals	Approvals
Draft Environmental Impact Statement	NT EPA	NT EPA Government Agencies Members of the public	n/a
Supplementary to the EIS	NT EPA	NT EPA Government Agencies	NT EPA issue Assessment Report
<i>Additional information submitted as required.</i>			
Mining Management Plan	DME	DME Government Agencies	DME issue Mine Authorisation

6.2.2 EMP Review

The EMP and Sub-EMP's will be continually revised throughout the Project. They are considered to be 'living' documents controlled electronically by TNG. The Environmental Manager is responsible for ensuring the EMP and Sub-EMP's are current and that it reflects current legislation and/or requirements of the NT EPA and DME.

Scheduled EMP reviews will be undertaken annually as part of the internal annual reporting requirements, internal auditing plan and mine authorisation (Mining Management Plan) documentation. A summary of EMP Sub-management Plans is provided in Table 6-2.



Figure 6-1 Environmental Management Structure

Table 6-2 Summary of EMP Documentation

Management Plan	Summary	Complete EMP	Review Summary		
			Frequency	Responsibility	Approval
Air and Dust Management Plan	7.1.1	Appendix B	Annual	Environmental Manager	Site Manager
Biodiversity Management Plan	7.1.2	Appendix C			
Cultural Heritage Management Plan	7.1.3	Appendix D			
Fire Management Plan	7.1.4	Appendix E			
Hazardous Substances Management Plan	7.1.5	Appendix F			
Non-mineralised Waste Management Plan	7.1.6	Appendix G			
Water Management Plan	7.1.7	Appendix H			
Weed Management Plan	7.1.8	Appendix I			
Emergency Response Plan	-	Appendix J			
Drainage, Erosion and Sediment Control Plan	7.1.9	Appendix K			

6.3 Roles and Responsibilities

Key roles and responsibilities for environmental and emergency management are provided in Table 6-3.

Table 6-3 Roles and Responsibilities

Role	Responsibilities
Construction Manager / Site Manager (Mine Manager)	- Ensure personnel and contractor conformance with the EMP and Sub-management Plans. - Assist the Environmental Manager with regulator and/or community consultation (i.e. complaints). - Act as the Emergency Response Coordinator (see Emergency Response Plan). - Assign Emergency Team Responsibilities and provide appropriate training.
OHS Manager	Act as the Emergency Operations Officer.
Environmental Manager	- Manage all EMP Sub-management Plans. - Confirm the Project environmental objectives and targets are being met. - Update the EMP with applicable approval conditions following the NT EPA DEIS request and provision of an Environmental Assessment Report. - Review and evaluate construction and operation contractor's EMP to ensure consistent with TNG EMP. - Liaise with the NT EPA and DME regarding any substantial amendments to the EMP and Sub-management Plans utilised as part of the EIS and mine authorisation approvals. - Approve minor amendments to the EMP and Sub-management Plans (minor amendments' being amendments that clarify or improve practices / procedures or add more stringent requirements / controls). No increase in or introduction of new environmental risks or impacts to be approved. - Liaise with regulators and other agencies as required in unison with the Site Manager (Mine Manager). - Undertake Environmental Manager role in emergency response procedures. - Ensure that the requirements of the EMP and Sub-management Plans have been addressed in all contractor environmental management documentation. - Undertake regular audits (or appoint an appropriately qualified representative) of environmental performance.
Site Personnel	Comply with site induction and/or additional procedures relevant to works through Sub-management Plans.
Sub-contractors	- Comply with the EMP and legislative requirements. - Obtain any additional permits from statutory authorities other than the applicable approvals. - Implement a project environmental management system in accordance with this EMP and Sub-management Plans. - Collect data and documentation to facilitate auditing by the Environmental Manager and/or appointed representative.

6.4 Environmental Training and Induction

6.4.1 Site Induction

The Sub-management Plans contain mitigation measures which are will be captured during site inductions. A summary of the environmental component of the site induction is provided in Table 6-4.

Table 6-4 Site Induction – Environmental Component

Area	Details
Air and Dust Management Plan	Description of dust risks across the Project and areas of higher risk (i.e. adjacent to the Stuart Highway). All personnel to drive on predetermined roads across the site with speeds limited to 25 km/h on unconsolidated/unsealed roads. Drivers to ensure haulage vehicles are covered on transit from Mine Site to the Adnera Loadout Facility.
Biodiversity Management Plan	Summary of biodiversity at the Project including threatened flora and fauna (threatened species information cards are located in Appendix A and Appendix B of the Biodiversity Management Plan). Details of construction activities that could impact on flora and fauna. Procedure if fauna is injured or killed through Project activities including removal of roadkill at least 10 m from road. Requirement to enter and exit site through recognised vehicle access points. Speed limits across the Project. Areas to be cleared are to be flagged and approved through a Ground Disturbance Permit System (located in Appendix D of the Biodiversity Management Plan). All onsite personnel are to utilise existing/approved roads and tracks only.
Cultural Heritage Management Plan	Location of sacred sites and RWAs across the Project including a map. Summary RWA access requirements. Description of sacred sites and RWAs and consequences for entering and/or interfering. Example of installed fencing and signage at sacred sites and RWAs which are accessible / adjacent to Project infrastructure. Areas to be cleared are to be flagged and approved through a Ground Disturbance Permit System. Procedures if unidentified heritage is exposed / identified.
Emergency Response Plan	Summary of emergency responses to Fire – Building, Machinery or Explosion, Human Health – Injured Person, Human Health – Fatality, Sacred Site / RWA Interference, Structural Failure, Hazardous Substances Spill and Vehicle Incident.
Fire Management Plan	Awareness of potential bushfire risks across the Project. Requirements for reporting bushfires or incidental fires in close proximity to the Mine Site. Hot works permitting system. Management procedures/stop work requirements.
Hazardous Substances Management Plan	Summary of hazardous substance at the Project and associated locations. Summary of pictograms and dangerous goods code class labels and what they mean. Requirements for handling and utilising fuel infrastructure. No hot works or naked flames allowed within 20 m of flammable substances. Procedure for reporting and/or managing a spill.
Non-mineralised Waste Management Plan	Waste hierarchy. Identification of waste types and associated disposal requirements. Handling requirements in accordance with SDS. Waste burning health implications. All waste/items brought to Mine Landfill for appropriate disposal.
Water Management Plan	Summary of water sampling at the Project. Water saving initiatives due to Projects reliance on groundwater.
Weed Management Plan	Summary of known weed infestations at the site. Requirement to enter and exit site through recognised vehicle access points. Requirement to wash vehicles/equipment entering and exiting the Project if weed transfer likely. Weed removal required prior to vegetation clearing. Areas to be cleared are to be flagged and approved through a Ground Disturbance Permit Procedure. All onsite personnel are to utilise existing/approved roads and tracks only.

6.5 Reporting - Internal

Project reporting will be undertaken internally and externally. Internal reporting has been designed to capture the overall effectiveness of the EMP. The data from internal reporting will be utilised to fulfil external reporting requirements including to the Department of Mines and Energy and Central Land Council. The EMP internal reporting will be undertaken by the Environmental Manager.

6.5.1 Daily Inspections

The Environmental Manager will undertake a daily site inspection to assess Project risk including:

- Walkover of high risk locations including fuel farms, chemical storage shed, sewage treatment plant and stormwater ponds to identify any new risks / unmanaged risks
- Issuing Ground Disturbance Permits
- Walkover of construction activities to ensure the Ground Disturbance Permit procedure is being adhered
- Provision of environmental advice to personnel and/or contractors as required.

- **Responsibility:** Environmental Manager
- **Documentation:** Daily Inspection Checklist (to be developed) and Ground Disturbance Permit
- **Recipients:** Environment Team

6.5.2 Monthly Environmental Performance Report

A Monthly Report will be developed by the Environmental Manager throughout the construction and operation phase. The report will include the following:

- Assessment of compliance with Project approvals including NT EPA EIS Recommendations, DME Authorisation Approval Conditions and Sub-management Plans
- Summary of sub-management plan monitoring data and objectives identifying non-conformances
- Environmental inspections and auditing results
- Non-conformance register status
- Complaints and incidents register status
- Environmental performance details including:
 - Fuel, water and electricity consumption
 - No. deliveries to site
 - Hazardous substances and recyclable material transfers
 - No. burns at the landfill
 - Chemicals utilised.

- **Responsibility:** Environmental Manager
- **Approval:** Site Manager (Mine Manager)
- **Documentation:** Monthly Environmental Performance Report
- **Recipients:** Construction Manager and Site Manager

6.5.3 Half-Year Report

Half-Year Report will capture monthly reporting details and provides a detailed summary of compliance with the EMP. The report is designed to capture trends, non-compliance and complaints. All non-compliances which cannot be reasonably explained will be scheduled for additional investigation and/or mitigation measures.

- **Responsibility:** Environmental Manager
- **Approval:** Site Manager (Mine Manager)
- **Documentation:** Half-Year Report
- **Recipients:** TNG Management Team, Construction Manager and Site Manager

6.5.4 Annual Performance Review

The EMP and sub-plans will be updated and modified annually. The modifications will be based on performance data from the previous 12 months and will summarise significant historical results.

- **Responsibility:** Environmental Manager
- **Approval:** Site Manager (Mine Manager)
- **Documentation:** EMP Annual Performance Review
- **Recipients:** TNG Management Team, Construction Manager and Site Manager

6.5.5 External

Mine Authorisation (Mining Management Plan)

The EMP will form appendices of the Mining Management Plan (MMP). The MMP is required to be reviewed and amended in accordance with the mine authorisation. The reviewed EMP will be included within the MMP.

Statutory Incident Reporting

External incident reporting will be provided in accordance with legislative requirements across the Project. A summary of incident reporting requirements is provided in Table 6-5.

The Site Manager is responsible for all external incident reporting communications. Statutory incident reporting will be summarised within future EMP.

Additional statutory reporting requirements will potentially be identified through the EIS and mine authorisation processes.

Table 6-5 Regulatory Body Reporting Requirements

Entity	Trigger	Timeframe and Contact Details	Incident Reporting Details
Northern Territory Environmental Protection Authority (NT EPA)	Incident which causes, or is threatening or may threaten to cause pollution resulting in material environmental harm or serious harm.	< 24 hrs post incident ntepa@nt.gov.au pollution@nt.gov.au	The Section 14 Incident Report Form requires the following details: - Incident causing or threatening to cause pollution - Location occurred and area impacted - Date and time - How the pollution has occurred, is occurring or may occur - Attempts made to prevent, reduce, control, rectify, investigation and/or clean up the pollution or resultant environmental harm caused or threatening to be caused by the incident - Operator details. The form is to be signed by the Emergency Response Coordinator (Mine Manager) for submission. The Section 14 Incident Report Form is provided within the Hazardous Substances Management Plan in Appendix F.
Department of Mines and Energy (DME)	Incident which causes minor environmental impact with some minor actual or potential harm to the environment.	As soon as practicable. Mineral.Info@nt.gov.au	The Section 28 Notification of Environmental Incident Form requires the following details: - Site and operator details - Location occurred and area impacted (GPS coordinates) - Date and time - Description of incident - Emergency and remedial actions taken - Nature of impact and severity - Current situation - Details of sampling undertaken - Notification status internally and externally. The form is to be signed by the Emergency Response Coordinator (Mine Manager) for submission. The Section 28 Notification of Environmental Incident Form is provided within the Hazardous Substances Management Plan in Appendix F.
Heritage Branch	Exposure and/or interference with unidentified natural, cultural or indigenous heritage.	As soon as practicable. Tel: 08 8951 9247 heritage@nt.gov.au	No standard notification form is available. However, the following should be provided within the initial notification: - Type of natural, cultural or indigenous heritage - Location of the site (grid reference) - Type and method of interference (exposed and/or damaged) - Name and organisation of discoverer - Photograph of site.

Entity	Trigger	Timeframe and Contact Details	Incident Reporting Details
NT WorkSafe	Incident which results in either: • Death of a person; • Serious injury or illness; or • Dangerous incident.	Immediate verbal communication. Tel: 1800 019 115 Written notification < 48 hrs post incident. ntworksafe@nt.gov.au	The NT WorkSafe Incident Notification Form requires the following details: • Person submitting details • Incident details including date, time and human injury details • Work activity being undertake at the time of incident • Witness(es) details • Details of injured / deceased persons • Summary of injury or illness • Future remedial actions. The form is to be signed by the Emergency Response Coordinator (Mine Manager) for submission. The NT WorkSafe Incident Notification Form is provided within the Hazardous Substances Management Plan in Appendix F.
Department of the Environment	Impact (injury or death) involving matters of national environmental significance.	As soon as practicable. 02 6274 1372 compliance@environment.gov.au	n/a
Central Land Council	Entrance and/or damage of sacred site or restricted works area.	As soon as practicable. Tel: 08 8951 6338 gstoll@clc.org.au	No standard notification form is available. However, the following should be provided within the initial notification: • Location of the site (grid reference) • Sacred Site Clearance Certificate pertaining to the site • Summary of damage • Name and organisation of discoverer • Type and method of interference (exposed and/or damaged) • Photograph of damage.
Aboriginal Areas Protection Authority	Entrance and/or damage of sacred site or restricted works area.	As soon as practicable. Tel: 08 8999 5511 enquiries.aapa@nt.gov.au	No standard notification form is available. However, the following should be provided within the initial notification: • Location of the site (grid reference) • Sacred Site Clearance Certificate pertaining to the site • Summary of damage • Name and organisation of discoverer; • Type and method of interference (exposed and/or damaged) • Photograph of damage.

6.6 Internal Auditing Plan

Internal auditing will be undertaken by the Environmental Manager and/or suitably qualified representative. The audit will assess the implementation of each sub-environmental management plan and/or EMP requirements.

Prior to the audit, a checklist will be developed that includes:

- Mitigation / commitment being assessed
- Compliance with each mitigation measure / commitment
- Corrective actions required and responsibility
- Risks associated with non-compliance
- Additional mitigation measures.

The Environmental Manager shall ensure that investigations are initiated into non-conformances to determine whether mitigation measures are possible and appropriate.

Frequency during construction will be quarterly and biannually during operations.

6.7 Complaints

The Project has the potential to impact upon the local community both negatively and positively. The mitigation measures developed through the Sub- management Plans are designed to mitigation and reduced environmental impacts. Should complaints be received from the general public in relation to the Project they will be lodged within the complaints register including:

- Date
- Name and location of complainant
- Contact details
- Complaint
- Aspect
- Flow-up Actions / Mitigation Measures
- Close-out Approval.

All complaints will be investigated to determine the source of the complaint, identify any underlying cause, establish additional investigation measure (if required), summarise corrective actions and undertake follow-up to ensure corrective actions are undertaken. The outcomes of investigations will be shared with the complainant and summarised in both Monthly, Half-Year Reporting and the Annual Performance Review.

6.8 Emergency Response Management

The management of emergency responses will be undertaken in accordance with the Emergency Response Plan (ERP) (Appendix J). The ERP outlines standardised responses to the most likely emergency situations pertaining to the Project including:

- Fire – Building, Machinery or Explosion
- Human Health – Injured Person
- Human Health – Fatality
- Sacred Site / RWA Interference
- Structural Failure
- Hazardous Substances Spill
- Vehicle Incident.

7. Environmental Management Plans

7.1.1 Air and Dust Management Plan

Objectives	Minimise dust impacts at the Project.	
	Minimise air pollutant impacts at the Project.	
Actions	Site Induction	
	Site induction includes the following components for air and dust:	
	• Description of dust risks across the Project and areas of higher risk (i.e. adjacent to the Stuart Highway) • All personnel to drive on predetermined roads across the site with speeds limited to 25 km/h on unconsolidated/unsealed roads • Drivers to ensure haulage vehicles are covered on transit from Mine Site to the Adnera Loadout Facility.	
	Water Cart / Water Spraying	
	Water carts will operate across the Project during construction and operation. The water carts will spray at a minimum level of 2 L/m ² /hr across unsealed roads.	
	Exposed stockpiles will either be covered and/or routinely sprayed with water.	
	Product being removed from the Mine Site and placed at the Adnera Loadout Facility will be sprayed prior/during loading/unloading.	
	Construction dust suppression water will be sourced from production bores across the Project.	
	Operation dust suppression water will be sourced from:	
	• Production bores • Stormwater retention ponds • Pit water.	
	Dust General	
	Defined access roads and haul routes to be used.	
	Daily review of weather reports to establish potential of extreme weather events requiring additional water application across the site.	
	Stockpiles of fines and/or soils across the Project will be managed to reduce dust emission including spraying with water or covering.	
	Areas cleared which are no longer required will be rehabilitated in accordance with the Closure and Rehabilitation Management Plan.	
	Areas to be cleared will be flagged prior to any cleaning being undertaken. Following clearing the areas will form part of the water cart dust suppression program.	
	Offloading of waste and ore will be undertaken from minimum heights with water sprays utilised at high frequency dump locations (i.e. crushing screens).	
	Processing	
	Ore to be sprayed with water prior to entering crusher.	
	Crushers to be hooded and High Pressure Grinding Rollers (HPGR) to be enclosed.	
	Following the beneficiation process, moisture will be maintained to reduce product loss while in storage onsite.	
	Haulage from the Mine Site to Adnera Loadout Facility will be in covered hoppers.	
	Air Pollutants General	
	All construction and maintenance equipment/vehicles to be operated and maintained to manufacturer's specifications in order to minimise exhaust emissions.	
	Power Station stack height to be a minimum of 9.37 m and have a radius of 0.229 m.	
Monitoring and Reporting	Daily visual dust inspections of work areas to determine if additional dust suppression measures are required.	Daily
	Monthly inspection and reporting of dust mitigation measures to ensure they are being implemented including covered haulage, application of sufficient water across the Project and summary of potential dust issues and visit to sensitive receptors.	Monthly
	Annual stack emission testing, assessment and recommendation for mitigation measures.	Annual
	Annual Energy Efficiency Assessment.	Annual
	Annual Air and Dust Management Plan performance review.	Annual

Responsibility	Situation		
	Standard	Level 1	Level 2
	Activities and associated dust emissions are contained within Project area.	Trigger: Dust complaint received but not validated.	Trigger: Dust complaint received and validated.
Site Personnel	Comply with site inductions and mitigation measures.		
Environmental Manager	- Daily visual inspections across Project to determine if additional measures are required - Monthly inspection and reporting of all dust control measures.	Undertake an investigation of the complaint including an assessment of operations, weather conditions and visual observation of impact.	Undertake an investigation of the complaint including an assessment of operations, weather conditions and visual observation of impact. Review efficiency of dust mitigation measures and detail additional mitigation measures and associated monitoring at sensitive receptors (including complainant location where appropriate).
Construction Manager Site Manager	Review reports and determine if additional measures are to be implemented.	Provide feedback to complainant.	Review and implement additional dust mitigation measures provided by the Environmental Manager. Provide feedback to complainant.
	Annual stack emission test within operational limits.	Trigger: Stack emission tests indicate concentrations exceed design criteria by 20%	Trigger: Stack emission tests indicate concentrations exceed design criteria by 50%
Environmental Manager	Schedule and manage subcontractor to undertake annual testing of the power station stacks. Stack sampling is to comply with the Victorian EPA A Guide to the Sampling and Analysis of Air Emissions and Air Quality.	Assess subcontractors report and recommendations. Evaluate the viability of mitigation measures and produce summary report for Site Manager.	
Site Manager	-	Review summary report of emissions failure and potential mitigation measures. Determine in consultation with the subcontractor and Environmental Manager what remedial works will be undertaken.	

7.1.2 Biodiversity Management Plan

Objectives	Establish and maintain awareness and importance of protecting biodiversity across the Project. Minimise the extents of vegetation clearance and undertake in accordance with the Ground Disturbance Permit system. Avoid injury or death to native fauna results from road collision or clearing. Implement system for the management of injured and dead fauna.
Actions	Site Induction Site induction will include the following components for biodiversity management: - Summary of biodiversity at the Project including threatened flora and fauna (threatened species information cards are located in Appendix A and Appendix B of the BMP) - Details of construction activities that could impact on flora and fauna - Procedure if fauna is injured or killed through Project activities including removal of roadkill at least 10 m from road - Requirement to enter and exit site through recognised vehicle access points - Speed limits across the Project - Areas to be cleared are to be flagged and approved through a Ground Disturbance Permit System (Appendix D of the BMP) - All onsite personnel are to utilise existing/approved roads and tracks only. General Implement an Erosion and Sediment Control Plan including: - Installation of erosion and sediment control measures prior to construction - Regular inspection of erosion and sediment control measures, particularly following rainfall

	events, to ensure their ongoing functionality • Runoff from disturbed and rehabilitated areas diverted into sediment ponds and not discharged into the natural system • Constructing adequate bunds around potential contamination sources, to contain contaminated water in the event of heavy rainfall.
	Application of industry dust control measures including: • Road wetting, covering of exposed loads where practicable and maintaining moisture levels in bulk loose construction materials • Minimising hauling and vehicle travel in conditions when wind strength results in spatially extensive and heavy dust deposition in surrounding habitats • Reduced vehicle speeds for high-use areas/roads • Progressive reinstatements of cleared land as activities are completed.
	The use of areas which have previously been disturbed will be used over new vegetation clearance.
	Management of weeds in accordance with the Weed Management Plan.
	Management of hazardous substances in accordance with the Hazardous Substances Management Plan.
	Management of fire in accordance with the Fire Management Plan.
	Management of non-mineralised waste in accordance with the Non-mineralised Waste Management Plan.
	Management of groundwater drawdown in accordance with a Water Management Plan and Borefield Management Plan (to be produced).
	Concentrate loads are to be covered to prevent dust generation and product loss.
	Develop and implement a Traffic Management Plan.
	Clearing
	Prior to clearing a Ground Disturbance Permit is required to be issued by the Environmental Manager. The system is to be developed prior to the construction phase and will comply with the objective outlined in Appendix D of the BMP.
	Minimise ground disturbance at all location and specifically at riparian zones and within the Anmatyerr North Site of Conservation Significance (SOCS).
	Large scale vegetation clearing or earthworks will be undertaken in the Dry Season and staged (where practical).
	Areas to be cleared will be flagged and marked sufficiently to reduce the risk of over clearing.
	Clearing of firebreak surrounding infrastructure will be undertaken in accordance with the Fire Management Plan.
	Clearing will be restricted to times when fauna are least vulnerable where possible (e.g. avoiding breeding period) where possible.
	Fauna Management
	Produce a Noise Management Plan for the operations phase to minimise and avoid (where possible) high-impact noises.
	Wastes will be managed to prevent/reduce interaction with fauna. Waste management includes: • Regular burns of the landfill • Fencing installed surrounding the landfill to restrict interaction with fauna • Waste storage outside of the landfill is to be situated in bins with lids secured • Waste oils and/or hazardous substances will be kept in sealed containers and/or covered.
	Monitoring bores, production wells and exploration bores will be sealed / covered to prevent fauna entering.
	Stormwater ponds have sufficient slopes to deter fauna entering ponds and will be maintained / monitored.
	Implement a light reduction during the detailed design phase including: • Limit artificial light to areas where it is essential • Turn off lights when not required • Avoid the flood of light into natural habitats and limit the escape of light into surrounding areas of fauna habitat (i.e. using shields/deflectors) • Ensure that artificial lighting is not directed upwards or laterally (i.e. should be directed towards the ground) • Use lower (i.e. closer to the ground) rather than higher lighting installations • Use lower wavelengths of light wherever possible i.e. red/yellow lights • Use light intensities that are as low as possible without reducing safety or efficiency • Avoid painting large structures bright or reflective colours and minimise use of bright or reflective construction materials and finishes for large structures.
	If fauna is injured, assess the situation and potential requirement to euthanize and/or contact Wild

	Care Alice Spring for advice:		
	- M: 0419 221 128 - E: wildcareasp@gmail.com		
	Roadkill to be removed at least 10 m into adjacent land.		
	Rehabilitation		
	Areas not required for ongoing operations will be progressively rehabilitated with local provenance native species.		
	Topsoil will be stripped and stockpiled in a designated area, to prevent erosion or run-off.		
Monitoring and Reporting	Flora survey to identify presence and distribution of phreatophytic vegetation and implement Borefield management strategy (if present).		Prior to Borefield operation
	Pre-clearing fauna surveys will be undertaken by an appropriately qualified ecologist prior to clearing.		As required
	Daily assessment of compliance with Ground Disturbance Permits.		Daily
	Fauna sighting register to be completed (Appendix C of the BMP). If there is an increase in the sighting of pest / feral animals at the Project baiting and/or control measures will be established in consultation with DLRM and CLC.		As required
	Annual Biodiversity Management Plan performance review including assessment of fauna sightings, incidents and ground disturbance permit approval performance.		Annual
Responsibility	Situation		
	Normal	Level 1	Level 2
	Site activities are being managed in accordance with mitigation measures and no incidents have occurred.	Areas of vegetation to be cleared will be outside of Project boundary / existing disturbance.	Vegetation cleared outside of approved boundary.
Site Personnel	Comply with: - Site Induction requirements - Personnel, Vehicle and Equipment Hygiene Procedures - Ground Disturbance Permit Procedures.		Stop work and inform the Environmental Manager of additional disturbance.
Environmental Manager	Undertake walkovers / inspection of work areas.	Assess requirement to clear outside of Project boundary. Areas to be cleared outside of existing disturbance will be flagged to prevent over clearing. Ensure top soil and seed bank are reserved to facilitate rehabilitating the area. Survey additional disturbance Ensure sufficient erosion and sediment control measures are used.	Provide guidance on rehabilitation of additional disturbance. Survey additional disturbance Ensure sufficient erosion and sediment control measures are used. Undertake investigation into disturbance and provide to Construction and/or Site Manager.
Construction and Site Manager	Ensure the Biodiversity Management Plan is being implemented by all Site Personnel.		Assess the ground disturbance incident and undertaken relevant management measures.
	Fauna observed and behaving normally.	Native fauna observed in the area of the landfill, construction and/or operational activities.	Native fauna injured or killed due to Project activities.
Contractor	Continue to operate diligently and remember the site induction flora and fauna components.	Encourage or wait for native fauna to vacate construction areas. Report sighting to the Site Caretaker.	Report to Site Caretaker. If fauna is killed, remove from road at least 10 m into adjacent bush land.

Responsibility	Situation		
	Normal	Level 1	Level 2
Site Caretaker	-	Enter sighting in Fauna Sighting and Incident Register (Appendix C of the BMP).	If fauna is injured, assess the situation and potential requirement to euthanize and/or contact Wild Care Alice Springs for advice: M: 0419 221 128 E: wildcareasp@gmail.com If fauna is killed, remove from road at least 10 m into adjacent land. Record incident in Fauna Sighting and Incident Register (Appendix C of the BMP).

7.1.3 Cultural Heritage Management Plan

Objectives	Protection and preservation of identified Sacred Sites and RWAs. Establish and maintain personnel and contractor awareness of the importance of cultural heritage. Protection of previously unidentified cultural heritage finds.	
Actions	Site Induction Site induction will include the following components for cultural heritage management: • Location of sacred sites and RWAs across the Project including a map • Summary RWA access requirements • Description of sacred site and RWA and associated consequences for entering and/or interfering • Example of installed fencing and signage at sacred sites and RWAs which are accessible / adjacent to Project infrastructure • Areas to be cleared are to be flagged and approved through a Ground Disturbance Permit System • Procedures if unidentified heritage is exposed / identified. General Lodge an 'Application to Carry Out Work on Heritage Place or Objective' to for the recording and relocation of stone artefacts within the access road footprint. Notify the CLC of stone artefact recording and relocation activities. No site works will be undertaken within CLC identified sacred site areas. Site works at the RWA will be undertaken in accordance with the CLC Clearance Certificate conditions including: • Murray Creek and Hanson River RWA Construction of river crossing allowed for the Haul Road on the condition the road goes no deeper than existing levels and works are supervised by traditional Aboriginal owners • Mud Hut Swamp RWA Transit only permitted along existing tracks within the RWA. Installation of signage and fencing (where appropriate) at sacred sites adjacent to infrastructure including site identified A, B, C, D, E, F, L and Q. Installation of signage at RWAs summarising access requirements. If unidentified cultural heritage is exposed / identified the following procedures will be undertaken: • Cease works in/adjacent to the area • Install barrier/flagging to identify the area • Inform the Construction and/or Site Manager and provide the location of works (coordinates), nature and purpose and identified cultural heritage • Construction and/or Site Manager to contact the Department of Lands, Planning and the Environment Heritage Branch (08 8999 5039) and the Central Land Council (08 8951 6388) for details on how to proceed • Undertake Heritage Branch and Central Land Council requirements and complete/postpone works.	
Monitoring and Reporting	Prior to clearing the extents shall be inspected to confirm the works do not disturb identified sacred site, RWAs or cultural heritage in accordance with the Ground Disturbance Permit procedure. The flagging shall be inspected to ensure integrity. Sacred site and RWA signage and fencing (where installed) will be inspected to ensure they remain insitu and to establish if there is evidence of disturbance. Establish a geotechnical stability monitoring program for sacred site A (situated near	Prior to clearing activities. Weekly Quarterly Prior to pit

	the north eastern edge of the pit).		expansion
	Undertake additional monitoring and/or investigation if an issue is identified or complaint occurs.		At all times.
	Annual Cultural Heritage Management Plan performance review.		Annual
Responsibility	Situation		
	Standard	Level 1	Level 2
	Activities are contained within approved disturbances, outside of sacred site or RWA areas and flagging installed.	Trigger: Site inspection identifies activities have potential to disturb areas outside of approved disturbances, installed flagging or within sacred sites or RWAs.	Trigger: Activities are impacting areas outside of approved disturbances, installed flagging or within sacred sites or RWAs.
Site Personnel	Comply with: • Site Induction requirements • Ground Disturbance Permit Procedures.		Implement the Emergency Response Plan. Raise Alarm on UHF Channel 12 stating: • Your name • Location of the incident • Description of the incident scene • Extents of impact • Best route to be used to approach the incident location.
Environmental Manager	Weekly inspection of flagging installed and replacement where necessary. Monitor activities to ensure no disturbance or interference with cultural heritage occurs. Quarterly inspection of sacred site and RWA signage to ensure they remain in situ and to establish if there is evidence of disturbance.	Instruct personnel to cease works in/adjacent to the area. Re-evaluate potential disturbance / interference issues. Install additional barrier / flagging to eliminate risk to RWAs or cease works completely. Inform Site Manager with the location of works (coordinates), nature and purpose and potential impacts.	Attend incident location to undertake initial assessment of the incident. Establish if any short term remediation measures could be implemented.
Emergency Operations Officer	-	-	Implement the Emergency Response Plan. Attend incident location to undertake initial assessment of the incident. Establish if any short term remediation measures could be implemented. Summarise incident details and provide the Construction and Site Manager with: • Location of sacred site / RWA (grid reference) • CLC certificate pertaining to the site • Summary of damage • Type and method of interferences (exposed and/or damaged) • Photograph of damage.

Responsibility	Situation		
	Standard	Level 1	Level 2
Construction and Site Manager	Ensure the Cultural Heritage Management Plan is being implemented by all Site Personnel.	Toolbox talk with Contractor and/or personnel working in close proximity of RWAs.	Immediately notify the Central Land Council and Aboriginal Areas Protection Authority (CLC and AAPA) and provide the following details: • Name and organisation • Location of sacred site / RWA (grid reference) • CLC certificate pertaining to the site • Summary of damage • Type and method of interferences (exposed and/or damaged) • Photograph of damage.
	Activities are contained within approved disturbances, outside of RWA areas and flagging installed.	Trigger: Unidentified cultural heritage is exposed / identified.	-
Site Personnel	Comply with: • Site Induction requirements • Ground Disturbance Permit Procedures.	Cease works immediately and contact the Environmental Manager.	
Environmental Manager	Weekly inspection of flagging installed and replacement where necessary. Monitor activities to ensure no disturbance or interference with cultural heritage occurs. Quarterly inspection of sacred site and RWA signage to ensure they remain insitu and to establish if there is evidence of disturbance.	The following procedures will be undertaken: • Install barrier / flagging to identify the area • Inform Site Manager and provide the location of works (coordinates), nature and purpose and identified cultural heritage.	-
Construction and Site Manager	Ensure the Cultural Heritage Management Plan is being implemented by all Site Personnel.	Contact the Department of Lands, Planning and the Environment Heritage Branch (08 8999 5039) and the Central Land Council (08 8951 6388) for details on how to proceed. Undertake Heritage Branch and Central Land Council requirements and complete/postpone works.	

7.1.4 Fire Management Plan

Objectives	Reduction of bushfire risk prior to bushfire season. Effectively manage potential risks from offsite bushfires or incidental onsite fires. Minimise fuel loads adjacent to Project infrastructure.
Actions	Site Induction Site induction includes the following components for fire management: • Awareness of potential bushfire risks across the Project • Requirements for reporting bushfires or incidental fires in close proximity to the Mine Site • Hot works permitting system • Management procedures/stop work requirements. General Management Permanent site personnel to undertake fire control training, including the correct use of extinguishers. All vehicles to carry fire extinguishers and UHF radios. Pre-fire season planning between Mount Peak Management Team, Traditional Owners and Bushfires NT (Alice Springs Office 08 8952 3066). Annually collaborate controlled burns activities with stakeholders including: • Central Land Council (Traditional Owners) • Stirling Pastoral Lease • Anningie Pastoral Lease • Northern Territory Emergency Service – Ti Tree Volunteer Unit. Storage of flammable and combustible materials will be in accordance with the Hazardous Substances Management Plan. Open flame or other ignition sources are prohibited within 20 m of bulk flammable storage areas, fuel dispensing vehicles or refuelling operations and activities in hazardous atmospheres. If “hot work” is to be undertaken in any area where a potential fire hazard exists or in areas designated as a potential fire risk by Contractor in the risk assessment, a ‘Hot Works’ permit is required. In addition, a fire watcher or fire warden shall remain on watch for a minimum of 30 minutes after completion of the hot works. The “hot work” risk assessment will use Australian Standard AS 1674.1 Safety in welding and allied processes – Fire precautions to determine the required controls to be implemented. Firefighting equipment will be inspected, maintained and tested annually. Inspections of landfill and waste management practices to identify potential accumulation of combustible materials and associated risks prior to April. Bushfire Monitor the fire Danger Rating for Simpson West (http://www.bom.gov.au/nt/forecasts/fire.shtml). In the event of a bushfire the following measures should be taken: • If you see smoke or fire in the immediate area, alert all onsite personnel and provide regular updates • Contact the Site Manager / Construction Manager who will monitor the radio for any changes and determine best course of action, whether to work or not work • If the bushfire is threatening, ensure your own safety and Contractors by evacuating to the Gatehouse • If injuries have occurred attend to and assist injured personnel • Contact the Site Manager using the Emergency Communication Procedure as follows: - o Call “Emergency, Emergency, Emergency” over UHF channel 12 - o Response is given directly to the reportee acknowledging the call - o Describe the nature of the emergency including number of people involved, details of accident and nature of the injuries - o Continue to stay close to your source of communication • Site Manager to determine response and fire management plan. Building Structure Fire In the event of a building fire, the following measures should be taken: • If you hear a smoke alarm or see smoke, raise the alarm and evacuate the building • Assist other personnel in evacuating the building to the muster point • Contact the Site Manager using the Emergency Communication Procedure as follows: - o Call “Emergency, Emergency, Emergency” over UHF channel 12 - o Response is given directly to the reportee acknowledging the call - o Describe the nature of the emergency including number of people involved, details of accident and nature of the injuries - o Under direction of the Site Manager attempt to extinguish the fire with fire hoses and fire extinguishers, if safe to do so

	• Site Manager to attend with onsite firefighting equipment.	
	Machinery / Plant Fire	
	In the event of plant fire, the following measures should be taken:	
	• If you see smoke or fire and it's safe to do so, turn off plant • Ensure your own safety by evacuating plant and moving yourself to a safe distance • Alert people working in the area of the fire • Attempt to extinguish the fire with fire suppression system and fire extinguishers, if safe to do so • Contact the Site Manager using the Emergency Communication Procedure as follows: - o Call "Emergency, Emergency, Emergency" over UHF channel 12 - o Response is given directly to the reportee acknowledging the call - o Describe the nature of the emergency including number of people involved, details of accident and nature of the injuries - o Under direction of the Site Manager attempt to extinguish the fire with fire hoses and fire extinguishers, if safe to do so • Site Manager to attend with onsite firefighting equipment.	
	Vehicles maintained and serviced at regular intervals to reduce potential of fire related to engines or exhausts.	
	No machinery left running unattended.	
	Firebreaks	
	Maintain a clear and continuous firebreak of 10m minimum around infrastructure including:	
	• Processing Plant • Gatehouse • Explosives Magazine • Mine Camp • Adnera Loadout Facility.	
	Landfill Burning	
	Controlled burns are held at the landfill site as necessary to control amount of putrescible and windblown waste. The impacts of burning wastes are reduced by:	
	• Transferring of recyclable products to an appropriate licenced facility for recycling offsite • Transfer of hazardous wastes including chemical waste, paints, solvents, gas bottles, waste oil and batteries to an appropriately licenced offsite facility for disposal • Storage of tyres onsite in a stable form and outside of potential impact from bushfires • Burning waste within the designated fire pit with maintain firebreaks to control potential spread to the surrounding area.	
Monitoring and Reporting	Controlled Burns	
	Identify areas with high fuel loads requiring controlled burns. Liaise with Traditional Owners, Landholders and Bushfires NT prior to burning.	
	Implementing patchy prescribed fires of low scorch height wherever practicable.	
	No fire to be lit during designated fire bans. Fire ban status can be checked at: http://www.bom.gov.au/nt/warnings/index.shtml .	
	Fire register to be completed following any fire related incident.	At all times
	Firefighting equipment will be maintained, inspected and tested.	Monthly
	Firebreaks, active working areas and fuel storage locations will be regularly inspected to determine if they are increasing fire risk.	As required or Monthly
	Inspections of landfill and waste management practices to identify potential accumulation of combustible materials and associated risks during the bushfire season.	Prior to April
	Annual Fire Management Plan performance review.	Annual

Responsibility	Situation			
	Standard	Level 1	Level 2	Level 3
	Firebreaks maintained. Equipment sufficiently maintained. No bushfires or planned fires within the vicinity of the Project.	Trigger: Inspection identifies elevated risk due to activities or firebreaks not maintained.	Trigger: Bushfire within the vicinity of the Project.	Trigger: Unplanned fire at the Project.
Site Personnel	Maintain awareness of potential bushfire risks across the Project. Maintain vigilance against potential outbreaks of fire in work areas.	The onsite personnel should: • If a work specific risk the Contractor should mitigate the situation to reduce/eliminate the risk • Notify the Site Manager of the elevated risk on UHF Channel 12.	The onsite personnel should: • Maintain safe distance from bushfire • Report bushfire to Site Manager on UHF Channel 12.	Contact the Site Manager using the Emergency Communication Procedure as follows: • Call "Emergency, Emergency, Emergency" "over UHF Channel 12 • Response is given directly to the reportee acknowledging the call. • Describe the nature of the emergency including number of people involved, details of accident and nature of the injuries. • Under direction of the Site Manager attempt to extinguish the fire with fire hoses and fire extinguishers, if safe to do so.
Site Manager	Maintain a clear and continuous firebreak of 10 m minimum around infrastructure. Vehicles maintained and services at regular intervals. Continue controlled burns of landfill. Firefighting equipment will be inspected, maintained and tested annually. Inspections of landfill and waste management practices to identify potential accumulation of combustible materials. Active working areas and fuel storage locations regularly inspected to determine if they are increasing fire risk.	Maintain a clear and continuous firebreak of 10 m minimum around infrastructure. Firefighting equipment will be inspected, maintained and tested. Log incident.	Monitoring bushfires through internet sources and on ground inspection to determine risk to site personnel. Provide updates to personnel within vicinity of the bushfire and inform of requirements (i.e. stop work). Log incident.	Utilise firefighting equipment at incident. Undertake incident investigation and support the implementation of corrective and preventive actions.

7.1.5 Hazardous Substances Management Plan

Objectives	Protection of the surrounding environment from hazardous substances.
Actions	Site Induction Site induction includes the following components for hazardous substances: • Summary of hazardous substance at the Project and associated locations • Summary of hazardous pictograms and dangerous goods code class labels and what they mean • Requirements for handling and utilising fuel infrastructure • No hot works or naked flames allowed within 20 m of flammable substances • Procedure for reporting and/or managing a spill. General Management of hazardous substances in accordance with Australian Standards including: • AS/NZS 1940:2004 <i>Storage and handling of flammable and combustible liquids</i> • AS/NZS 4452:1997 <i>Storage and handling of toxic substances</i> • AS 4360:1999 <i>Risk Management</i> • AS 2187.1: 1998 <i>Explosives – Storage, transport and use</i> • AS/NZS 2444:2001 <i>Portable Fire Extinguishers and Fire Blankets - Selection and Location</i> • AS/NZS 3833:1998 <i>Storage and Handling of Mixed Classes of Dangerous Goods in Packages and Bulk Containers</i> • AS 2430.3:1997 <i>Classification of Hazardous Areas – Examples of Area Classification – General.</i> Hazardous substances to be stored in Chemical Storage Shed with internal bunding to collect spills and ventilation to prevent the build-up of fumes. These are used for drum storage of oil, petrol and similar materials. Waste oil and oil filters are to be stored in appropriately labelled Intermediate Bulk Containers (IBC). IBCs are determined as small containers, drums (up to 205 litres) and storage up to 1000 litres. All IBS labelled and hazard it poses listed on container. The IBC are to be removed from site by a suitably licensed contractor and delivered to a licensed depot. Storage of IBCs at the landfill will not exceed 1,000 L at any one time. Fuel (diesel) storage tanks will be double skinned and self bunded and meet environmental guidelines for the safe storage of bulk fuel (AS1692-2006 Steel Tanks for Flammable and Combustible Liquids) and AS 1940:2004: The Storage and handling of combustible and flammable liquids. Fire extinguishers fitted in site vehicles. Hazardous substances stored minimum of 10 m from surface water and 50 m from groundwater wells. Storage of flammable and combustible materials will be in accordance with the Hazardous Substances Management Plan. Open flame or other ignition sources are prohibited within 20 m of bulk flammable storage areas, fuel dispensing vehicles or refuelling operations and activities in hazardous atmospheres. Spill Management Spill kits are located at all hazardous substance storage locations in addition to area supervisors having mobile spill kits. In addition, spill kits are available to be relocated to specific areas in accordance with scopes of work. Monthly inspections of hazardous substance storage location to ensure spill kits are present/contain sufficient materials for potential spillages. In the event of a spill follow the spill management procedure within the Emergency Response Plan including: • Isolate and contain the spill utilising the spill kit • Evacuate from the area if potential danger • Notify the Emergency Operations Officer (HSE Manager) on UHF Channel 12 and provide location, extents, substance type, quantity, environments impact (soils, surface water courses and groundwater) and spill kit contents used • Emergency Operations Officer, Emergency Field Team Member and Environmental Manager to attend and assess the significance and flag the area • Emergency Operations Officer, Emergency Field Team Member and Environmental Manager to manage insitu engineering work to capture and control the spill • Where spill cannot be controlled regularly monitoring flow, extents and sample (upstream, adjacent and downstream at consistent locations) • Environmental Manager to commence investigation in soil, surface and/or groundwater

	impacts from the spill. The investigation will detail the spill quantity, determine extent and significance of the impact to human health and the ecosystem (including upstream / control samples as required) - Where relevant, excavate and appropriately dispose of contaminated sediments with validation samples taken and disposal certification provided - Emergency Response Coordinator (Site Manager) to provide Department of Mines and Energy with Section 29 Notification (Appendix F of the HSMP) and Northern Territory Environmental Protection Authority with Section 14 Incident Report Form (Appendix E of the HSMP) within 24 hours of the incident occurring if the incident caused or is threatening or may threaten to cause pollution resulting in minor or serious environmental harm - Spill to be logged with the spill register (Appendix C of the HSMP) - Clean-up of spill location including spill kit consumables and replace.	
Monitoring and Reporting	Monthly hazardous substances inventory. The inspection is to update the hazardous substances inventory (Appendix A of the HSMP). In addition, any new hazardous substances will be included when they are brought to site.	Monthly /As required
	Safety Data Sheets (SDSs) register will be maintained at storage locations and the Site Office. The register will be supplemented when new hazardous substances are brought to site.	As required
	Spill kits to be inspected on a monthly basis to ensure kits contain adequate equipment.	Monthly
	Fuel inventory control system including: - Product level measurements compared with dispenser meter readings, deliveries, removals and internal transfers (Appendix D of the HSMP) - Reconciliation conducted fortnightly for each individual tank product is added to or removed - Inventory control computations of any loss or gain of product recorded and included with a monthly summary of cumulative losses or gains of product.	At all times
	If the daily inventory identifies a leak, spill or other cause of discrepancy the following will be undertaken: - If required, take action as soon as practicable to prevent any further release of product or used oil into the environment - Identify and mitigate any fire, explosion or vapour hazards - Take all reasonable steps to prevent migration of product or used oil that has leaked or spilled - Take all reasonable steps to recover or remove product or used oil that has leaked or spilled so that the site does not pose any threat to the environment or human health and safety - Remove or, where practical to do so, repair any leaking components of the AST.	Daily
	Annual Hazardous Substances Management Plan performance review.	Annual

Substance	Spill Volume (L)		
Hazardous substance	<10	10 – 20	>20
Hydrocarbon	<50	50 – 500	>500
Stormwater (retention pond discharges)	<1,000	1,000 – 10,000	>10,000
Receiving Environment	Trigger Level		
Bund / impermeable area	n/a	n/a	Level 1
Permeable surface or stormwater retention pond	Level 1	Level 2	Level 3
Surface water or groundwater	Level 1	Level 3	Level 3

Responsibility	Situation		
	Level 1	Level 2	Level 3
Personnel who identify spill	Isolate and contain the spill utilising the spill kit. Evacuate from the area if potential danger. Notify the Emergency Operations Officer (HSE Manager) on UHF Channel 12 and provide location, extents, substance type, quantity, environments impact (soils, surface water	Isolate and contain the spill utilising the spill kit. Evacuate from the area if potential danger. Notify the Emergency Operations Officer (HSE Manager) on UHF Channel 12 and provide location, extents, substance type, quantity, environments impact (soils, surface water courses and	Isolate and contain the spill utilising the spill kit. Evacuate from the area if potential danger. Notify the Emergency Operations Officer (HSE Manager) on UHF Channel 12 and provide location, extents, substance type, quantity, environments impact (soils, surface water courses and

Responsibility	Situation		
	Level 1	Level 2	Level 3
	courses and groundwater) and spill kit contents used.	groundwater) and spill kit contents used.	groundwater) and spill kit contents used.
Emergency Operations Officer (HSE Manager)	Attend and assess the significance and flag the area. Re-commence operations where possible, excluding the area of the incident. Replenish spill kit consumables. Undertake and/or manage investigation into spill incident which is to be provided to the Emergency Response Coordinator (Site Manger) within 24 hours of the incident occurring. Spill to be logged with the spill register (Appendix C of the HSMP). Produce a 'Safety Moment' to onsite personnel within 1 week of incident occurring. Review and implement recommendations.	Attend and assess the significance and flag the area. Re-commence operations where possible, excluding the area of the incident. Replenish spill kit consumables. Undertake and/or manage investigation into spill incident which is to be provided to the Emergency Response Coordinator (Site Manger) within 24 hours of the incident occurring. Spill to be logged with the spill register (Appendix C of the HSMP). Produce a 'Safety Moment' to onsite personnel within 1 week of incident occurring. Review and implement recommendations.	Attend and assess the significance and flag the area. Manage insitu engineering works to capture and control the spill. Re-commence operations where possible, excluding the area of the incident. Replenish spill kit consumables. Undertake and/or manage investigation into spill incident which is to be provided to the Emergency Response Coordinator (Site Manger) within 24 hours of the incident occurring. Spill to be logged with the spill register (Appendix C of the HSMP). Produce a 'Safety Moment' to onsite personnel within 1 week of incident occurring. Review and implement recommendations.
Environmental Officer	Attend and assess the significance and potential requirement for further assessment (laboratory samples).	Attend and assess the significance and potential requirement for further assessment (laboratory samples). Commence investigation in soil, surface and/or groundwater impacts from the spill. The investigation will detail the spill quantity, determine extent and significance of the impact to human health and the ecosystem (including upstream / control samples as required).	Attend and assess the significance and flag the area. Regularly monitor flow, extents and sample (upstream, adjacent and downstream at consistent locations). Commence investigation in soil, surface and/or groundwater impacts from the spill. The investigation will detail the spill quantity, determine extent and significance of the impact to human health and the ecosystem (including upstream / control samples as required). Excavate and appropriately dispose of contaminated sediments with validation samples taken and disposal certification provided.
Emergency Response Coordinator (Site Manager)	Provide Department of Mines and Energy with Section 29 Notification (Appendix F of the HSMP) and Northern Territory Environmental Protection Authority with Section 14 Incident Report Form (Appendix E of the HSMP) within 24 hours of the incident occurring if the incident caused or is threatening or may threaten to cause pollution resulting in minor or serious environmental harm. Notify NT WorkSafe as required.	Provide Department of Mines and Energy with Section 29 Notification (Appendix F of the HSMP) and Northern Territory Environmental Protection Authority with Section 14 Incident Report Form (Appendix E of the HSMP) within 24 hours of the incident occurring if the incident caused or is threatening or may threaten to cause pollution resulting in minor or serious environmental harm. Notify NT WorkSafe as required.	Provide Department of Mines and Energy with Section 29 Notification (Appendix F of the HSMP) and Northern Territory Environmental Protection Authority with Section 14 Incident Report Form (Appendix E of the HSMP) within 24 hours of the incident occurring if the incident caused or is threatening or may threaten to cause pollution resulting in minor or serious environmental harm. Notify NT WorkSafe as required.

7.1.6 Non-mineralised Waste Management Plan

Objectives	Prevent of environmental impact from waste generation. Prevent increased environmental risk by the removal of hazardous substances from storage at the landfill prior to the Wet Season.
Actions	Site Induction Site inductions will include the following specific waste management components: • Waste hierarchy • Identification of waste types and associated disposal requirements • Handling requirements in accordance with SDS • Waste burning health implications • All waste/items brought to Mine Landfill for appropriate disposal. General Materials to be recycled at site include paper, cardboard, aluminium tins/cans, metal, electronics, plastics and glass. The items are to be stored at the landfill and/or waste collection points and removed from site monthly. Cleared vegetation will be mulched, stockpiled and/or used for rehabilitation. Litter sweep of the Landfill on a monthly interval to collect any windblown waste. Monthly inspection of burn pit cage (used to restrict access to vermin and/or other pests). All Project waste is to be disposed of at the Landfill. The landfill will be fenced with a single entry / exit which will be kept closed. Waste Hierarchy A waste hierarchy will be implemented on site including: • Elimination and removal • Substitution • Isolation, enclosure or sealing • Engineering controls • Safe work practices (administrative controls) Hazardous Waste Waste oils are to be stored in Intermediate Bulk Container (IBC) to be removed from site by a suitably licensed contractor and delivered to a licensed depot Intermediate bulk container (IBC) used to store waste oil and other hydrocarbon waste located in designated areas. IBCs are determined as small containers, drums (up to 205 litres) and storage up to 1,000 L. All IBCs to be labelled and hazard it poses listed on container. Hazardous substances stored minimum of 10 m from surface water and 50 m from groundwater wells. Spill kits are located at all hazardous substance storage locations. In addition, spill kits are available to be relocated to specific areas in accordance with scopes of work. Quarterly inspections of hazardous substance storage location to ensure spill kits are present/contain sufficient materials for potential spillages. The quarterly inspection is to update the hazardous substances inventory (within the Hazardous Substances Management Plan). Removal of hazardous substances from storage at the landfill prior to the Wet Season to reduce potential offsite migration risks. In the event of a spill follow the spill management procedure within the Emergency Response Plan including: • Isolate and contain the spill utilising the spill kit • Evacuate from the area if potential danger • Notify the Emergency Operations Officer (HSE Manager) on UHF Channel 12 and provide location, extents, substance type, quantity, environments impact (soils, surface water courses and groundwater) and spill kit contents used • Emergency Operations Officer, Emergency Field Team Member and Environmental Manager to attend and assess the significance and flag the area • Emergency Operations Officer, Emergency Field Team Member and Environmental Manager to manage insitu engineering work to capture and control the spill • Where spill cannot be controlled regularly monitoring flow, extents and sample (upstream, adjacent and downstream at consistent locations) • Environmental Manager to commence investigation in soil, surface and/or groundwater impacts from the spill. The investigation will detail the spill quantity, determine extent and significance of the impact to human health and the ecosystem (including upstream / control samples as required) • Where relevant, excavate and appropriately dispose of contaminated sediments with validation samples taken and disposal certification provided • Emergency Response Coordinator (Site Manager) to provide Department of Mines and Energy

	with Section 29 Notification) and Northern Territory Environmental Protection Authority with Section 14 Incident Report Form within 24 hours of the incident occurring if the incident caused or is threatening or may threaten to cause pollution resulting in minor or serious environmental harm • Spill to be logged with the spill register in the Hazardous Substance Management Plan • Clean-up of spill location including spill kit consumables and replace.		
	Uncontrolled Burn		
	Management of an uncontrolled burn at the landfill will be managed as follows: • If you see smoke or fire in the immediate area, alert all onsite personnel and provide regular updates • If the bushfire is threatening, ensure your own safety and Contractors by evacuating to Mining Services area • Contact the Site Manager using the Emergency Communication Procedure as follows: - o Call "Emergency, Emergency, Emergency" over UHF channel 12 - o Response is given directly to the reportee acknowledging the call - o Describe the nature of the emergency including number of people involved, details of accident and nature of the injuries/incident - o Continue to stay close to your source of communication • Site Manager to attend with onsite firefighting team and equipment.		
	Hazardous Waste Transport		
	Hazardous waste being removed from site will be undertaken by licenced contractor who holds an Environmental Protection Licence through the NT EPA for Listed Waste Handlers (http://www.ntepa.nt.gov.au/waste-pollution/approvals-licences/ep-licences). Certificates of disposal will be stored and provided within the Waste Management Plan revisions.		
Monitoring and Reporting	Monthly burn pit cage inspection and litter sweep.		Monthly
	Spill kits to be inspected on a monthly basis to ensure kits contain adequate equipment		Monthly
	Annual Waste Management Plan performance review.		Annually
Responsibility	Situation		
	Standard	Level 1	Level 2
	Landfill and waste collection sites containing wastes with limited interaction with vermin/pests.	Trigger: Waste incorrectly disposed of resulting in potential cross contamination of other wastes within the burn pit.	Trigger: Spill of Hazardous waste causing environmental harm.
Site Manager	Conduct monthly inspections of burn cage, hazardous substance storages, wastes within the burn pit and litter sweep. Monthly removal of recyclables at site including paper, cardboard, aluminium tins/cans, metal, electronics, plastics and glass. Quarterly inspections of hazardous substance storage location to ensure spill kits are present/contain sufficient materials for potential spillages. Removal of hazardous substances from storage at the landfill prior to the Wet Season.	Remove and segregate hazardous waste, plastics, tyres and recyclable wastes from the burn pit. Removal of hazardous substances from storage at the landfill prior to October.	Isolate and contain the spill utilising the spill kit; Evacuate from the area if potential danger; Notify Site Manager on UHF Channel 12. Monitor and determine if spill kit response has been effective in containing and managing spill. Undertake an investigation of soils and potentially install groundwater wells to determine extent of impact.
	Controlled burn to reduce amount of putrescible and windblown waste	Trigger: Uncontrolled burn at the landfill within the burn pit.	Trigger: Uncontrolled burn at the landfill outside of the burn pit.

Responsibility	Situation		
	Standard	Level 1	Level 2
Site Manager	Transferring of recyclable products to an appropriate licenced facility for recycling offsite. Transfer of hazardous wastes including chemical waste, paints, solvents, gas bottles, waste oil and batteries to an appropriately licenced offsite facility for disposal. Storage of tyres onsite in a stable form and outside of potential impact from bushfires. Burning waste within the designated fire pit with maintain firebreaks to control potential spread to the surrounding area. Controlled burns on low wind days at the landfill as necessary to control the amount of putrescible and windblown wastes. Hazardous waste and recyclables are kept out of the burn. Routine monitoring of the controlled burn and firefighting equipment within close proximity. Close landfill during the burning of wastes to reduce impact to human health (related to dioxins, sulphur dioxide, lead and mercury).	Management of an uncontrolled burn at the landfill will be managed as follows: - If you see smoke or fire in the immediate area, alert all onsite personnel and provide regular updates - If the bushfire is threatening, ensure your own safety and Contractors by evacuating to Mining Services area - Contact the Site Manager using the Emergency Communication Procedure as follows: - Call "Emergency, Emergency, Emergency" over UHF Channel 12 - Response is given directly to the reportee acknowledging the call - Describe the nature of the emergency including number of people involved, details of accident and nature of the injuries/incident - Continue to stay close to your source of communication. - Site Manager to attend with onsite firefighting team and equipment.	

7.1.7 Water Management Plan

Objectives	Provide a framework for the management of water resources within the Project area. Identifying key risks to these resources and developing a monitoring program to assess their condition before, during and after Project completion.
Actions	Undertake monitoring as detailed below and within the Water Management Plan.
Monitoring and Reporting	Groundwater - Monitoring of field parameters at monitoring wells located in the following areas: - Borefield – monthly levels and continuous data at select locations(data loggers) - Regional locations including existing stock wells – quarterly - Mine site, including pit, TSF, rock dump and camp area – quarterly - Field parameters to include: - Standing Water Level (SWL), temperature, pH, oxidation-reduction potential (ORP), electrical conductivity (EC), total dissolved solids (TDS), dissolved oxygen (DO) and turbidity. - Comprehensive laboratory assessment of groundwater on a biannual basis at a select number of locations for the following parameters: - Total acidity and alkalinity. - Major ions and nutrients (CaCO₃, CO₃, HCO₃, CaCO₃, Ca, Mg, K, Na, Cl, Cn, SO₄, NO₃) - Total and dissolved metals: Al, As, B, Ba, Cd, Co, Cu, Fe, Li, Pb, P, Mn, Hg, Mo, Ni, Rb, Se, Sr, Ag, U and Zn - Hydrocarbon screening. Monitoring of abstraction volumes for all production bores will be undertaken with continuous flow monitors. Data will be collated and summarised on a monthly basis.
	Surface Water - During flow events, where access is possible, sampling of surface water will be undertaken at the following locations: - Murray Creek - Upstream

	- o Murray Creek - Downstream - o Bloodwood Creek - o Hanson River - Borefield - o Hanson River - Highway - o Hanson River – Downstream • Sampling for field parameters will be undertaken on a daily basis for the following: - o Water level and photographic record of event. - o Temperature, pH, oxidation-reduction potential (ORP), electrical conductivity (EC), total dissolved solids (TDS), dissolved oxygen (DO) and turbidity. • Laboratory assessment will be undertaken on at least one occasions during each flow event at all locations and include the following parameters: - o Total suspended solids (TSS) - o Total hardness (hardness as CaCO₃) - o Total acidity and alkalinity. - o Major ions and nutrients (CaCO₃, CO₃, HCO₃, CaCO₃, Ca, Mg, K, Na, Cl, Cn, SO₄, NO₃) - o Total and dissolved (0.45 µm field filtered) metals: Al, As, B, Ba, Cd, Co, Cu, Fe, Li, Pb, P, Mn, Hg, Mo, Ni, Rb, Se, Sr, Ag, U and Zn.
	Sediment
	• Sediment sampling at the surface water monitoring locations will be undertaken following the end of the wet season (nominally March). Analysis will include the following: - o Particle Size Distribution (sieve and hydrometer) - o Electrical Conductivity and pH - o Total Organic Carbon - o Major ions (CaCO₃, CO₃, HCO₃, CaCO₃, Ca, Mg, K, Na, Cl, Cn, SO₄, NO₃) - o Metals Al, As, B, Ba, Cd, Co, Cu, Fe, Li, Pb, P, Mn, Hg, Mo, Ni, Rb, Se, Sr, Ag, U and Zn.
	Process Water
	• Water from various streams of the water circuit will be tested including the following locations: - o Raw Water Dam – weekly field water quality and levels - o Process Water Dam - weekly field water quality - o Water Treatment Plant - weekly field water quality and E.Coli on a monthly basis - o Tailing seepage/decant - o Rock dump drainage • Continuous automated monitoring (basic water quality and flow) is also likely to be included at various areas within the water circuit. • Comprehensive laboratory assessment, including assessment of Drinking water requirements will also be undertaken from the above locations on a biannual basis. Summary reporting of water monitoring will be completed at the end of each month during operations. This will highlight any breaches of trigger values and appropriate contingency actions. An annual report will be compiled including all water monitoring data for the program. The reporting will include an assessment of the water balance, abstraction volumes, groundwater level and groundwater quality trends and any breaches of trigger values and appropriate contingency actions.
Responsibility	TNG Environmental Supervisor and Mine Manager

7.1.8 Weed Management Plan

Objectives	Prevent the spread of Class A, B and C weeds, WoNS and environmental weeds. Prevent the introduction of new classified weed species across the Project. Undertake weed management across the Project. Monthly and annual weed survey and control.
Actions	Site Induction Site inductions will include the following components for weed management: • Summary of known weed infestations at the site • Requirement to enter and exit site through recognised vehicle access points • Requirement to jet wash vehicles/equipment entering and exiting the Project • Weed removal required prior to vegetation clearing • Areas to be cleared are to be flagged and approved through a Ground Disturbance Permit Procedure • All onsite personnel are to utilise existing/approved roads and tracks only. General Imported fill will be certified weed-free prior to being utilised at the Project. All vehicles entering and exiting the Project area are to be jet washed to remove potential seeds. Monthly survey and control of weeds across the Project. The survey is to determine if weed controls have been effective and if additional measures are required.

	If works are being undertaken in an area known to contain classified weeds, plant/equipment and vehicles are to be washed prior to vacating the areas.		
	Vegetation Clearance		
	Prior to clearing a Ground Disturbance Permit is required to be issued by the Environmental Manager.		
	Minimise ground disturbance at all location and specifically at riparian zones and within the Anmatyerr North Site of Conservation Significance (SOCS).		
	Weed removal prior to vegetation clearing so that vegetative material would be clean and able to be mulched and reused directly on site.		
	Areas to be cleared outside of existing disturbance will be flagged to prevent over clearing.		
	Vegetation stockpiled from clearing activities will be monitored and chemical control undertaken should weeds be identified.		
Monitoring and Reporting	Daily assessment of compliance with Ground Disturbance Permits.		Daily
	Monthly weed infestation monitoring and application of chemical control. Monitoring and applications will be recorded in the Weed Register (Appendix C of the Weed Management Plan).		Monthly
	Annual weed survey and control by an appropriately experienced and qualified botanist. The annual weed survey will include the Mine Site, Haul Road, Adnera Loadout Facility and exploration areas.		Annually
	The annual weed survey will establish potential requirements for additional measures such as planting of native species.		
Responsibility	Situation		
	Standard	Level 1	Level 2
	No introduction of weeds at the Project or spread of weeds from current locations.	Trigger: Spread of environmental weeds to areas previous weed free.	Trigger: Introduction of Class A, B and C weeds and WoNS to areas previous weed free or within SOCS.
Site Personnel	Comply with: - Site Induction requirements - Personnel, Vehicle and Equipment Hygiene Procedures - Ground Disturbance Permit Procedures.		
Environmental Manager	Ensure all employees and contractors are aware of all required procedures and systems to erosion and sediment management and are provided with all required resources to implement the requirements effectively. Daily assessment of compliance with Ground Disturbance Permits. Monthly weed infestation monitoring and application of chemical control. Ensure all employees and contractors are provided with appropriate clearance approvals and on-ground guidance prior to giving any ground disturbance instructions. Commission an annual weed survey and control by an appropriately experienced and qualified botanist following Wet Season rains.	Undertake additional chemical control and increase frequency to weekly. Record monitoring and application of chemical control in the Weed Register.	Undertake additional chemical control and increase frequency to weekly. Record monitoring and application of chemical control in the Weed Register. Commission an appropriately experienced and qualified botanist to undertake a weed survey and control across the Project. The subcontractor is to establish additional weed mitigation measures required. Provide summary of weed survey within Monthly Report and recommend additional mitigation measures. Revise the Environmental Management Plan and Weed Management Plan following Site Manager approval of additional mitigation measures.
Subcontractor	Annual weed survey and control by an appropriately experienced and qualified botanist. Weed surveyor to provide assessment report summarising controls, spread and additional management measures (if any).		Undertake weed survey and assessment of Project activities and exiting weed mitigation measures. Determine additional mitigation measures and provide a summary report.
Site Manger	Ensure that the Weed Management Plan is implemented by all Site Personnel.		Assess and implement Monthly Report mitigation measures. Facilitate the revision of the Environmental Management Plan and Weed Management Plan.

	Clearing undertaken in accordance with Ground Disturbance Permit.	Trigger: Clearing undertaken outside of established Ground Disturbance Permit approval but outside of sensitive areas (i.e. restricted works areas).	Trigger: Clearing undertaken outside of established Ground Disturbance Permit approval and within sensitive areas (i.e. restricted works areas).
Environmental Manager	Daily assessment of compliance with Ground Disturbance Permits.	Commence investigation into the clearing works to determine root cause of over clearing. Establish the significance of over clearing and determine rehabilitation measures. Produce summary report within 1 week of the incident occurring.	Commence investigation into the clearing works to determine root cause of over clearing. Establish the level/area of impact within the sensitive area. Produce summary report within 24 hours of the incident occurring.
Site Manager	Ensure that the Weed Management Plan is implemented by all Site Personnel.	Review summary report and establish undertake debriefing with site personnel.	Review summary report and inform relevant stakeholder regarding over clearance. Review contractor / personnel performance and implement management measures.

7.1.9 Drainage, Erosion and Sediment Control Plan

Objective	The Drainage, Erosion and Sediment Control Plan (DESCP) provides: • An outline of the Drainage, Erosion and Sediment Control (DESC) strategy that will inform the development of the Project design • An overview of key risks identified for the management of drainage, erosion and sedimentation during the construction, operation and closure of the Project • A framework for managing the risk of erosion and release of sediment to the receiving waters, contamination of stormwater and it facilitates runoff separation and catchment classification for water quality and management planning purposes.
Actions	Finalise the mine design according to the requirements of the DESC. Update the DESC following the final mine design providing details of all DESC measures and ongoing maintenance requirements. Ensure that all rehabilitation measures relating to the DESC are cross-referenced in the construction and ongoing Environmental Management Plan. Update the DESC as mining develops and any unforeseen DESC problems arise along with the management measures thereof.
Monitoring and Reporting	Establish an appropriate monitoring checklist for all DESC measures. Inspect and maintain all DESC measures prior to the wet season and after all major rainfall events. Record details of each inspection, including: • Condition of DESC structures and stabilised surfaces • Repair/maintenance requirements for any damage to DESC structures • Rainfall prior to inspection, including duration and times. Initiate a work instruction to repair any damage and ensure that corrective measures are investigated and implemented,
Responsibility	Mine planner and designer. Environmental Supervisor and Mine Manager.

Appendices

Appendix A – Environmental Policy

TNG LIMITED POLICY

Document Title	Environmental Policy
Policy Number	8.0
Date of Issue	Tuesday, 7 August 2012

8.01 OBJECTIVES

The Company is committed to minimising the impact of all aspects of its operations on the environment to a statutory and socially acceptable level through the pro-active implementation, maintenance and continuous improvement of our Environmental Management Plan (Plan).

The Company aims to continually review and improve its Environmental Management System to ensure it is compliant with International and Australian Standard ISO/AS 14001 (Environmental Management Systems).

The standards outlined in this document are important in maintaining the Company's commitment to the environment and the communities in which the company operates.

8.02 APPLICATION

This policy applies to the Company and its Employees (as defined in this policy). It may also apply to representatives of independent contractors who perform work for the Company, depending on the terms of their particular contractual arrangements.

In this policy:

- "Company" means TNG Limited, as well as each other company within the TNG Limited Group, i.e.: all companies defined as "related bodies corporate" of TNG Limited under the Corporations Act 2001, as amended; and
- "Employee" means:
 - Anyone employed directly by the Company, i.e.: Employees engaged to do work directly for the Company;
 - Volunteers, i.e.: Persons who do work directly for the Company or on Company premises but who are not employees and are not independent contractors (or representatives of independent contractors); and
 - Independent contractors.

8.03 RESPONSIBILITIES

The Company is committed to the preservation of our natural environment and to the community heritage that may be affected by our business activities and believes that environmental goals can and should be consistent with economic growth.

It is every employee's responsibility to minimise their impact on the environment and to ensure that they are aware of the environmental requirements and raise any issues or concerns regarding them.

Each Manager is required to ensure that the intent and requirements of the Environmental Policy is effectively met and implemented in their areas of control, and to support any

subordinates and hold them accountable for their specific responsibilities.

8.04 REQUIREMENTS

The key environmental elements of the Environmental Management Plan (Plan):

- Recognise the Company's responsibility to protect the environment and minimise, as far as is safe;
- Practicable and economically sound, any adverse environmental impact of its activities;
- Increasing employee awareness through the induction and training process;
- Compliance with all applicable laws and regulations and promotion of the commitment and skills of its personnel to ensure effective environmental management at all its sites;
- Report and investigate fully any environmental mishaps or incidents;
- Clearly define responsibilities and accountabilities within the organisation;
- Effective operating procedures and work standards; and
- Independent monitoring and audit process of all operations.

This policy will be reviewed every twenty four months.

8.05 INTERACTION WITH OTHER POLICES

All Employees are required to comply with the Occupational Health and Safety Policy to protect their own health and safety and that of others in the workplace.

The Company is committed to providing and maintaining safe working environments in which employees are not exposed to hazards arising from the use and abuse of alcohol or drugs.

These substances must not be permitted to jeopardise our employees, contractors, visitors and the public's safety.

Appendix B – Air and Dust Management Plan



TNG Limited

Mount Peake

Air and Dust Management Plan

December 2015

Document Status

Version	Author	Reviewer	Approved by	Date	Status
Rev. 0	A. Koscielski				

Amendments

Section	Details
n/a	

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Appendix A – Risk Matrix	

1. Introduction

1.1 Purpose

The Mount Peake Project involves several key activities with the potential to impact on air quality. TNG Limited (TNG) will manage Air and Dust in accordance with the Air and Dust Management Plan (ADMP).

The purpose of the ADMP is to provide a framework for environmental management. The Plan has been developed in accordance with NT EPA requirements and references commonwealth air quality legislation.

The impacts of dust emissions fall under two categories including health and amenity as follows:

- Potential health impacts are attributable to the concentration of respirable particles in ambient air. Respirable particles of dust (PM₁₀) would have maximum impact under light winds and stable atmospheric conditions. These conditions most frequently occur overnight and very early in the morning
- The presence of total suspended particles (TSP), greater than 35 microns, is likely to affect amenity by way of 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 and soiling surfaces. Mitigation of amenity related dust impacts would in turn act to reduce health impacts due to dust emissions.

1.2 Objective

The ADMP has been established to ensure there is no health risk or loss of amenity due to emission of dust or pollutants from the power station to the environment. The Plan has been designed to achieve this object through the following:

- Summarising potential impacts through modelling of dust and air quality
- Implementation of a dust prevention strategy including dust control and mitigation measures
- Annual performance reviews to determine if additional mitigation measures are required.

1.3 Legislation and Guidelines

The ADMP has been developed with reference to several industry standards and guidelines in relation to dust and pollutants:

- National Environment Protection (Ambient Air Quality) Measure (Air NEPM)
- National Environment Protection (Air Toxics) Measure (Air Toxics NEPM)
- WA Environmental Protection Authority (EPA) criteria for total suspended particulates (TSP)
- Victoria Mining Protocol for Environmental Management (PEM) criteria for PM_{2.5} and PM₁₀
- Victorian Environment Protection Authority (Vic EPA) Design Criteria for PM₁₀
- National Standards for Air Quality - Australian Government, Department of the Environment and Heritage, 2005
- Department of Sustainability, Environment, Water, Population and Communities, National Pollutant Inventory Emission Estimation Technique Manual for Mining Version 3.1 (January 2012)

- Department of Infrastructure 2013/2014 Standard Specification for Environmental Management
- EPA Victoria, Best Practice Environmental Management – Environmental Guidelines for Major Construction Sites
- World Bank Group, International Finance Corporation, Environmental, Health and Safety Guidelines for Mining.

1.4 Previous Investigations

A summary of previous air quality investigations at the site are provided in Table 1-1.

Table 1-1 Summary of Air Quality Investigations

Report Title	Author	Date	Purpose
Mount Peake Project Air Quality Assessment Report	GHD	December 2015	The assessment was undertaken to address NT EPA Terms of Reference. The report: • Assess the likely level of dust generation and other pollutants associated with construction of the Project • Models dust and emissions from the operation of the Project • Assess air quality impacts from the operation of the Project, including dispersion modelling and assessment against relevant air quality criteria • Specifies intended air quality management and mitigation measures during construction and operation of the Project to allow compliance with relevant air quality criteria • Summarises greenhouse gas emissions for the operation of the Project.

2. Existing Conditions

2.1 Climate

The Bureau of Meteorology (BOM) Territory Grape Farm Station is situated approximately 80 km south of the Mine Site (BOM Site No. 015643).

The Station has collected temperature and rainfall from 1987 to 2015. The data indicates the climate of the region is arid to semi-arid with a mean annual rainfall of approximately 310 mm. Rainfall generally falls over 30 days across the year predominately between October and March. However, rainfall in the region is highly variable.

The average annual mean minimum and maximum temperature range from 21.1 to 36.3°C respectively. The higher temperatures are generally experienced from October to March (corresponding with rainfall in the region).

The winds at the Project are predominant south easterly wind direction throughout the year. The average wind speeds range from 2.50 to 3.17 m/s with an annual average of 2.86 m/s.

A summary of the climate data is provided in Table 2-1 and wind roses are provided in Figure 2-1.

Table 2-1 Mount Peak Climate Summary from 1987 to 2015 (Source: BOM, Territory Grape Farm Station No. 015643)

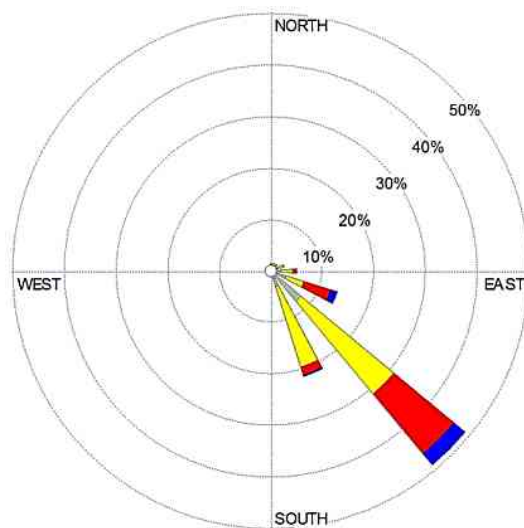
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
Temperature													
Mean Max (°C)	37.3	36.2	34.3	30.4	25.5	22.2	22.5	25.3	30.4	33.3	35.6	36.3	30.8
Mean Min (°C)	21.9	21.7	19.5	14.5	9.5	6.2	5.1	7.0	11.9	15.6	18.8	21.1	14.4
Rainfall													
Mean (mm)	62.4	65.8	21.0	18.0	22.5	8.6	4.7	4.6	10.0	14.7	30.9	50.5	312
Decile 5 (median) (mm)	44.2	33.8	10.2	3.0	1.0	1.6	0.0	0.0	1.6	7.1	19.1	40.7	298
Mean No. Days (≥1 mm)	4.3	4.7	2.1	1.5	2.2	1.2	0.7	0.8	1.0	2.7	3.9	4.9	30

2.2 Sensitive Receptors

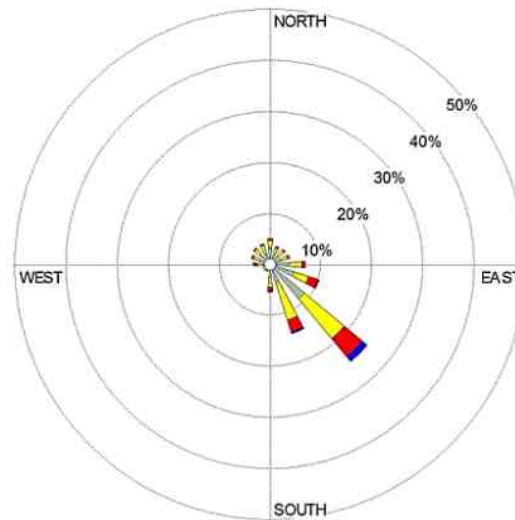
The Mount Peake Project lies within the Burt Plain bioregion. Land use immediately adjacent to the Project is pastoral activities. Existing infrastructure includes the Stuart Highway, Adelaide to Darwin Railway, the Amadeus Gas Pipeline, pastoral station tracks and wells for stock watering.

The nearest non-mining sensitive receptor to the mine site is Anningie Station homestead approximately 30 km to the south-west. The access road lies approximately 20 km to the south of the Wilora Aboriginal community.

A number of sensitive receptors were identified in the Mount Peake region as listed in Table 2-2 and shown in Figure 2-2.

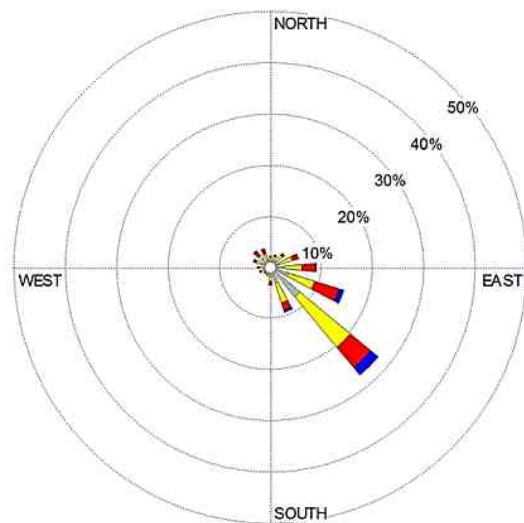


Spring (September – November)

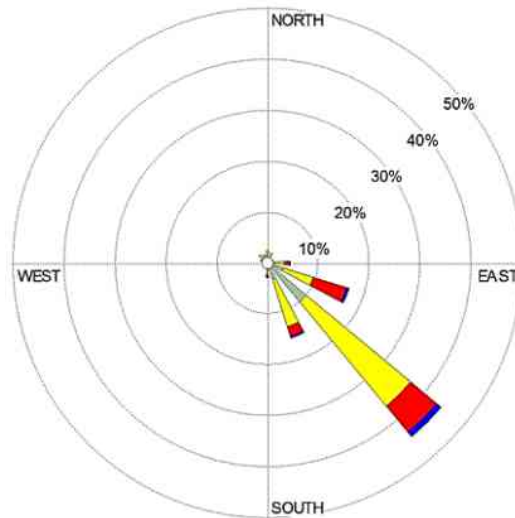


Summer (December – February)

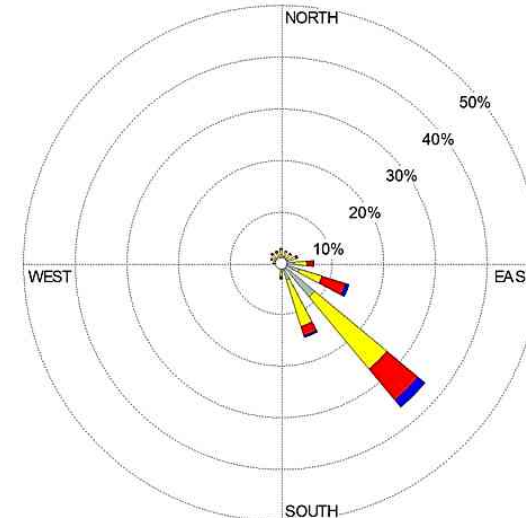
Wind Speed (m/s)	Average wind speed (m/s)	
>= 10.0	Annual:	2.86
8.0 - 10.0	Spring:	3.17
6.0 - 8.0	Summer:	2.50
4.0 - 6.0	Autumn:	2.92
2.0 - 4.0	Winter:	2.84
0.0 - 2.0		



Autumn (March – May)

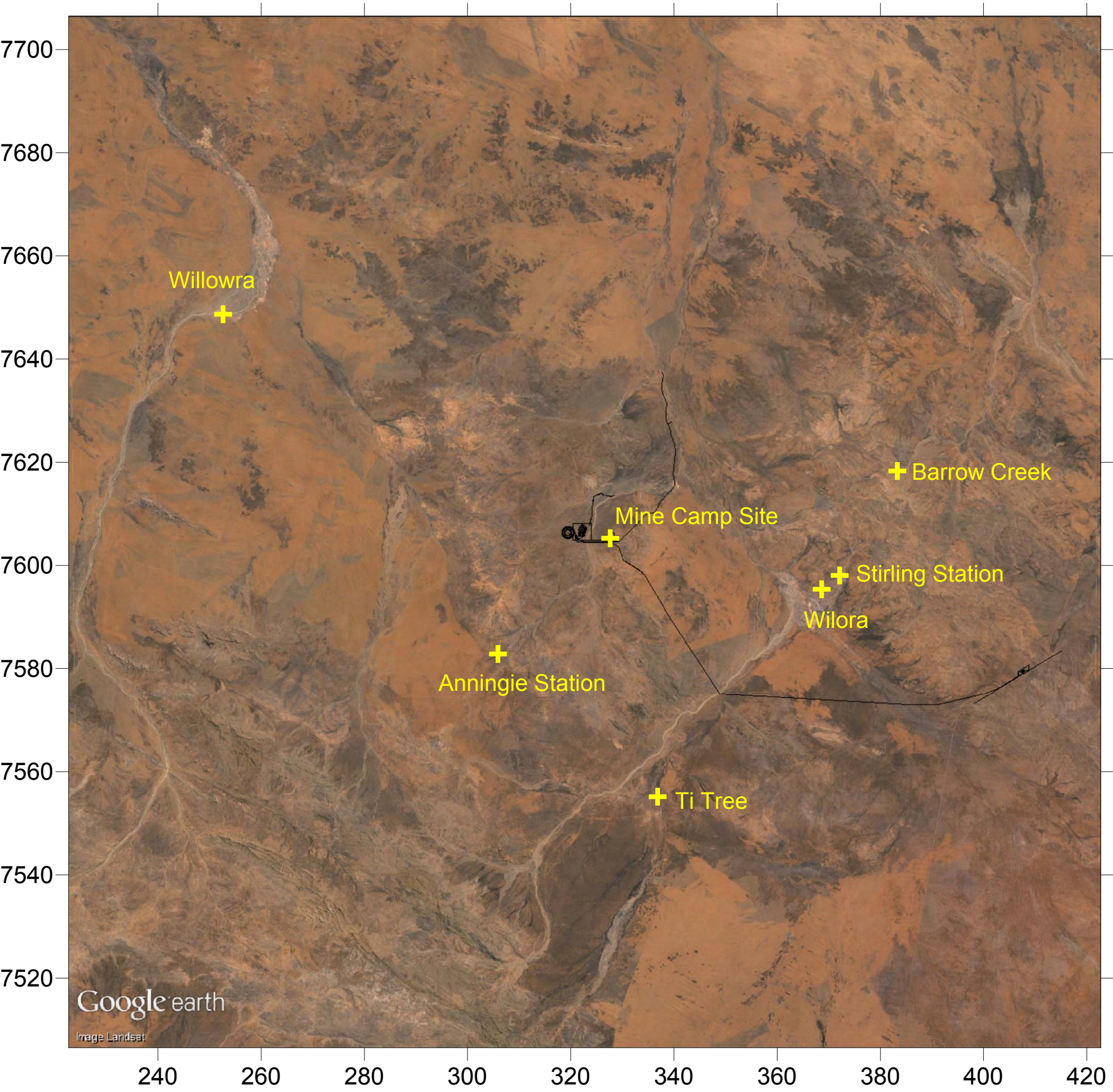


Winter (June – August)



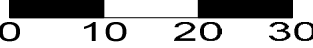
Annual

Figure 2-1 Annual and Seasonal Wind Roses (Source: BOM, Territory Grape Farm Station No. 015643)



- LEGEND**
-  Proposed mine layout
 -  Sensitive receptors

SCALE



Kilometres (at A3)

MAP PROJECTION:
Transverse Mercator

HORIZONTAL DATUM:
Geocentric Datum of Australia (GDA)

GRID:
Map Grid of Australia 1994, Zone 53

DATA SOURCE:
GE_MGA53_20151028

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TNG Limited
Mount Peake Project

Figure 2-2
Sensitive Receptor Locations

CREATED	CHECKED	APPROVED	DATE	FILE LOCATION	DRAWING NO.	REVISION
SW	JF	JF	28.10.15	G:/61/2905711/Technical/Surfer/Figure 2-1	Figure 2-1.srf	0

Table 2-2 Sensitive Receptor Locations

Name	Detail	Easting (m)	Northing (m)	Distance from Mount Peake Mine (km)
Mine camp site	Mine accommodation village	327,657	7,605,251	5
Anningie Station	Pastoral lease homestead	305,913	7,582,817	30
Wilora	Aboriginal community	368,646	7,595,380	47
Stirling Station	Pastoral lease homestead	372,097	7,598,030	51
Ti Tree	Small town	336,844	7,555,160	52
Barrow Creek ^A	Small town	383,314	7,618,267	62
Willowra	Aboriginal community	252,622	7,648,678	80

Note: ^A 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.

2.3 Potential Dust and Pollutant Impacts

As part of the EIS in 2015 an assessment of air quality was undertaken to assess the potential impact of dust and pollutants on adjacent sensitive receptors.

The assessment included modelling using the United States Environmental Protection Agency (US EPA) approved CALPUFF dispersion model (version 5.8.4) to predicted particle concentrations at sensitive receptor locations.

The model used July 2011 to June 2012 meteorological data obtained from BOM and Project activities replicated mining year four (shallow pit, 24 hour operation and highest throughputs resulting in the highest estimated emissions).

2.3.1 Assessment Guideline Values

Dust

The dust assessment guideline values were adopted from the following references with the most conservative value utilised for the assessment:

- National Environment Protection (Ambient Air Quality) Measure (Air NEPM)
- WA Environmental Protection Authority (EPA)
- Victoria Mining Protocol for Environmental Management (PEM)

The levels are provided within the assessment in Table 2-4.

Pollutants

The pollutant guideline values for assessing stack emissions from the power station were adopted from the following reference with the most conservative value utilised for the assessment:

- National Environment Protection (Ambient Air Quality) Measure (Air NEPM)
- National Environment Protection (Air Toxics) Measure
- Victorian State Environment Protection Policy (Air Quality Management) (SEPP-AQM).

The levels are provided within the assessment in Table 2-5.

2.3.2 Sources

The modelling assessed the operational period of 15 years following the initial two year construction period. Mine site activities with potential to generate dust and pollutants were established and modelled. Activities included within the model are provided in Table 2-3.

Table 2-3 Potential Air and Dust Sources

Source Type	Source Location
Dust	
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 dumps 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
Pollutants	
Stack emissions - nitrogen (NO _x), carbon monoxide (CO), volatile organic compounds (VOC).	Power Station
Vehicles and generator emissions - carbon dioxide (CO ₂), methane (CH ₄), nitrous oxide (N ₂ O), sulphur dioxide (SO ₂).	All of site

2.3.3 Impacts

Construction

Construction activities were not modelled as part of the EIS process as the specific construction requirements are still being determined. Emission locations of dust during construction will consistently change throughout the program reducing potential persistent impacts across the two year period. Dust emissions during construction are not considered to represent a significant source of emissions

Operation

Air emissions during operations are unlikely to have an adverse impact, with pollutant concentrations well below assessment guidelines. Predicted concentrations for CO, NO₂ and VOCs at the sensitive receptor locations are also below the adopted investigation guidelines. A summary of predicted dust and pollutants emissions at sensitive receptors is provided in Table 2-4 and Table 2-5 respectively.

Table 2-4 Predicted Particle Concentrations at Sensitive Receptors

Receptor	PM10, µg/m3			TSP, µg/m3	
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	- -
Source	Air NEPM	Air NEPM	SEPP AQM	WA EPA	
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

Note: PM₁₀: Particulate Matter < 10 µm.
TSP: Total Suspended Particulates.

Table 2-5 Predicted CO, NO₂ and VOCs concentrations at sensitive receptors

Receptor	CO	NO ₂ ¹		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
Source	Air NEPM	Air NEPM	Air NEPM	SEPP AQM	Air Toxic NEPM	SEPP AQM	SEPP AQM	Air Toxics NEPM	Air Toxics NEPM	SEPP AQM
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

Note: ¹ Taken as 20% of NO_x results.

3. Air and Dust Management

Management of air and dust is structured as follows:

- **Key Activities, Risks and Impacts:** A summary of the key activities being undertaken during the management period. The potential environmental impacts and residual risk levels are identified for each environmental aspect
- **Objective:** The guiding environmental management objective(s) and activities that apply to the element
- **Mitigation Measures:** The procedures to be employed to ensure that the relevant objectives are met
- **Responsibility:** Nominates the responsible position for implementing actions and monitoring
- **Trigger, Action, Response Plan (TARP):** The actions to be implemented in the case of non-compliance. This includes strategies of remediation and the person(s) responsible for the actions.

3.1 Key Activities, Risks and Impacts

The key activities and potential environmental impact have been identified for air and dust and are listed in Table 3-1. The risk matrix is provided in Appendix A.

Table 3-1 Key Activities, Risks and Impacts

Activity	Potential Environmental Impact	Residual Risk Level		
		Consequence	Likelihood	Risk
Wind erosion mobilising dust from exposed surfaces, such as pits, waste dump, tailings storage facility, laydown areas, stockpiles, roads and sites of vegetation clearing. Drilling, blasting, excavation and materials handling at the mine site during operations results in dispersion of particulates and dust.	Dust deposition leading to disturbance / loss of general terrestrial flora species and vegetation communities.	2	2	L
	Modify or inhibit ecological processes.	2	2	L
	Reduce the diversity or modify the composition of plant species.	2	2	L
	Cause a long term reduction in rare, endemic or unique plant populations or species.	4	1	M
	Modify or inhibit ecological processes.	1	2	VL
	Reduce the diversity or modify the composition of fauna species.	1	2	VL
	Cause a long term reduction in rare, endemic or unique fauna species.	1	2	VL
	Dust levels at closest sensitive receptor exceed air quality criteria.	3	1	L
Air emissions from the power station.	Reduced air quality at closest sensitive receptor.	3	1	L
Greenhouse gas emissions from Project activities.	Contribution to Northern Territory and Australian emission levels.	1	5	M

3.2 Objective

Air and dust management objectives have been established and are detailed in Table 3-2.

Table 3-2 Air and Dust Objectives

Objective	Target	Indicator
Minimise dust impacts at the Project.	No significant dust deposition outside of the Project footprint and/or at the Mine Camp.	Number of incidents reported for dust deposition outside of the Project footprint or at the Mine Cramp.
	No reports of dust impacts from the Project at sensitive receptors.	Number of incidents of dust deposition at sensitive receptors.
Minimise air pollutant impacts at the Project.	No reports of pollutant impacts from the Project at sensitive receptors.	Number of pollutant impacts/complaints at sensitive receptors.
	Utilise best practice for the management of the Power Station and monitoring of stack emissions.	Number of stack emissions outside of design specification.
	Maintain all machinery at the Project to ensure it is operating efficiently.	Percentage of vehicles maintained with prescribed timeframe of routine maintenance schedule.

3.3 Mitigation Measures

Mitigation measures have been developed to minimise potential impacts associated air quality. The mitigation measures, timing and responsibilities are provided in Table 3-3.

Table 3-3 Mitigation Measures

ID	Mitigation Measure	Timing	Responsibility
Site Induction			
AD1	Site induction includes the following components for air and dust: - Description of dust risks across the Project and areas of higher risk (i.e. adjacent to the Stuart Highway). - All personnel to drive on predetermined roads across the site with speeds limited to 25 km/h on unconsolidated/unsealed roads. - Drivers to ensure haulage vehicles are covered on transit from Mine Site to the Adnera Loadout Facility.	Site Induction	All personnel
Water Cart / Water Spraying			
AD2	Water carts will operate across the Project during construction and operation. The water carts will spray at a minimum level of 2 L/m ² /hr across unsealed roads.	Construction and Operation	Construction Manager Site Manager
AD3	Exposed stockpiles will either be covered and/or routinely sprayed with water.		
AD4	Product being removed from the Mine Site and placed at the Adnera Loadout Facility will be sprayed prior/during loading/unloading.		
AD5	Construction dust suppression water will be sourced from production bores across the Project.	Construction	Construction Manager
AD6	Operation dust suppression water will be sourced from: - Production bores; - Stormwater retention ponds; or - Pit water	At all times	Site Manager
Dust General			
AD7	Defined access roads and haul routes to be used.	Construction and Operation	Construction Manager Site Manager
AD8	Daily review of weather reports to establish potential of extreme weather events requiring additional water application across the site.		

ID	Mitigation Measure	Timing	Responsibility
AD9	Stockpiles of fines and/or soils across the Project will be managed to reduce dust emission including spraying with water or covering.		
AD10	Areas cleared which are no longer required will be rehabilitated in accordance with the Closure and Rehabilitation Management Plan.		
AD11	Areas to be cleared will be flagged prior to any cleaning being undertaken. Following clearing the areas will form part of the water cart dust suppression program.		
AD12	Offloading of waste and ore will be undertaken from minimum heights with water sprays utilised at high frequency dump locations (i.e. crushing screens).	Operation	Site Manager
Processing			
AD13	Ore to be sprayed with water prior to entering crusher.	At all times	Site Manager
AD14	Crushers to be hooded and High Pressure Grinding Rollers (HPGR) to be enclosed.	At all times	Site Manager
AD15	Following the beneficiation process, moisture will be retained in the concentrate to reduce product loss while in storage onsite.	At all times	Site Manager
AD16	Haulage from the Mine Site to Adnera Loadout Facility will be in covered hoppers.	At all times	Site Manager
Air Pollutants General			
AD17	All construction and maintenance equipment/vehicles to be operated and maintained to manufacturer's specifications in order to minimise exhaust emissions.	Construction and Operation	Construction Manager Site Manager
AD18	Power Station stack height to be a minimum of 9.37 m and have a radius of 0.229 m.		
Monitoring and Inspections			
AD20	Daily visual dust inspections of work areas to determine if additional dust suppression measures are required.	Daily	Environmental Manager
AD21	Monthly inspection and reporting of dust mitigation measures to ensure they are being implemented including covered haulage, application of sufficient water across the Project and summary of potential dust issues and visit to sensitive receptors.	Monthly	Environmental Manager
AD22	Annual stack emission testing, assessment and recommendation for mitigation measures.	Annual	Environmental Manager
AD23	Annual Energy Efficiency Assessment.	Annual	TNG Management Team
AD24	Annual Air and Dust Management Plan performance review (Section 4).	Annual	TNG Management Team

3.4 Trigger, Action and Response Plan

The Trigger, Action and Response Plan (TARP) outlines remedial actions and responses to the situation. The TARP is outlined in Table 3-4 for the following situations:

- Standard – all mitigation measures are installed and no disturbance/interference with cultural heritage is apparent
- Level 1 – potential for disturbance/interference with cultural heritage has been identified but has not occurred
- Level 2 – disturbance/interference of cultural heritage has occurred.

Table 3-4 Trigger, Action and Response Plan

Responsibility	Situation		
	Standard	Level 1	Level 2
	Activities and associated dust emissions are contained within Project area.	Trigger: Dust complaint received but not validated.	Trigger: Dust complaint received and validated.
Site Personnel	Comply with site inductions and mitigation measures outlined in Table 3-3.		
Environmental Manager	Daily visual inspections across Project to determine if additional measures are required. Monthly inspection and reporting of all dust control measures.	Undertake an investigation of the complaint including an assessment of operations, weather conditions and visual observation of impact.	Undertake an investigation of the complaint including an assessment of operations, weather conditions and visual observation of impact. Review efficiency of dust mitigation measures and detail additional mitigation measures and associated monitoring at sensitive receptors (including complainant location where appropriate).
Construction Manager Site Manager	Review reports and determine if additional measures are to be implemented.	Provide feedback to complainant.	Review and implement additional dust mitigation measures provided by the Environmental Manager. Provide feedback to complainant.
	Annual stack emission test within operational limits.	Trigger: Stack emission tests indicate concentrations exceed design criteria by 20%	Trigger: Stack emission tests indicate concentrations exceed design criteria by 50%
Environmental Manager	Schedule and manage subcontractor to undertake annual testing of the power station stacks. Stack sampling is to comply with the Victorian EPA A Guide to the Sampling and Analysis of Air Emissions and Air Quality.	Assess subcontractors report and recommendations. Evaluate the viability of mitigation measures and produce summary report for Site Manager.	
Site Manager	-	Review summary report of emissions failure and potential mitigation measures. Determine in consultant with the subcontractor and Environmental Manager what remedial works will be undertaken.	

4. Previous Period Performance

No previous period performance data is available for review.

6. References

Bureau of Meteorology (BOM), 2015. Climate Statistics for Australian Locations - Monthly Climate Statistics – All Years of Record – Territory Grape Farm.

http://www.bom.gov.au/climate/averages/tables/cw_015643.shtml. Accessed 5 May 2015.

EPA Vic, 1996. Best Practice Environmental Management - Environmental Guidelines for Major Construction Sites. Melbourne, February 1996.

GHD, 2015. TNG Limited. Mount Peake Project Air Quality Assessment Report.

Appendices

Appendix A – Risk Matrix

An environmental risk assessment was undertaken for the Project during the EIS phase. The risk assessment identified the risk source (hazard and event), receptors and potential impact. The consequence and likelihood were determined using the descriptions identified in Table A1 and Table A2 respectively. The risk matrix is provided in Table A3.

Table A1 Consequence Description

Consequence	Insignificant	Minor environmental impact. Impacts are contained on-site and short term in nature. No detrimental effect on the environment.
	1	Minor repairable damage to common historic structures or sites. No disturbance of cultural heritage sites.
	Minor	Minor local habitat modification and / or lifecycle disruption for a listed species. No loss of individuals of listed species.
		Negligible soil impact. Chemical concentrations are above background but below EILs.
	2	No detectable change to background water quality. No exceedance of background and applicable Water Quality guidelines.
	Moderate	Moderate, unplanned localised environmental impact (may be of a temporary nature) or discharge contained on-site or with negligible off-site impact.
		Moderate but repairable damage to important historic structures or sites of cultural importance.
	3	Moderate local habitat modification and / or lifecycle disruption for a listed species. Minor local decrease in size of population(s) of listed species.
	Major	Localised soil impact. Low level <2 times exceedance of EILs.
		Local short-term minor exceedance of background and applicable Water Quality guidelines.
	Critical	Significant, unplanned environmental impact contained on-site or minor impact that is off-site.
		Considerable damage or infringement to sensitive historic structures or sites of cultural significance.
	4	Substantial local habitat modification and / or lifecycle disruption for a listed species. Moderate local decrease in size of population(s) of listed species.
		Localised long term or widespread short term soil impact. Chemical concentrations 2-5 times EILs.
	5	Local long-term or widespread short-term exceedance of background and applicable Water Quality guidelines.
		Major or widespread, unplanned environmental impact on or off-site. Could include substantial pollutant discharges. Significant resources required to respond and rehabilitate.
	Critical	Major damage or infringement to sensitive historic structures or sites of cultural significance.
		Moderate regional habitat modification and / or lifecycle disruption for a listed species. Substantial local decrease in size of population(s) of listed species.
	5	Widespread and / or long term impact to soils. Chemical concentrations 5-10 times EILs.
		Local, permanent or widespread, long-term exceedance of background and applicable Water Quality guidelines.

Table A2 Likelihood Description

Likelihood	Rare	Unlikely	Possible	Likely	Almost Certain
	1	2	3	4	5
Description	The event may occur only in exceptional circumstances.	The event could occur at some time.	The event might occur at some time.	The event will probably occur in most circumstances.	The event is expected to occur in most circumstances.
Occurrence Intervals	>10 years	5 – 10 years	2 – 5 years	1 – 2 years	1 year

Table A3 Risk Matrix

			Severity of Consequence				
			Critical	Major	Significant	Moderate	Minor)
			5	4	3	2	1
Likelihood of Consequence	Almost Certain	5	Extreme	Extreme	High	High	Medium
	Likely	4	Extreme	High	High	Medium	Medium
	Possible	3	Extreme	High	Medium	Medium	Low
	Unlikely	2	High	Medium	Medium	Low	Very Low
	Rare	1	Medium	Medium	Low	Low	Very Low

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Appendix C – Biodiversity Management Plan



TNG Limited

Mount Peake Project Biodiversity Management Plan

December 2015

Document Status

Version	Author	Reviewer	Approved by	Date	Status
Rev. 0	A Koscielski	Ian McCardle	Ian McCardle		

Amendments

Section	Details
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Appendix B – Threatened Fauna Species Identified at Mount Peake

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Appendix D – Ground Disturbance Permit System

Appendix E – Risk Matrix

1. Introduction

1.1 Purpose

The Mount Peake Project involves several key activities during construction and operations which have the potential to impact upon biodiversity:

- Clearing of vegetation
- Planned and/or unplanned fire
- Collisions between fauna and traffic
- Hazardous substances storage and use
- Introduction and/or spread of weeds (particularly through inadequate site reinstatement); and
- Increase in population size of native and non-native predators (particularly through inadequate management of putrescible waste, which could attract vermin, and subsequently their predators such as cats and foxes).

TNG will manage the potential impacts to biodiversity in accordance with this Biodiversity Management Plan (BMP). The purpose of the BMP is to provide a process for mitigating Project activities on biodiversity including:

- Avoiding injury or death to native fauna resulting from Project activities
- Minimising the disturbance of native flora
- Reducing the Projects potential to facilitate an increase in non-native fauna numbers (pests)
- Establishing and maintaining awareness and importance of protecting biodiversity across the Project.

The BMP forms part of the Environmental Management Plan and is considered to be a working document. It will be updated prior to implementation at the Project following formal assessment by the Northern Territory Environment Protection Authority (NT EPA) through the Environmental Impact Statement (EIS) process and Department of Mines and Energy through the mine authorisation process.

1.2 Objective

The BMP has been developed to reduce the Project impact on the surrounding environment. Its objects are to:

- Identify key biodiversity issues requiring control measures
- Develop and implement strategies to manage impact to biodiversity
- Assign responsibilities for management and provide sufficient information to assist in auditing the implementation of the BMP.

1.3 Legislation and Guidelines

The legislation and guidelines relating to the management of flora and fauna at the Project are:

- Legislation
 - *Bushfires Act*
 - *Environment Protection and Biodiversity Conservation Act (EPBC Act)*
 - *Environmental Offences and Penalties Act*
 - *Mining Management Act*
 - *National Environment Protection Council (Northern Territory) Act*
 - *Territory Parks and Wildlife Conservation Act (TPWC Act)*
 - *Weed Management Act.*
- Guidelines
 - Northern Territory Survey Methods for Flora and Fauna Surveys Used for Standard Biodiversity Unit Survey Sites.

2. Existing Conditions

2.1 Flora and Vegetation

2.1.1 Survey

An assessment of flora and vegetation was undertaken in April 2013 as part of the EIS process (GHD 2015). The survey targeted the mine site, mine camp, 1 km corridor along the initially proposed alignment of the access road and Adnera Loadout Facility.

Flora survey techniques used were consistent with the *Northern Territory Guidelines and Field Methodology for Vegetation Survey and Mapping* (Brocklehurst *et al.* 2007) and included:

- 45 quadrats
- 24 check sites
- Aerial surveys
- Opportunistic collections
- Vegetation mapping.

The location of flora surveys across the Project is provided in Figure 2-1. A summary of survey results is provided below.

2.1.2 Results

The fine-scale vegetation mapping identified eight broad vegetation communities within the Project area. The dominant vegetation types to be impacted by the Project are:

- Mulga shrublands, which occur on alluvial fans and plains containing clayey red earths
- Triodia hummock grasslands which grow on sandy plains and undulating hills.

Vegetation is generally in good condition with little anthropologic disturbance and high species richness. In more fertile riparian areas and associated floodplains there is clear evidence of impacts associated with cattle grazing including weed invasion, reduction in ground cover species and soil erosion. In particular there is a high abundance of the invasive grass *Cenchrus ciliaris* (Buffel Grass).

The vegetation communities are detailed in Table 2-1

Table 2-1 Vegetation Communities

Veg. Code	Vegetation Type	NVIS Description (Level III Broad Floristic Formation)	Area (ha)
VT 1	Low open Eucalyptus woodland on limestone	Triodia hummock grassland	775
VT 2	Mulga shrubland on sandy red earths	Acacia shrubland	11,885
VT 3	Riparian woodland along watercourses and drainage channels	Eucalyptus open woodland	554
VT 4	Low <i>Corymbia</i> woodland on loamy alluvial plains	Tussock grassland	675
VT 5	Floodplains dominated by <i>Eucalyptus victrix</i>	Eucalyptus open woodland	609
VT 6	Triodia grassland on sandy plains	Triodia hummock grassland	8,115
VT 7	Low Acacia shrubland on rocky slopes	Triodia hummock grassland	441
VT 8	Tall Acacia shrubland on stony quartz	Acacia shrubland	223



Flora

The NT Government flora records for the study area (plus a 20 km buffer) contain 1,392 records of 494 species. These records include one threatened flora species, the Dwarf Desert Spike Rush (*Eleocharis papillosa*), listed as vulnerable under both the TPWC Act and the EPBC Act.

Database records for the locality included 1 vulnerable species, 7 near threatened species¹, 6 endemic species and 13 species recorded as being data deficient². Table 2-2 provides a list of vulnerable, threatened and data deficient species previously recorded in the locality. A total of 16 exotic species have also been recorded within the locality.

The site survey identified 238 flora species (233 native and five introduced). Habitat for the Dwarf Desert Spike Rush (*Eleocharis papillosa*) was identified but no specimens were present. The Department of Land Resource Management (DLRM) Dwarf Desert Spike-Rush fact sheet is provided in Appendix A.

No threatened flora species were recorded during the survey.

Table 2-2 Threatened Flora Species

Name		Conservation Status		Number of records within locality
Scientific	Common	TPWC	EPBC	
<i>Eleocharis papillosa</i>	Dwarf Desert Spike Rush	V	V	5
<i>Goodenia cylindrocarpa</i>	-	dd	-	3
<i>Lawrenzia viridi-grisea</i>	-	dd	-	2
<i>Brachyscome ciliaris</i>	Variable daisy	dd	-	13
<i>Ectrosia schultzei</i> var. <i>schultzei</i>	-	dd	-	3
<i>Acacia oswaldii</i>	Umbrella Wattle	dd	-	4
<i>Acacia incurvaneura</i>	-	dd		2
<i>Acacia pteraneura</i>	Mulga	dd		1
<i>Eriachne</i> sp <i>Davernport Ranges</i>		dd		3
<i>Triumfetta chaetocarpa</i>	Urchins	dd	-	2
<i>Triumfetta deserticola</i>		dd		1
<i>Ixiochlamys nana</i>		dd		2
<i>Peplidium foecundum</i>		dd		1
<i>Swainsona acuticarinata</i>		dd		1
<i>Bulbostylis pyrifolmis</i>		nt		1
<i>Ipomoea polpha</i> subsp. <i>latzii</i>	Giant Sweet Potato	nt	-	11
<i>Gymnanthera cunninghamii</i>	-	nt	-	-
<i>Osteocarpum salsuginosum</i>	-	nt	-	1
<i>Sclerolaena densiflora</i>	-	nt	-	1
<i>Spartothamnella puberula</i>		nt		2
<i>Trianthema flossostigma</i>		nt		2

Notes: V = vulnerable
dd = data deficient
nt = near threatened

¹ Under IUCN criteria this conservation category is defined as taxa that do not meet the criteria for Critically Endangered, Endangered or Vulnerable at present but is close to qualifying for or is likely to qualify for a threatened category in the near future.

² Under IUCN data deficient taxa are defined as species where there is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status.

Weeds

Weeds can be categorised according to the areas they colonise and the types of threat they pose. Several different categories of weeds (noxious weeds, environmental weeds, Weeds of National Significance (WONS), unlisted common weeds) are recognised at a national, state and local level. A summary of classified weeds (WONS and/or NT *Weed Management Act*) and environmental weeds from database records and those identified onsite are provided in Table 2-3.

Table 2-3 Summary of Weeds

Name		Classification					Presence	
Common	Scientific	WONS	Class A	Class B	Class C	Env	Bioregion ^A	Project ^B
Athel Pine	<i>Tamarix aphylla</i>			✓	✓		✓	
Bathurst Burr	<i>Xanthium spinosum</i>			✓	✓		✓	
Buffel Grass	<i>Cenchrus ciliaris</i>					✓		✓
Bitter Melon	<i>Citrullus lanatus</i>					✓		✓
Caltrop	<i>Tribulus terrestris</i>			✓	✓		✓	✓
Castor Oil Plant	<i>Ricinus communis</i>			✓	✓		✓	
Coffee Senna	<i>Senna occidentalis</i>			✓	✓		✓	
Elastic Grass	<i>Eragrostis tenuifolia</i>					✓		✓
Khaki Weed	<i>Alternanthera pungens</i>			✓	✓		✓	
Mesquite, Algaroba	<i>Prosopis pallida</i>	✓	✓		✓		✓	
Mimosa Bush	<i>Vachellia farnesiana</i>					✓		✓
Mossman River Grass	<i>Cenchrus echinatus</i>			✓	✓		✓	
Noogoora Burr	<i>Xanthium strumarium</i>			✓	✓		✓	
Parkinsonia	<i>Parkinsonia aculeata</i>	✓		✓	✓		✓	
Patterson's Curse	<i>Echium plantagineum</i>		✓		✓		✓	
Prickly Pears – Devil's Rope Pear	<i>Opuntia spp. – Opuntia imbricata</i>			✓	✓		✓	
Rubber Bush	<i>Calotropis procera</i>			✓	✓		✓	
Saffron Thistle	<i>Carthamus lanatus</i>			✓	✓		✓	
Thornapples – Native Thornapple	<i>Datura spp – Datura leichhardtii</i>			✓	✓		✓	
Total		2	2	13	15	3	15	5

Notes: ^A Sourced from Neave *et al* 2006.
^B Sourced from GHD April 2013 survey data.
WONS: Weed of National Significance

2.2 Fauna

2.2.1 Survey

An assessment of fauna was undertaken in April 2013 as part of the EIS process (GHD 2015a). The survey targeted the mine site, mine camp, 1 km corridor along the proposed alignment of the access road and Adnera Loadout Facility.

The fauna assessment utilised an initial desktop assessment of potential fauna species at the site including the Commonwealth Department of the Environment (DotE) Protected Matters Search Tool (PMST) and Department of Land Resource Management (DLRM) Fauna Atlas database.

The onsite fauna survey techniques used were consistent with the Guidelines for assessment of impacts on terrestrial biodiversity (NT EPA 2013) and Territory Parks and Wildlife Conservation Act permit issued to GHD by the NT Parks and Wildlife Commission (Permit number 40623, expiry date 30 April 2014). The survey included the following techniques:

- 50 x 50m trapping quadrant (baited Elliot-type traps, baited cage traps, pitfall buckets and funnel traps), bird surveys, bat surveys and active surveys in Mulga Woodland (x8), Rocky Shrubland (x3), Spinifex (x2), Riparian Woodland (x2) and *Corymbia* Woodland (x1).

The location of fauna surveys across the Project is provided in Figure 2-2. A summary of survey results is provided below.

2.2.2 Results

Fauna

PMST and the Fauna Atlas database identify that 280 fauna species are known to occur within the vicinity of the Project. The majority of these species are native to the Northern Territory including 40 mammals, 145 birds, 74 reptiles and nine amphibians (268 in total).

The survey identified 116 fauna species within the Project area including 24 mammals, 58 birds, 34 reptiles and no amphibians.

Eighteen species detected during the survey had not previously been recorded on databases for this area. These include 11 native species of mammal (one dunnart and 10 insectivorous bats), three native species of bird and four native species of reptile.

Threatened Species

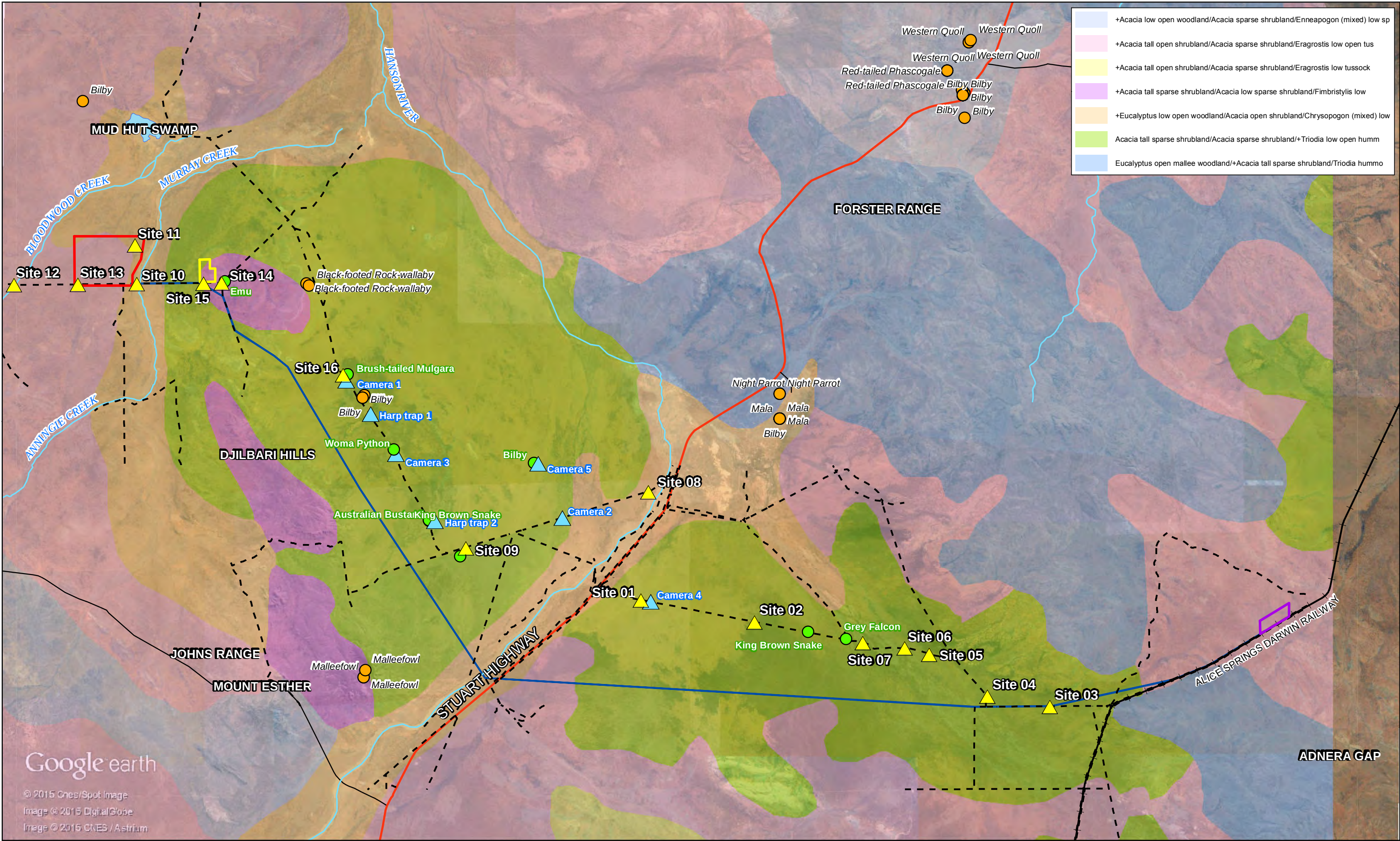
The PMST and Fauna Atlas database indicate a total of 22 threatened or near-threatened species are likely to occur in the Project area including 15 mammals, six birds and one reptile. Of the 15 mammals, 8 mammals are considered extinct, extinct in the wild or regionally extinct in the Northern Territory and have not been included within the BMP.

Three species listed as threatened under the TPWC Act or EPBC Act were observed during the baseline survey and are detailed in Table 2-4. The locations of these sightings or suspected sightings are illustrated in Figure 2-2. DLRM fact sheets for the species are provided in Appendix B.

The survey identified indicators that the Brush-tailed Mulgara (*Dasycercus blythi*) and Bilby (*Macrotis lagotis*) are likely to be present within the area but were not observed.

Table 2-4 Observations of threatened fauna

Name		Status		Evidence of Presence
Common	Scientific	EPBC	TPWC	
Mammals				
Brush-tailed mulgara	<i>Dasycercus blythi</i>	VU	VU	At least one active burrow located during baseline survey. Thus species may occur wherever suitable habitat is present in the study area.
Bilby (Greater bilby)	<i>Macrotis lagotis</i>	VU	VU	Diggings/scratchings observed in suitable habitat during fauna survey are thought to have been made by a Bilby.
Birds				
Grey falcon	<i>Falco hypoleucos</i>		VU	Observed during the baseline survey.



Near Threatened Species

Four species listed as near threatened under the TPWC Act were recorded during this baseline survey and are detailed in Table 2-5. The locations of these sightings are illustrated in Figure 2-2. DLRM fact sheets for the two bird species are provided in Appendix B.

Table 2-5 Observations of near threatened fauna

Common	Name	TPWC	Evidence of Presence
	Scientific		
Birds			
Emu	<i>Dromaius novaehollandiae</i>	NT	Observed at one location during GHD survey.
Australian bustard	<i>Ardeotis australis</i>	NT	Observed at four locations during GHD survey.
Reptiles			
Woma python	<i>Aspidites ramsayi</i>	NT	Observed at one location during GHD survey.
King brown snake	<i>Pseudechis australis</i>	NT	Observed at two locations during GHD survey.

Migratory Species

Seven bird species are predicted or known to occur within the Project area are listed as Migratory under the EPBC Act and are provided in Table 2-6. The rainbow bee-eater (*Merops ornatus*) is the only one that is known to occur historically, and this species was detected during the baseline fauna survey.

Table 2-6 EPBC Act-listed Migratory fauna species identified for the Project area (50 km buffer)

Name		Identifying Entity		
Common	Scientific	DLRM	PMST	GHD
Birds				
Fork-tailed Swift	<i>Apus pacificus</i>		✓	
Great Egret	<i>Ardea alba</i>		✓	
Cattle Egret	<i>Ardea ibis</i>		✓	
Oriental Plover	<i>Charadrius veredus</i>		✓	
Australian Painted Snipe	<i>Rostratula australis</i>		✓	
Oriental Pratincole	<i>Glareola maldivarum</i>		✓	
Rainbow Bee-eater	<i>Merops ornatus</i>	✓	✓	✓

Feral / Pests

Twelve non-native fauna species were observed at the Project including ten mammals, one bird and one reptile. A summary of non-native fauna species identified in the PMST and Fauna Atlas database and those observed onsite are provided in Table 2-7.

Table 2-7 Non-native Fauna Species

Common	Name		Identifying Entity		
	Scientific		DLRM	PMST	GHD
Mammals					
Cat	<i>Felis catus</i>		✓	✓	✓
European Rabbit	<i>Oryctolagus cuniculus</i>		✓		✓
Donkey	<i>Equus asinus</i>		✓		✓
Dog (domestic)	<i>Canis lupus familiaris</i>			✓	
House Mouse	<i>Mus musculus</i>		✓	✓	
Red Fox	<i>Vulpes vulpes</i>			✓	
Horse	<i>Equus caballus</i>		✓		
Pig	<i>Sus scrofa</i>		✓		
Cattle	<i>Bos taurus</i>		✓	✓	✓
Camel	<i>Camelus dromedarius</i>			✓	
Birds					
Rock Dove	<i>Columba livia</i>		✓	✓	
Reptiles					
Asian House Gecko	<i>Hemidactylus frenatus</i>		✓	✓	

3. Biodiversity Management

Biodiversity management refers to flora, vegetation (excluding weeds) and wildlife at the Project. Weeds will be managed through the Weed Management Plan. Previously identified species have been identified in Section 2.

Management of biodiversity is structured as follows:

- **Key Activities, Risks and Impacts:** A summary of the key activities being undertaken during the management period. The potential environmental impacts and residual risk levels are identified for each environmental aspect
- **Objective:** The guiding environmental management objective(s) and activities that apply to the element
- **Mitigation Measures:** The procedures to be employed to ensure that the relevant objectives are met
- **Responsibility:** Nominates the responsible position for implementing actions and monitoring
- **Trigger, Action, Response Plan (TARP):** The actions to be implemented in the case of non-compliance. This includes strategies of remediation and the person(s) responsible for the actions.

3.1 Key Activities, Risks and Impacts

The key activities and potential environmental impact identified for biodiversity are listed in Table 3-1. The residual risk level identified is the risk remaining once management and mitigation measures are implemented. The risk matrix is provided in Appendix E.

Table 3-1 Key Activities, Risks and Impacts

Activity	Potential Environmental Impact		Residual Risk Level		
			Consequence	Likelihood	Risk
Fauna					
Clearing of habitat	- Reduction of fauna habitat. - Adverse impact on habitat critical to the survival of a species. - A long term reduction in rare, endemic or unique fauna populations or species. - Modification, destruction, removal or isolation of habitat availability or quality such that a threatened species is likely to decline.	Black-footed Rock-wallaby	1	2	VL
		Greater Bilby, Brush-tailed Mulgara, Great Desert Skink, Southern Marsupial Mole	2	2	L
		Night Parrot, Red Goshawk, Princess Parrot, Grey Falcon	1	2	VL
		Common Brushtail Possum	1	2	VL
	Fragment or damage habitat important for the conservation of biological diversity.	1	2	VL	
Alteration to surface water flows caused by construction of roads, hard stands or embankments.	- Modify or inhibit ecological processes. - Reduce the species diversity. - Fragment or damage habitat important for the conservation of biological diversity. - Cause a long term reduction in rare, endemic or unique population or species.	Black-footed Rock-wallaby, Greater Bilby, Brush-tailed Mulgara, Great Desert Skink, Southern Marsupial Mole Night Parrot, Red Goshawk, Princess Parrot, Grey Falcon	1	2	VL
Contamination of surface water bodies Erosion and sedimentation		Common Brushtail Possum	1	2	VL
Lowering or contamination of water table	- Reduce species diversity. - Cause a reduction in a population. - Fragment or damage habitat important for the conservation of biological diversity	Black-footed Rock-wallaby	1	1	VL
		Greater Bilby, Brush-tailed Mulgara, Great Desert Skink, Southern Marsupial Mole	1	2	VL
		Night Parrot, Red Goshawk, Princess Parrot, Grey Falcon	1	1	VL
		Common Brushtail Possum	1	2	VL
Production, transport and storage of mine waste	- Injury and death of fauna as a result of increase in waste-carrying transport and resulting collisions with wildlife. - Clearing of breeding and/or foraging habitat to create space to store/pile waste products. - Dust as a result of increased traffic and specifically due to haulage of waste rock.	Black-footed Rock-wallaby	2	1	VL
		Greater Bilby, Brush-tailed Mulgara, Great Desert Skink, Southern Marsupial Mole	1	3	L
		Night Parrot, Red Goshawk, Princess Parrot, Grey Falcon	1	1	VL
		Common Brushtail Possum	2	1	VL
Production of non-mineralised waste	- Increase in vermin (rats and mice). - Increase in predators (cats, foxes and dingoes).	Black-footed Rock-wallaby and Common Brushtail Possum	2	1	VL

Activity	Potential Environmental Impact		Residual Risk Level		
			Consequence	Likelihood	Risk
	Cause a reduction in a population.	Greater Bilby, Brush-tailed Mulgara, Great Desert Skink, Southern Marsupial Mole	2	2	L
		Night Parrot, Red Goshawk, Princess Parrot, Grey Falcon	1	1	L
Noise from Project activities	- Modify or inhibit ecological processes. - Reduce the diversity or modify the composition of fauna species. - Cause a long term reduction in rare, endemic or unique fauna species.	Black-footed Rock-wallaby	1	2	VL
		Greater Bilby, Brush-tailed Mulgara, Great Desert Skink, Southern Marsupial Mole, Common Brushtail Possum	1	2	VL
		Night Parrot, Red Goshawk, Princess Parrot, Grey Falcon	1	1	VL
Dust from Project activities	- Modify or inhibit ecological processes. - Reduce the diversity or modify the composition of fauna species. - Cause a long term reduction in rare, endemic or unique fauna species.	Black-footed Rock-wallaby	1	2	VL
		Greater Bilby, Brush-tailed Mulgara, Great Desert Skink, Southern Marsupial Mole	1	2	VL
		Night Parrot, Red Goshawk, Princess Parrot, Grey Falcon	1	2	VL
		Common Brushtail Possum	1	2	VL
Light from Project activities	- Reduce the diversity or modify the composition of fauna species. - Cause a long term reduction in rare, endemic or unique fauna species.	Black-footed Rock-wallaby	1	2	VL
		Greater Bilby, Brush-tailed Mulgara, Great Desert Skink, Southern Marsupial Mole, Night Parrot, Red Goshawk, Princess Parrot, Grey Falcon	1	2	VL
		Common Brushtail Possum	1	2	VL
Unplanned Wildfire	- Long-term decrease in the size of a population. - Reduce the area of occupancy of the species. - Adversely affect habitat critical to the survival of the species. - Fragment an existing population into two or more populations. - Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline. - Interfere with recovery of the species.	Black-footed Rock-wallaby	4	2	M
		Greater Bilby, Brush-tailed Mulgara, Great Desert Skink, Southern Marsupial Mole	4	2	M
		Night Parrot, Red Goshawk, Princess Parrot, Grey Falcon	3	2	L
		Common Brushtail Possum	4	2	M
Impacts from vehicles/transport	Long-term decrease in the size of a population.	Black-footed Rock-wallaby	1	1	VL

Activity	Potential Environmental Impact		Residual Risk Level		
			Consequence	Likelihood	Risk
	- Interfere with recovery of the species. - Cause a long term reduction in rare, endemic or unique fauna species.	Greater Bilby, Brush-tailed Mulgara, Great Desert Skink, Southern Marsupial Mole	1	2	VL
		Night Parrot, Red Goshawk, Princess Parrot, Grey Falcon	2	1	VL
		Common Brushtail Possum	1	1	VL
Introduction of weed species to site and / or spread of existing weeds into new areas	- Modify or inhibit ecological processes. - Reduce the diversity or modify the composition of fauna species. - Fragment or damage habitat important for the conservation of biological diversity. - Cause a long term reduction in rare, endemic or unique fauna species. - Fragment, isolate or substantially damage habitat for rare, endemic or unique fauna species.		2	3	L
Poisoning of fauna from drinking contaminated water	- Long-term decrease in the size of a population. - Interfere with recovery of the species. - Cause a long term reduction in rare, endemic or unique fauna species.		1	1	VL
Flora and Vegetation					
Construction activities requiring the clearance of approximately 1,038 ha of native vegetation	Adverse impact on habitat critical to the survival of a species or community.		3	1	L
	- Fragment or damage habitat important for the conservation of biological diversity. - Cause a long term reduction in rare, endemic or unique plant populations or species. - Modification, destruction, removal or isolation of habitat availability or quality such that a threatened species or community is likely to decline.		4	1	M
	Increased likelihood of weed establishment in cleared areas.		3	2	M
Wind erosion mobilising dust from exposed surfaces, such as pits, waste dumps, tailings storage facility, laydown areas, stockpiles, roads and sites of vegetation clearing	- Dust deposition leading to disturbance / loss of general terrestrial flora species and vegetation communities. - Modify or inhibit ecological processes - Reduce the diversity or modify the composition of plant species.		2	2	L
Drilling, blasting, excavation and materials handling at the mine site during operations results in dispersion of particulates and dust	Cause a long term reduction in rare, endemic or unique plant populations or species.		4	1	M
Removal of individuals or habitat for the threatened flora species <i>Eleocharis papillosa</i> (Dwarf Desert Spike Rush).	Decrease in the population size of a listed threatened species.		4	1	M
Unplanned wildfire	- Modify or inhibit ecological processes. - Reduce the species diversity or modify the composition of plant communities. - Fragment or damage habitat important for the conservation of biological diversity.		2	2	L

Activity	Potential Environmental Impact	Residual Risk Level		
		Consequence	Likelihood	Risk
	• Cause a long term reduction in rare, endemic or unique plant populations or species.	4	1	M
Alteration to surface water flows caused by construction of roads, hard stands or embankments	• Modify or inhibit ecological processes. • Reduce the species diversity or modify the composition of plant communities. • Fragment or damage habitat important for the conservation of biological diversity.	2	3	M
	• Cause a long term reduction in rare, endemic or unique plant populations or species.	4	1	M
Lowering of the water table caused by groundwater extraction	• Disturbance to significant vegetation and flora within Mud Hut or Stirling Swamp. • Reduce the species diversity or modify the composition of plant communities (i.e. Riparian communities or Swamp Vegetation within Anmatyerr North SOCS).	3	1	L
	• Cause a reduction in the population of Eleocharis papillosa (Dwarf Spike Rush) at Stirling Swamp.	4	1	M
	• Fragment or damage habitat important for the conservation of biological diversity.	2	2	L
	• Impact on phreatophytic vegetation in the area of borefield groundwater drawdown	2	5	H
Contamination of surface and/or groundwater caused by erosion and sedimentation, hydrocarbon or chemical spills	• Disturbance to significant vegetation and flora within Anmatyerr North SOCS.	3	1	L
	• Disturbance of vegetation along Hanson River.	3	3	M
Failure of TSF	• Destruction of flora and vegetation.	3	1	L

3.2 Objective

Biodiversity management objectives have been established and are detailed in Table 3-2.

Table 3-2 Flora and Fauna Management Objectives

Objective	Target	Indicator
Establish and maintain awareness and importance of protecting biodiversity across the Project.	All onsite personnel (including Contractors) to undertake site induction which will include a summary of the Project biodiversity.	Percentage of personnel who completed the site induction.
Minimise the extents of vegetation clearance and undertake in accordance with the Ground Disturbance Permit system.	Zero incidents of clearing outside Project footprint and approved borrow pit locations.	Number of incidents of clearing outside of approved clearance areas.
Avoid injury or death to native fauna results from road collision or clearing.	All vehicles to adhere to establish Project speed limits. Zero incidents of native fauna injury or death from Project activities.	Number of native fauna injury or death from Project activities.
Implement system for the management of injured and dead fauna.	Zero additional incidents from roadkill. Injured fauna to be reported to the Environmental Manager to manage and/or to contact Wild Care Alice Springs.	Number of incidents occurring as a result of roadkill. Percentage of injured fauna incidents resolved and/or managed in unison with Wild Care Alice Springs.

3.3 Mitigation Measures

Mitigation measures have been developed to minimise potential impacts to flora, vegetation and fauna. The mitigation measures, timing and responsibilities are provided in Table 3-3.

Table 3-3 Mitigation Measures

ID	Mitigation Measure	Timing	Responsibility
Site Induction			
FF1	Site induction will include the following components for biodiversity management: - Summary of biodiversity at the Project including threatened flora and fauna (threatened species information cards are located in Appendix A and Appendix B) - Details of construction activities that could impact on flora and fauna - Procedure if fauna is injured or killed through Project activities including removal of roadkill at least 10 m from road - Requirement to enter and exit site through recognised vehicle access points - Speed limits across the Project - Areas to be cleared are to be flagged and approved through a Ground Disturbance Permit System (Appendix D) - All onsite personnel are to utilise existing/approved roads and tracks only.	Site Induction	All personnel
General			
FF2	Implement an Erosion and Sediment Control Plan including: - Installation of erosion and sediment control measures prior to construction - Regular inspection of erosion and sediment control measures, particularly following rainfall events, to ensure their ongoing functionality - Runoff from disturbed and rehabilitated areas diverted into sediment ponds and not discharged into the natural system - Constructing adequate bunds around potential contamination sources, to contain contaminated water in the event of heavy rainfall.	Construction	Construction Manager

ID	Mitigation Measure	Timing	Responsibility
FF3	Application of industry dust control measures including: - Road wetting, covering of exposed loads where practicable and maintaining moisture levels in bulk loose construction materials - Minimising hauling and vehicle travel in conditions when wind strength results in spatially extensive and heavy dust deposition in surrounding habitats - Reduced vehicle speeds for high-use areas/roads - Progressive reinstatements of cleared land as activities are completed.	At all times	Construction and Site Manager
FF4	The use of areas which have previously been disturbed will be used over new vegetation clearance.	At all times	Construction and Site Manager
FF5	Management of weeds in accordance with the Weed Management Plan.		
FF6	Management of hazardous substances in accordance with the Hazardous Substances Management Plan.		
FF7	Management of fire in accordance with the Fire Management Plan.		
FF8	Management of non-mineralised waste in accordance with the Non-mineralised Waste Management Plan.		
FF9	Management of groundwater drawdown in accordance with a Water Management Plan and Borefield Management Plan (to be produced).		
FF10	Concentrate loads are to be covered to prevent dust generation and product loss.	Operation	Site Manager
FF11	Develop and implement a Traffic Management Plan.	Prior to construction.	TNG Management Team
Clearing			
FF12	Prior to clearing a Ground Disturbance Permit is required to be issued by the Environmental Manager. The system is to be developed prior to the construction phase and will comply with the objective outlined in Appendix D.	At all times	Environmental Manager
FF13	Minimise ground disturbance at all location and specifically at riparian zones and within the Anmatyerr North Site of Conservation Significance (SOCS).		Construction and Site Manager
FF14	Large scale vegetation clearing or earthworks will be undertaken in the Dry Season and staged (where practical).		
FF15	Areas to be cleared will be flagged and marked sufficiently to reduce the risk of over clearing.		
FF16	Clearing of firebreak surrounding infrastructure will be undertaken in accordance with the Fire Management Plan.		
FF17	Clearing will be restricted to times when fauna are least vulnerable where possible (e.g. avoiding breeding period) where possible.		
Fauna Management			
FF18	Produce a Noise Management Plan for the operations phase to minimise and avoid (where possible) high-impact noises.	Operation	Environmental Manager
FF19	Wastes will be managed to prevent/reduce interaction with fauna. Waste management includes: - Regular burns of the landfill - Fencing installed surrounding the landfill to restrict interaction with fauna - Waste storage outside of the landfill is to be situated in bins with lids secured - Waste oils and/or hazardous substances will be kept in sealed containers and/or covered.	At all times.	Construction and Site Manager
FF20	Monitoring bores, production wells and exploration bores will be sealed / covered to prevent fauna entering.	At all times.	
FF21	Stormwater ponds have sufficient slopes to deter fauna entering ponds and will be maintained / monitored.	As constructed.	

ID	Mitigation Measure	Timing	Responsibility
FF22	Implement a light reduction during the detailed design phase including: - Limit artificial light to areas where it is essential - Turn off lights when not required - Avoid the flood of light into natural habitats and limit the escape of light into surrounding areas of fauna habitat (i.e. using shields/deflectors) - Ensure that artificial lighting is not directed upwards or laterally (i.e. should be directed towards the ground) - Use lower (i.e. closer to the ground) rather than higher lighting installations - Use lower wavelengths of light wherever possible i.e. red/yellow lights - Use light intensities that are as low as possible without reducing safety or efficiency - Avoid painting large structures bright or reflective colours and minimise use of bright or reflective construction materials and finishes for large structures.	Design Phase	TNG Management Team
FF23	If fauna is injured, assess the situation and potential requirement to euthanize and/or contact Wild Care Alice Spring for advice: - M: 0419 221 128 - E: wildcareasp@gmail.com	Construction and Operation	Construction and Site Manager
FF24	Roadkill to be removed at least 10 m into adjacent land.		All personnel
Rehabilitation			
FF25	Areas not required for ongoing operations will be progressively rehabilitated with local provenance native species.	At all times	Construction and Site Manager
FF26	Topsoil will be stripped and stockpiled in a designated area, to prevent erosion or run-off.		
FF27	Seeds collected for the rehabilitation program will be sourced locally, within a 20 km radius of the Project area, wherever possible. Should insufficient quantities of seed be available within the area, seed of local provenance will be sourced where possible.		
FF28	Management and monitoring of vegetation rehabilitation will be undertaken in accordance with the Mining Management Plan.		
Inspection and Monitoring			
FF29	Flora survey to identify presence and distribution of phreatophytic vegetation and implement Borefield management strategy (if present).	Prior to Borefield operation.	TNG Management Team
FF30	Pre-clearing fauna surveys will be undertaken by an appropriately qualified ecologist prior to clearing.	As required.	Construction and Site Manager
FF31	Daily assessment of compliance with Ground Disturbance Permits.	Daily	Environmental Manager
FF32	Fauna sighting register to be completed (Appendix C). If there is an increase in the sighting of pest / feral animals at the Project baiting and/or control measures will be established in consultation with DLRM and CLC.	As required	Environmental Manager
FF33	Annual Biodiversity Management Plan performance review including assessment of fauna sightings, incidents and ground disturbance permit approval performance.	Annual	Environmental Manager

3.4 Trigger, Action and Response Plan

The Trigger, Action and Response Plan (TARP) outlines remedial actions and responses to the situation. The TARP is provided in Table 3-4.

Table 3-4 Trigger, Action and Response Plan

Responsibility	Situation		
	Normal	Level 1	Level 2
	Site activities are being managed in accordance with mitigation measures and no incidents have occurred.	Areas of vegetation to be cleared will be outside of Project boundary / existing disturbance.	Vegetation cleared outside of approved boundary.
Site Personnel	Comply with: • Site Induction requirements. • Personnel, Vehicle and Equipment Hygiene Procedures. • Ground Disturbance Permit Procedures.		Stop work and inform the Environmental Manager of additional disturbance.
Environmental Manager	Undertake walkovers / inspection of work areas.	Assess requirement to clear outside of Project boundary Areas to be cleared outside of existing disturbance will be flagged to prevent over clearing Ensure top soil and seed bank are reserved to facilitate rehabilitating the area. Survey additional disturbance Ensure sufficient erosion and sediment control measures are used.	Provide guidance on rehabilitation of additional disturbance Survey additional disturbance Ensure sufficient erosion and sediment control measures are used Undertake investigation into disturbance and provide to Construction and/or Site Manager.
Construction and Site Manager	Ensure the Biodiversity Management Plan is being implemented by all Site Personnel.		Assess the ground disturbance incident and undertaken relevant management measures.
	Fauna observed and behaving normally.	Native fauna observed in the area of the landfill, construction and/or operational activities.	Native fauna injured or killed due to Project activities.
Contractor	Continue to operate diligently and remember the site induction flora and fauna components.	Encourage or wait for native fauna to vacate construction areas Report sighting to the Site Caretaker.	Report to Site Caretaker. If fauna is killed, remove from road at least 10 m into adjacent bush land.
Site Caretaker	-	Enter sighting in Fauna Sighting and Incident Register (Appendix C).	If fauna is injured, assess the situation and potential requirement to euthanize and/or contact Wild Care Alice Springs for advice: M: 0419 221 128 E: wildcareasp@gmail.com If fauna is killed, remove from road at least 10 m into adjacent land. Record incident in Fauna Sighting and Incident Register (Appendix C).

4. Previous Period Performance

No data from the previous period is available for review.

5. References

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Appendices

Appendix A – Threatened Flora Species

THREATENED SPECIES OF THE NORTHERN TERRITORY

DWARF DESERT SPIKE-RUSH

Eleocharis papillosa



Conservation status

Australia: Vulnerable.

Northern Territory: Vulnerable.

Conservation reserves where reported:
None.

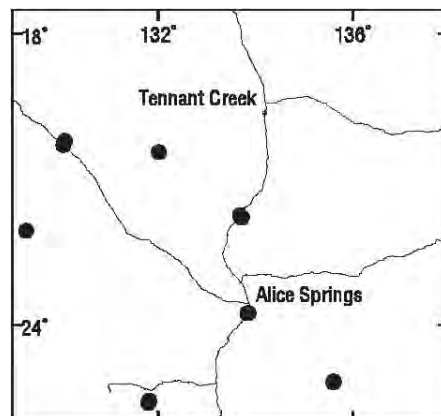
Description

The dwarf desert spike-rush is a small erect perennial sedge, typically less than 10 cm high. The above ground parts grow in response to inundation, subsequently dying back to underground parts which consist of roots, rhizomes and tuberooids. The leaf sheaths are purplish at base.

Flowering and fruiting: recorded throughout the year.



Eleocharis papillosa.



Known locations of *E. papillosa*.

Ecology

All records are from temporary wetlands; predominantly freshwater and semi-saline swamps but one record is from the edge of a temporary riverine waterhole.

Growth, seeding and germination are presumed to occur in response to temporary inundation. Seed set has not been observed at Ilparpa Swamp which is the most frequently visited location. Cultivated greenhouse plants from Ilparpa, with constant water conditions, have also 'failed' to set seed. However, some herbarium specimens from other locations do have seed, indicating that sexual reproduction may occur in some populations. The abundance of above ground shoots may vary between different inundation events. On occasions it can be difficult to determine whether a population consists of many

Distribution

The dwarf desert spike-rush is endemic to the NT. It is known from just eight locations, ranging from the northern Tanami Desert to the southern parts of the Finke bioregion and the edge of the Simpson Desert (White *et al.* 2000). Most locations are remote and repeated collections have been made at only three of them. The latitudinal range of the species is 600 km and the longitudinal range is 560 km.



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individuals or few individuals that are extensively rhizomatous. The species has been locally abundant (estimated at up to approximately 1000 plants, D.Albrecht and P.Latz *pers. obs.*) at some times at some sites. However, the actual number of genetically different individuals may be substantially fewer in some populations where asexual reproduction is significant.

During dry times, populations persist as soil-stored seed or soil-stored root tuberooids and/or rhizomes. Plants with constant water conditions (at the Alice Springs Desert Park Nursery) exhibit an annual die-off of the above ground shoots. It is not known what controls this but age, season and cold are all possible factors. These plants subsequently resprout. Informal trials indicate that resprouting can occur from the tuberooids after they have been stored in dry conditions (Tim Collins *pers. comm.*).

The dominant plants at some sites are *Eucalyptus coolabah* (Coolibah), *Halosarcia* sp. (Samphire), *Chenopodium auricomum* (Northern Bluebush) and *Eragrostis* spp. including *E. australasica* (swamp canegrass). It is recorded as growing both in the open and under shrubs, which may provide protection from trampling by stock at some sites.



A semi-saline swamp with
E. papillosa

Conservation assessment

Eleocharis papillosa appears to be genuinely rare. Due to its small size and the intermittent presence of surface shoots it is likely that it is 'under collected' and that additional populations do exist. However, an extensive survey of wetlands in 2000 and 2001, in apparently ideal conditions, only found one new population (Duguid *et al.* 2002). The population at Ilparpa Swamp and one from the Burt Plain bioregion are being encroached upon by the exotic couch grass (*Cynodon dactylon*) such that they are highly likely to be eliminated. Recent searches (in 2000, 2001, 2002, 2003 and 2004) at Ilparpa Swamp, following two particularly wet summers, failed to find the species.

It is rated as **Vulnerable** (under criteria: B2ab(iii,iv)) due to:

- the small area of occupancy (<2000 km²);
- the severely fragmented distribution;
- the small number of known locations (<10); and
- a continuing/projected decline in the area, extent and quality of habitat and number of subpopulations.

Threatening processes

Invasion by couch grass (*Cynodon dactylon*) is the main threat at two populations. Changed hydrological conditions may affect some subpopulations. Trampling by stock occurs at some sites, but any long-term effect is unquantified.

Conservation objectives and management

Known populations require monitoring as does the spread of couch grass. The feasibility of controlling couch grass in swamp environments needs to be investigated.



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Compiled by

Angus Duguid
Raelee Kerrigan
David Albrecht
[June 2006]

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Appendix B – Threatened Fauna Species Identified at Mount Peake

THREATENED SPECIES OF THE NORTHERN TERRITORY



BRUSH-TAILED MULGARA (MULGARA)

Dasycercus blythi

Conservation status

Australia: Vulnerable (as *D. cristicauda*).

Northern Territory: Vulnerable.

Description

The brush-tailed mulgara is one of the larger carnivorous marsupials with a body mass of over 100 g, head body length of 15 cm and tail length of 9 cm. The species shows sexual dimorphism in size; males are significantly larger than females (Masters *et al.* 2003). The back is sandy brown and the belly is greyish-white. The short tail is enlarged and reddish near the body, tapering quickly to a point.

There has been considerable taxonomic confusion and re-sorting of the mulgaras. For most of the last 30 years only one species, *D. cristicauda*, was recognized. More recently, based on some genetic and morphological attributes, two species were recognized, the Mulgara *D. cristicauda* and Ampurta *D. hillieri* (Adams *et al.* 2000), with both occurring in the Northern Territory. However, Woolley (2005, 2006) re-considered the complex historical treatment of *Dasycercus* and re-assigned the species to the brush-tailed mulgara *D. blythi* and crest-tailed mulgara *D. cristicauda*, both of which occur in the Northern Territory. Woolley (2005, 2006) distinguished these two species on the following characteristics: (i) appearance of black hairs on the distal half of the tail (a brush in *D. blythi* versus a dorsal crest in *D. cristicauda*), (ii) the number of upper pre-molar teeth (two in *D. blythi* versus three in *D. cristicauda*), and (iii) in females, the

number of teats (6 in *D. blythi* versus 8 in *D. cristicauda*).



brush-tailed mulgara.

Distribution

Because most previous records did not distinguish among the two species of mulgara now recognized, there is ambiguity about the distribution of both species.

The brush-tailed mulgara is known from at least the western and Simpson deserts, with confirmed records in the Northern Territory from Haast Bluff, Uluru, Papunya, Tanami Desert, Illamurta, Charlotte Waters and Crown Point (Woolley 2005, 2006).

The species was once widespread and common throughout the central deserts region of Australia. However, it began to decline in the 1930s and now has a more restricted and fragmented distribution than in the past.

Conservation reserves where reported:

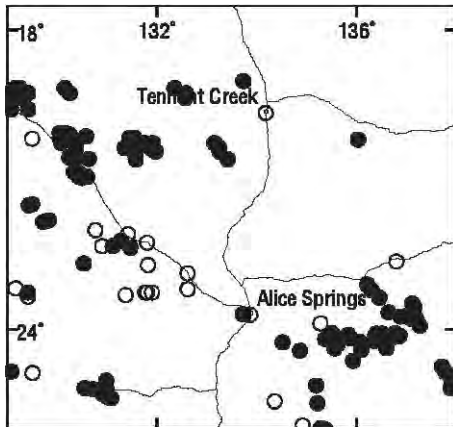
Uluru-Kata Tjuta National Park.



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Known locations of mulgara (note that this map includes records that may be either *D. blythi* or *D. cristicauda*).
o = pre 1970; • = post 1970.

Ecology

Brush-tailed mulgaras are primarily nocturnal, and shelter during the day in burrows that are about 0.5 m deep. Some animals are known to “sunbake” during the day in cold weather. The species is both insectivorous and carnivorous taking a range of insects, scorpions, centipedes, rodents, small marsupials and reptiles.

Brush-tailed mulgaras occur in a range of vegetation types; however, the principal habitat is mature hummock grasslands of spinifex, especially *Triodia basedowii* and *T. pungens* (Masters *et al.* 2003). The location of brush-tailed mulgara colonies may be influenced by the presence of better watered areas such as paleo-drainage systems or drainage lines in sandplain or sand dune habitats.

The species breeds once per year, mating in autumn or winter with litters of 3-6 young being produced between October and December. Home range size is highly variable with extremes of 1.0 to 14.4 hectares recorded (Masters 2003). Home ranges of individuals overlap extensively.

Conservation assessment

Numbers fluctuate dramatically according to climatic conditions making it difficult to estimate the size

of the population and, as a consequence, to determine population trends.

Assessment of the conservation status of this species is further complicated by the historical (and in some cases, current) ambiguity of records attributable to this species as distinct from those of *D. cristicauda*.

The decline in the range of the brush-tailed mulgara in the Northern Territory occurred earlier than relevant to IUCN criteria (i.e. <10 years or three generations). However, the species qualifies as **Vulnerable** (under criteria C2a(i)) based on:

- a population estimated to be <10,000 mature individuals;
- a continuing decline observed, projected, or inferred and
- no subpopulation estimated to contain >1000 mature individuals.

Threatening processes

The cause of decline in the brush-tailed mulgara is unknown and, therefore, it has not been possible to identify threatening processes. However, it is likely that the processes of environmental degradation and habitat homogenization that have occurred throughout arid Australia following European settlement have negatively affected the mulgara. Changes in fire regimes, grazing by introduced herbivores including cattle and rabbits, and predation by introduced predators are all likely threatening processes.

Conservation objectives and management

A national Recovery Plan for mulgaras is due for release in 2007.

Management priorities in the Northern Territory are:

- (i) to better safeguard existing populations by ensuring that large areas of mature spinifex are not subjected to extensive wildfires;



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- (ii) to continue regular monitoring of the relatively large population(s) in Uluru-Kata Tjuta NP/Yulara bore fields (currently being undertaken by Parks Australia and Voyages Hotels and Resorts, respectively);
- (iii) to better resolve the status and distribution of the two mulgara species; and
- (iii) to prevent harmful disturbances (e.g. mining operations) within lateritic areas in the north of the range.

This species is held and bred at the Alice Springs Desert Park.

Compiled by

Chris Pavey
Jeff Cole
John Woinarski
[December 2006]

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THREATENED SPECIES OF THE NORTHERN TERRITORY

GREATER BILBY BILBY

Macrotis lagotis



Conservation status

Australia: Vulnerable.

Northern Territory: Vulnerable.

Description

The greater bilby is a large bandicoot (body mass males, 800-2500 g; females, 600-1100 g) with soft silky fur. The fur is ash grey over most of the body, whereas on the belly it is pure white to cream. The basal 20 percent of the tail is the same colour as the upper-body, the central 40 percent is black and the distal 40 percent, pure white. The forelimbs are robust and equipped with three stoutly clawed toes (and two unclawed toes) giving the animal a formidable burrowing capacity. The slender hind limbs are long and resemble those of macropods. The snout is long and delicate and the ears are large and rabbit-like.



Greater bilby.

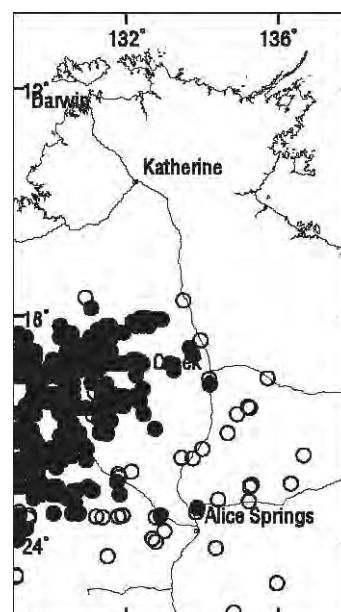
Distribution

Within the Northern Territory, it occurs in the central and western parts of the Tanami bioregion, the southern Sturt Plateau bioregion and the northern Great Sandy Desert bioregion. The distribution is highly fragmented within this area. The most southerly recent records are in the vicinity of Kintore,

the most northerly around Newcastle Waters and Wave Hill.

Historically, the greater bilby occupied a vast area of arid and semi-arid Australia.

Its distribution declined dramatically in the years following European settlement and it now occupies about 20% of its former range. The species occurs in two separate geographic areas; one extending from the western deserts region of the Northern Territory and Western Australia north to the Pilbara and Kimberley regions, the second in the Channel Country of south-west Queensland (Watts 1969; Southgate 1990a).



Known locations of the greater bilby.
o = pre 1970; • = post 1970.

Conservation reserves where reported:

None (although it formerly occurred in areas that are now included within Uluru Kata-Tjuta National Park,



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Watarrka National Park and West MacDonnell National Park).

Ecology

Habitat of the greater bilby in the Northern Territory is characterised by sandy soils dominated by hummock grasslands covered predominantly by three species of spinifex, *Triodia basedowii*, *T. pungens* and *T. schinzii*. An overstorey of low shrub cover dominated by *Acacia* and *Melaleuca* species grows over much of this country. This predominantly sandy landscape also includes rocky outcrops, laterite rises and low lying drainage systems (Southgate 1990b). Broad-scale surveys of bilbies in the Northern Territory in the 1990s indicated that laterite and drainage line land systems were occupied more frequently than sand plain and dune systems.

The greater bilby is omnivorous and major foods vary across seasons (Southgate 1990b). Important plant foods include seed from various grasses and sedges including Button Grass (*Dactyloctenium radulans*), Desert Flinders Grass (*Yakirra australiensis*) and Parakeelya (*Calandrinia* spp.) and bulbs from Bush Onion or Yalka (*Cyperus bulbosus*) and *Wurmbea deserticola*, many of which are most abundant soon after fires (Southgate and Carthew 2006). At a site in central Australia, fruiting bodies of underground fungi were the major dietary component. Major invertebrate prey includes termites, ants, beetles, insect larvae and spiders. Most of the food of the Greater Bilby is excavated from the soil and holes may attain 25 cm in depth.

Bilbies dig burrows up to two metres deep and an individual may have over a dozen regularly used burrows within its home-range. Bilbies forage at night. Movements of 5 km during one night have been recorded for male bilbies. Males, females and juveniles may

occupy overlapping home ranges. Densities of 12–16 individuals/km² are reached in optimal habitat. However; a density of 1-2/km² is more typical (Southgate 1987).

Litters, comprising one to three young, can be produced at any time of year (Southgate *et al.* 2000). Young remain in the pouch for approximately 75 days, before being cached and suckled in maternal burrows for a further two weeks prior to independence. Under ideal conditions, there is the potential to produce four litters every year. Captive animals live up to 10 years (Southgate *et al.* 2000).

Conservation assessment

No estimates are available for the size of the Northern Territory population of the greater bilby. The range of the species in the Territory is declining and contracting northwards. For example, populations located in the vicinity of Alice Springs in the late 1960s (Watts 1969) are no longer present. However, bilbies in the Northern Territory appear to be nomadic and undergo large population fluctuations in response to food availability. These characteristics result in it being difficult to accurately assess population trends for two reasons. First, no sites are known in the Territory that are considered to permanently hold colonies of bilbies. Second, depending on rainfall and food availability, very few bilby records may be reported during one time period but this can change quickly. This natural variation must be taken into account when considering the conservation status of the species.

Notwithstanding the above caveats, the greater bilby is **Vulnerable** in the Northern Territory (under criteria C2a(i)) based on:

- population size estimated to be <10,000 mature individuals;
- continuing decline in numbers of mature individuals; and



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- no subpopulation estimated to contain more than 1000 mature individuals.

Threatening processes

Predation by the introduced European fox appears to be the major threat faced by the greater bilby in the Northern Territory (Southgate 1987). Predation by other carnivores (i.e. feral cat, dingo) could also threaten bilby populations. However, there is considerable interaction between these three predators. Specifically, dingoes may protect a range of native species, including bilbies, by controlling cats and foxes either through direct predation or excluding them from carrion during droughts.

Competition with rabbits may also be an important threatening process faced by the greater bilby. However, the negative impact of rabbits has been greatly reduced following the release of rabbit calicivirus disease (RCD) in the 1990s. Grazing by cattle may be a threat on some pastoral leases. Unsuitable fire regimes may restrict breeding and impede dispersal into unoccupied areas, and reduce food options and availability (Southgate and Carthew 2006).

Conservation objectives and management

A national Recovery Plan for the greater bilby was established in 2006 (Pavey 2006).

The plan recommends the following management actions that include the Northern Territory:

- (i) reduce fox and cat numbers at key wild populations where bilbies are in decline;
- (ii) continue husbandry and coordinated management of captive populations;
- (iii) refine monitoring methodology;

- (iv) monitor trends in occurrence at wild populations; and
- (v) continue to manage the recovery process through a national recovery team.

The greater bilby is maintained in captivity at the Alice Springs Desert Park and is displayed in its nocturnal house. National Bilby Day takes place in September each year and the Desert Park is a focus for educational activities involving the species.

Compiled by

Chris Pavey
[May 2006]

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Threatened Species Information Sheet

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DEPARTMENT OF LAND RESOURCE MANAGEMENT

Threatened Species of the Northern Territory



Photo: P. McDonald

GREY FALCON

Falco hypoleucos

Conservation status

Australia: Not listed

Northern Territory: Vulnerable

Description

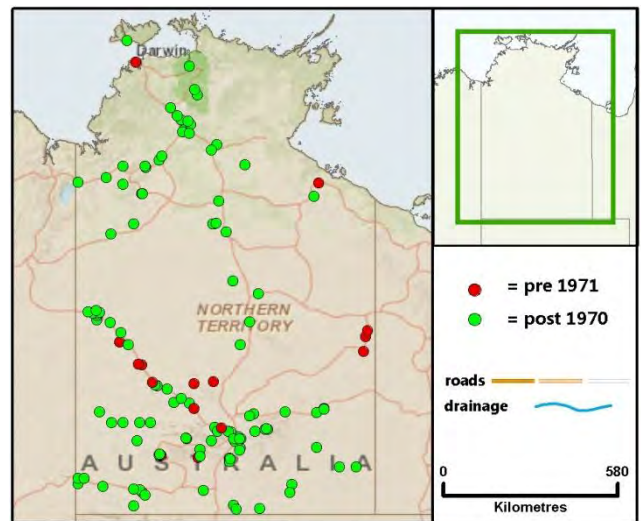
The Grey Falcon is a medium-sized compact pale falcon. The head and upperparts are a light blue-grey, with darker grey flecking on the wings and barring on the tail. The wing-tips are black. The cheeks and chin are white, except for the faint grey tear under each eye, and the underparts are white with fine dark streaks. The bill is grey with a dark tip. The cere, eye-ring and legs are bright yellow.

Distribution

The Grey Falcon is found in low densities through much of the arid and semi-arid areas of Australia and has been recorded in all Australian mainland states and territories. The majority of records from the Northern Territory (NT) are from the southern half, but there are records all the way up to Darwin and also a record from Groote Eylandt.

Conservation reserves where reported:

Finke National Park, Kakadu National Park, Nitmiluk National Park, Uluru National Park, Watarrka National Park and West MacDonnell Ranges National Park.



Known locations of the Grey Falcon

Ecology

Grey Falcons live in areas of lightly-timbered lowland plains, typically on inland drainage systems, where the average annual rainfall is less than 500 mm. Where they occur they are always at low densities and are mostly seen as singles or pairs. They use nests built by other species and prefer nests in the tallest trees along watercourses. Clutches are of one to four eggs. Nesting has been recorded from June to

November, but in any one area may occur only in above-average rainfall years.

Grey Falcons hunt birds, often parrots and pigeons, typically from the air with a distinctive fast, level and low-to-the-ground hunting flight. They will also take insects on the wing. They many also pounce on mammals, reptiles and birds from a high perch.

Conservation assessment

The status of Grey Falcons in Australia was assessed in 2010 by Garnett et al. (2011). They considered the Australia-wide population to be in the order of 500 pairs and they considered the species to be Vulnerable.

The population of breeding birds in the NT must be fewer than the Australia-wide population, so the species qualifies as **Vulnerable** in the NT (under criterion D1), based on:

- A very small total population size (<1 000).

Threatening processes

Threats to the Grey Falcon are not clearly defined. Habitat alteration and destruction through clearing for grazing and agriculture probably lead to declines in the species' southern and eastern ranges early last century, and confined them more to the arid parts of its range (Garnett et al. 2011). In the NT, such factors have probably been less influential. Here landscape-scale changes in fire-regimes or grazing by feral or domestic herbivores may, in the long-term, reduce the availability of nesting trees and appropriate prey species.

Conservation objectives and management

Conservation objectives are to maintain stable populations of Grey Falcons across their range in the NT and to maintain successful breeding. The management required includes developing methods of assessing population trends and implementing long-term monitoring of populations.

Compiled by

Simon Ward

[updated December 2012]

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THREATENED SPECIES OF THE NORTHERN TERRITORY

EMU

Dromaius novaehollandiae



Conservation status

Australia: Not listed.

Northern Territory: Vulnerable.

Description

The emu is a very large flightless bird (height 1.0-1.9 m) with long legs and neck. The plumage is shaggy, grey-brown, paler towards the base of the feathers. The skin of the face, throat and upper neck is almost bare and conspicuously bluish. The wings are rudimentary, and hang limply. The young are striped with dark brown/black-brown over a buff down.



Emu (Photo: M Armstrong)

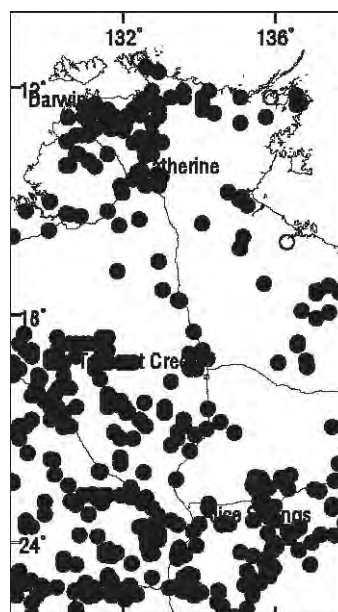
Distribution

The emu is extremely widespread across continental Australia. It occurs across most of the Northern Territory but is scarce in the driest desert regions and densities are low in most of the Top End woodlands (Marchant and Higgins 1990). It is absent from all NT islands.

Conservation reserves where reported:

Alice Springs Desert Park, Chamber's Pillar Historical Reserve, Connells Lagoon Conservation Reserve, Dulcie Ranges National Park, Garig Gunak Barlu National Park, Gregory National Park, Illamurta Springs Conservation Reserve, Kakadu National Park, Litchfield National Park, Longreach

Waterhole Protected Area, Mary River National Park, Nitmiluk National Park, Uluru-Kata Tjuta National Park, Watarrka National Park, West MacDonnell National Park.



Known locations of the Emu
o = pre 1970; • = post 1970.

Ecology

Emus can move large distances in response to a decline in food or water resources. They are probably more sedentary in the north than the south of the Territory. Emus are omnivorous, taking seeds, fruits, insects and the growing tips of plants. They often occur in loose groups. The male incubates the eggs and broods the chicks.

Conservation assessment

Barrett *et al.* (2002, 2003) reported a significant national decline in the reporting rate for the emu between the first (1997-81) and second (1998-2001) Australian bird atlases. The Northern Territory showed an 80% decrease (the largest of all states/territories). However, it is difficult to compare the



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results of the two surveys as different methods were used and the second atlas covered a period with a substantially different climate to that of the first atlas. However, there is other evidence from northern Australia of a substantial decline. There are consistent anecdotal reports of broad-scale decline of emus in the Kimberley and across the Top End (Yibarbuk and Cooke 2001; Wiynjorrotj *et al.* 2005).

We have taken a precautionary approach and listed the species as **Vulnerable** (under criteria A2b) due to an inferred reduction in population size of >30% over the last 10 years or three generations

Threatening processes

In the Top End, declining numbers may be associated with the occurrence of too frequent extensive fires. Such fires lead to a reduction in food supplies, particularly in the size and abundance of plants that produce fleshy fruit, and in the crop of fruit produced (Woinarski *et al.* 2004). Fires at the wrong time of year can also lead to destruction of eggs, over the long incubation period (50-60 days: Marchant and Higgins 1990). In Central Australia, declines may also be related to altered fire regimes or to vegetation change associated with pastoralism.

It has been suggested that the emu's decline in the Kimberley coincided with the heavy use of 1080 dingo poison in the pastoral industry (I. Morris *pers. comm.*). However this would not explain a decline in Arnhem Land where 1080 is not used.

Conservation objectives and management

The main research priorities are to assess the extent and causes of decline, and to monitor populations.

Management priorities cannot be determined until factors threatening the species are more definitely determined. However, a reduction in the extent and

frequency of fires is likely to benefit the species.

Compiled by

Rob Taylor
John Woinarski
[April 2006]

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THREATENED SPECIES OF THE NORTHERN TERRITORY

AUSTRALIAN BUSTARD

Ardeotis australis



Conservation status

Australia: Not listed.

Northern Territory: Vulnerable.

Description

Australia's heaviest flying bird, the Australian bustard is a large, stately bird that exhibits significant sexual size dimorphism between males and females, with males (5-10 kg) up to three times heavier than females (2-3 kg). The crown is brown-black, neck and breast grey-white with a distinct black breast band. The bend of wing is patterned black and white. The back, wings and tail are brown with fine buff markings. Females have a narrower brown crown, less distinct or absent breast band and greyer neck and breast.



Male Australian Bustard (Photo: M. Ziembicki)

Distribution

The Australian bustard is widespread though generally scarce in the Northern Territory. It is more common in the north, and tends to occur in loose aggregations, particularly during the breeding season. Its strongholds in the Northern Territory include the Barkly Tableland, Daly River region, the Victoria River District and the Tanami Desert.

Conservation reserves where reported:

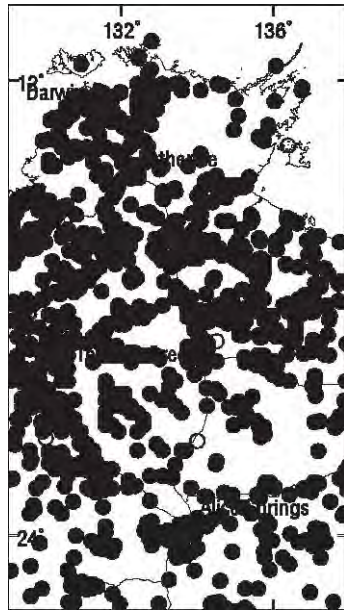
Alice Springs Telegraph Station Historical Reserve, Black Jungle / Lambells Lagoon Conservation Reserve, Bullwaddy Conservation Reserve, Caranbirini Conservation Reserve, Connells Lagoon Conservation Reserve, Cutta Cutta Caves Nature Park, Davenport Range National Park, Douglas River / Daly River Esplanade Conservation Area, Eley National Park, Flora River Nature Park, Gregory National Park, Ilparpa Swamp Wildlife Protected Area, Junction Reserve, Kakadu National Park, Keep River National Park, Kuyunba Conservation Reserve, Litchfield National Park, Longreach Waterhole Protected Area, Mary River National Park, Nitmiluk National Park, Rainbow Valley Conservation Reserve, Uluru-Kata Tjuta National Park, Watarrka National Park, West MacDonnell National Park.

Although the species has been recorded from a range of reserves, in the south of its range it is highly mobile meaning that few reserves host permanent, let alone viable, populations of bustards year-round and many records are of single individuals. They have most commonly been recorded from Uluru-Kata Tjuta National Park, Watarrka National Park, Kakadu National Park and Gregory National Park.



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Known locations of the Australian Bustard
○ = pre 1970; ● = post 1970.

Ecology

The Australian bustard typically occurs in open country preferring grasslands, low shrublands, grassy woodlands and other structurally similar but artificial habitats such as croplands and airfields (Downes and Speedie 1982). However, they respond readily to fire and are often found on recently burnt country, even in more wooded areas.

Bustards have a broad, omnivorous diet largely comprising seeds, fruit, vegetation, invertebrates and small vertebrates. They apparently move readily, tracking rainfall, fires and food resources (e.g. grasshopper outbreaks) across the landscape opportunistically. Their movements are not well defined. However, they are believed to be nomadic or irruptive in the arid and semi-arid regions and migratory with more regular north-south movements in relation to wet/dry seasons in the north. Some populations in the Top End may also be sedentary (Ziembicki and Woinarski in press).

The species' reproductive biology is unique in that it exhibits an "exploded" lek mating system. In lek systems males aggregate in display arenas that are visited by females for the purpose of

mating. The lek system of the bustard is referred to as "exploded" as the display arenas of the males are well spaced apart and aggregation may not be detectable until they are mapped over a larger area. Following mating, males play no further role in the breeding process and females care for young until independence.

Conservation assessment

Although still widespread in the Northern Territory, the species is relatively scarce. Localised fluctuations in numbers occur in relation to rainfall and fire events and they are locally common and possibly sedentary in several horticultural regions (e.g. Douglas-Daly Rivers region). Populations in the north are generally more robust than those in the south.

Outside the Northern Territory, the species' overall population size is still substantial. However, there has been a very large historical decline in abundance in southern Australia and parts of the north such that Garnett and Crowley (2000) categorised the Australian Bustard as Near Threatened in the *Action Plan for Australian Birds 2000*.

The widespread declines in the Northern Territory are evident from Bird Atlas reporting rates for bustards: these dropped by 70% between the first (1977-81) and second (1998-2001) atlases (the highest for any state/territory). These declines were largest in the southern regions (Barrett *et al.* 2002, 2003). These trends are consistent with anecdotal evidence from mail surveys of pastoral properties and private submissions that suggest that bustards are now absent from areas they were commonly recorded from before. Although populations in the north are more robust, similar declining trends are evident with consistent reports of lower overall numbers (e.g. flocks of 50+ in the past to present flocks of <20 at a time).



Threatened Species Information Sheet

Assessing numbers of highly mobile birds such as bustards is inherently difficult because of their readiness to move across the landscape in response to variable climatic conditions and patchily distributed resources and naturally large population fluctuations. However, given the evidence consistently suggests an overall decline, a precautionary approach has been adopted. The species qualifies as **Vulnerable** (under criterion A2b) based on an estimated population reduction of >30% over the last 10 years or three generations.

Threatening processes

The widespread decline in bustard numbers has been variously attributed to a combination of factors including predation, altered fire regimes, hunting, disturbance, habitat alteration (e.g. woody weed infestation), pesticides and grazing (Marchant and Higgins 1993; Garnett and Crowley 2000), yet there exists little information regarding the relative effects of these threats.

Another potential threatening process is hunting. Breakdown of controls on traditional hunting, compounded by access to modern weapons and vehicles, and a low reproductive rate (usually one young per year) increase the pressure on bustard populations in the N.T. The conspicuousness and size of males during the breeding period may make them particularly susceptible to hunting resulting in significant male-biased harvesting rates. Such a bias may have serious implications for the specialized lek mating system of the species.

Conservation objectives and management

Research priorities are to:

- (i) determine population size, distribution and habitat relationships (especially in relation to fire, land use and grazing);
- (ii) assess patterns of movements;
- (iii) establish an effective monitoring program and model numbers in

relation to landscape factors including rainfall and fire;

- (iv) identify key areas used for breeding and refuge sites in times of drought;
- (v) assess factors affecting breeding success;
- (vi) quantify the relative impact of hunting of the species, including assessment of the implications of significant male-biased harvesting.

Management priorities are to:

- (i) develop fire management programs, with the collaboration of Aboriginal land owners, that are not detrimental to this species. Particular emphasis should be placed on avoiding late dry season fires which coincide with the breeding season;
- (ii) develop harvesting protocols to minimize impacts;
- (iii) control feral predators in key breeding habitats.

Compiled by

Mark Ziembicki
[April 2006]

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Northern Territory Government

Department of Natural Resources, Environment and the Arts

Threatened Species Information Sheet

Ziembicki, M., and Woinarski, J. (in press).
Monitoring continental movement
patterns of the Australian Bustard
through community-based surveys and
remote sensing. *Pacific Conservation
Biology*



Appendix C – Fauna Sighting and Incident Register

Fauna Sighting and Incident Register

Table 1 Fauna Sighting and Incident Register

[illegible]

[illegible]

Appendix D – Ground Disturbance Permit System

All ground disturbance will be undertaken through a permitting system with sign-off required prior to ground disturbance occurring. If the area contains weeds they will be removed prior to vegetation clearance so that vegetative material would be clean and able to be mulched and reused directly on site.

The Ground Disturbance Permit (GDP) will have photo graphic evidence of before and after impacts. The area of disturbance will be kept to a minimum and no protected areas or buffer zones will be disturbed. The GDP will include:

- Disturbance Requirements (contractor, dates, works and dimensions)
- Area Assessment (restricted work areas, EIS approved area, within lease boundary, services, weeds controlled)
- Clearing Details (surveyed and demarked by flagging, supervisor of clearing, post clearing survey data).

The GDP will be issued by the Environmental Manger.

Appendix E – Risk Matrix

An environmental risk assessment was undertaken for the Project during the EIS phase. The risk assessment identified the risk source (hazard and event), receptors and potential impact. The consequence and likelihood were determined using the descriptions identified in Table E1 and Table E2 respectively. The risk matrix is provided in Table E3.

Table E1 Consequence Description

Consequence	Insignificant	Minor environmental impact. Impacts are contained on-site and short term in nature. No detrimental effect on the environment.
	1	Minor repairable damage to common historic structures or sites. No disturbance of cultural heritage sites.
	Minor	Minor local habitat modification and / or lifecycle disruption for a listed species. No loss of individuals of listed species.
		Negligible soil impact. Chemical concentrations are above background but below EILs.
	2	No detectable change to background water quality. No exceedance of background and applicable Water Quality guidelines.
	Moderate	Moderate, unplanned localised environmental impact (may be of a temporary nature) or discharge contained on-site or with negligible off-site impact.
		Moderate but repairable damage to important historic structures or sites of cultural importance.
	3	Moderate local habitat modification and / or lifecycle disruption for a listed species. Minor local decrease in size of population(s) of listed species.
	Major	Localised soil impact. Low level <2 times exceedance of EILs.
		Local short-term minor exceedance of background and applicable Water Quality guidelines.
	Critical	Significant, unplanned environmental impact contained on-site or minor impact that is off-site.
		Considerable damage or infringement to sensitive historic structures or sites of cultural significance.
	4	Substantial local habitat modification and / or lifecycle disruption for a listed species. Moderate local decrease in size of population(s) of listed species.
		Localised long term or widespread short term soil impact. Chemical concentrations 2-5 times EILs.
	5	Local long-term or widespread short-term exceedance of background and applicable Water Quality guidelines.
		Major or widespread, unplanned environmental impact on or off-site. Could include substantial pollutant discharges. Significant resources required to respond and rehabilitate.
	5	Major damage or infringement to sensitive historic structures or sites of cultural significance.
		Moderate regional habitat modification and / or lifecycle disruption for a listed species. Substantial local decrease in size of population(s) of listed species.
	5	Widespread and / or long term impact to soils. Chemical concentrations 5-10 times EILs.
		Local, permanent or widespread, long-term exceedance of background and applicable Water Quality guidelines.

Table E2 Likelihood Description

Likelihood	Rare	Unlikely	Possible	Likely	Almost Certain
	1	2	3	4	5
Description	The event may occur only in exceptional circumstances.	The event could occur at some time.	The event might occur at some time.	The event will probably occur in most circumstances.	The event is expected to occur in most circumstances.
Occurrence Intervals	>10 years	5 – 10 years	2 – 5 years	1 – 2 years	1 year

Table E3 Risk Matrix

			Severity of Consequence				
			Critical	Major	Significant	Moderate	Minor)
			5	4	3	2	1
Likelihood of Consequence	Almost Certain	5	Extreme	Extreme	High	High	Medium
	Likely	4	Extreme	High	High	Medium	Medium
	Possible	3	Extreme	High	Medium	Medium	Low
	Unlikely	2	High	Medium	Medium	Low	Very Low
	Rare	1	Medium	Medium	Low	Low	Very Low

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Appendix D – Cultural Heritage Management Plan



TNG Limited

Mount Peake

Cultural Heritage Management Plan

December 2015

Document Status

Version	Author	Reviewer	Approved by	Date	Status
Rev. 0	A. Koscielski	I. McCardle	I. McCardle		

Amendments

Section	Details
n/a	

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Appendices

Appendix A – Central Land Council Certificates

Appendix B – Risk Matrix

1. Introduction

1.1 Purpose

The Mount Peake Project involves several key activities during construction and operations which have the potential to impact upon cultural heritage. Surveys undertaken by Australian Museum Consulting and the Central Land Council have identified places of significance which require protection from activities including:

- Land clearing
- Pit expansion and potential instability
- Creek crossing construction
- General activities undertaken across the Project.

1.2 Objective

The objective of this management plan is to:

- Provide guideline for the management of aboriginal cultural heritage
- Protect and preserve Central Land Council identified Sacred Sites and RWAs
- Avoid disturbance , where possible, to aboriginal archaeological sites
- Establish and maintain personnel and contractor awareness of the importance of cultural heritage
- Protect previously unidentified cultural heritage finds.

1.3 Legislation

The conservation and management of heritage items, places, and archaeological sites takes place within the framework of relevant Commonwealth and Northern Territory legislation. A summary of the legislation and relevance to the Project is provided in Table 1-1.

Table 1-1 Summary of Cultural Heritage Legislation

Legislation	Summary	Relevance
Environment Protection and Biodiversity Conservation Act	The Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) provides a legal framework for the protection and management of places of national environmental significance. Several heritage lists are addressed by the EPBC Act, including the National Heritage List (protects places that have outstanding value to the nation) and the Commonwealth Heritage List (protects items and places owned or managed by Commonwealth agencies).	There are no Aboriginal or historic heritage items, places or archaeological sites listed on the National or Commonwealth Heritage Lists within the Project area or in its vicinity.
Aboriginal and Torres Strait Islander Heritage Protection Act	The purpose of the Aboriginal and Torres Strait Islander Heritage Protection Act 1984 (ATSIHP Act) is to preserve and protect areas and objects in Australia and in Australian waters, that are of particular significance to Indigenous people in accordance with their traditions. The ATSIHP Act allows the Minister for the Environment to make a declaration protecting significant Indigenous areas or objects, including human remains, from 'threat of injury or desecration'. The ATSIHP does not protect all forms of Indigenous heritage; for example, it	There are no areas or objects within the vicinity of the Project area that are the subject of a declaration under the ATSIHP Act.

Legislation	Summary	Relevance
	does not cover areas and objects whose heritage significance is due to their archaeological, scientific or historical interest.	
Native Title Act	This Act recognises native title in lands over which Native Title is not extinguished and where persons able to establish Native Title are able to prove continuous use, occupation or other classes of behaviour and actions consistent with a traditional cultural possession of those lands. The objectives of the Act are to: • Provide for the recognition and protection of native title • Establish ways in which future dealings affecting native title may proceed and to set standards for those dealings • Establish a mechanism for determining claims to native title • Provide for, or permit, the validation of past acts, and intermediate period acts, invalidated because of the existence of native title.	Mount Peake tenements are covered by a Native Title application. Registration of Native Title Determination Application – DC11/12 Stirling and Neutral Junction NTD17/2011 was registered with the National Native Title Tribunal on 17 August 2011 under Section 190A of the <i>Native Title Act</i>. The application was accepted for registration and entered onto the Register of Native Title Claims on 19 August 2011.
Aboriginal Land Rights (Northern Territory) Act	This Act provides for the granting of freehold title to traditional Aboriginal owners of land in the Northern Territory, the establishment of Land Councils, and the establishment and management of Land Trusts to hold the Aboriginal land for the benefit of traditional owners of the land. The Act also regulates exploration and mining on Aboriginal land and sets out the processes to be followed when negotiating with Traditional Owners for access to, and leases over, Aboriginal land. An exploration licence cannot be granted in relation to Aboriginal land without the consent of the relevant Land Council (for the traditional owners) and the Minister. A mineral lease cannot be granted unless an agreement has been entered into under the Act.	Exploration has been undertaken in consultation with the Central Land Council. TNG submitted an application to the Central Land Council for a Sacred Site Clearance Certificate for the Project. A certificate was issued by the Central Land Council on 30 June 2015. TNG will comply with the conditions set in the approval (SSCC2015-034).
Northern Territory Heritage Act	The Act provides for the protection of archaeological places and objects. If any archaeological places or objects are to be disturbed by the Project or operations, permission must be sought from the Minister for Department of Lands, Planning and the Environment to remove, disturb and/or destroy the objects or sites.	There are no nominated or declared heritage places in the Mount Peake Project Area. An archaeological survey of the Project area has been undertaken and recommendations are made in relation to protection of sites.
Northern Territory Aboriginal Sacred Sites Act	The Aboriginal Sacred Sites Act provides protection for Aboriginal sacred sites throughout the NT. Sacred sites are defined as sites that are 'sacred to Aboriginals, or otherwise of significance to Aboriginals according to Aboriginal tradition'. Aboriginal sacred sites are declared by the Aboriginal Areas Protection Authority (AAPA). It is an offence for a person to enter or remain on, carry out work on or use, or desecrate a Sacred Site without the prior issue of an Authority Certificate, issued by the AAPA. The Authority Certificates set out the conditions on which work may be carried out or the land used, according to Aboriginal custodians' wishes.	The Central Land Council has undertaken assessments of the Project area and provided a Sacred Site Clearance Certificate (No. 2015-034). The certificate is provided in Appendix A.

2. Cultural Heritage Conditions

2.1 Archaeological Survey

An Archaeological Survey was undertaken in June 2015 by Australian Museum Consulting for the Draft Environmental Impact Statement (DEIS).

The survey identified 16 aboriginal heritage sites across the Project area. The majority of these were stone tool artefact scatters or isolated stone artefacts found within 200 m of watercourses:

- Eight sites were identified on the lower slopes and banks of the Hanson River including:
 - MP1-MP5 adjacent to the Borefield
 - MP7-MP9 adjacent to the access road crossing of the Hanson River.
- One isolated artefact was found on the bank of Murray Creek (MP16) adjacent to the mine site
- Five sites were recorded on the banks of ephemeral watercourses at the foot of Djilbari Hills and Central Mount Stuart including MP6, MP10, MP13-MP15 adjacent to the access road
- Two isolated artefact sites were recorded on open, flat plains more than 200m from the nearest watercourse (MP11-MP12).

The predominant raw material of the aboriginal heritage sites was quartzite, quartz, and mudstone, with less frequent use of silcrete, chert and chalcedony. Flakes and scrapers made up a large portion of the assemblages identified, though cores as well as backed blades, retouched flakes and choppers/axes were observed.

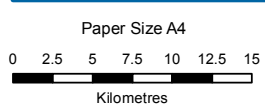
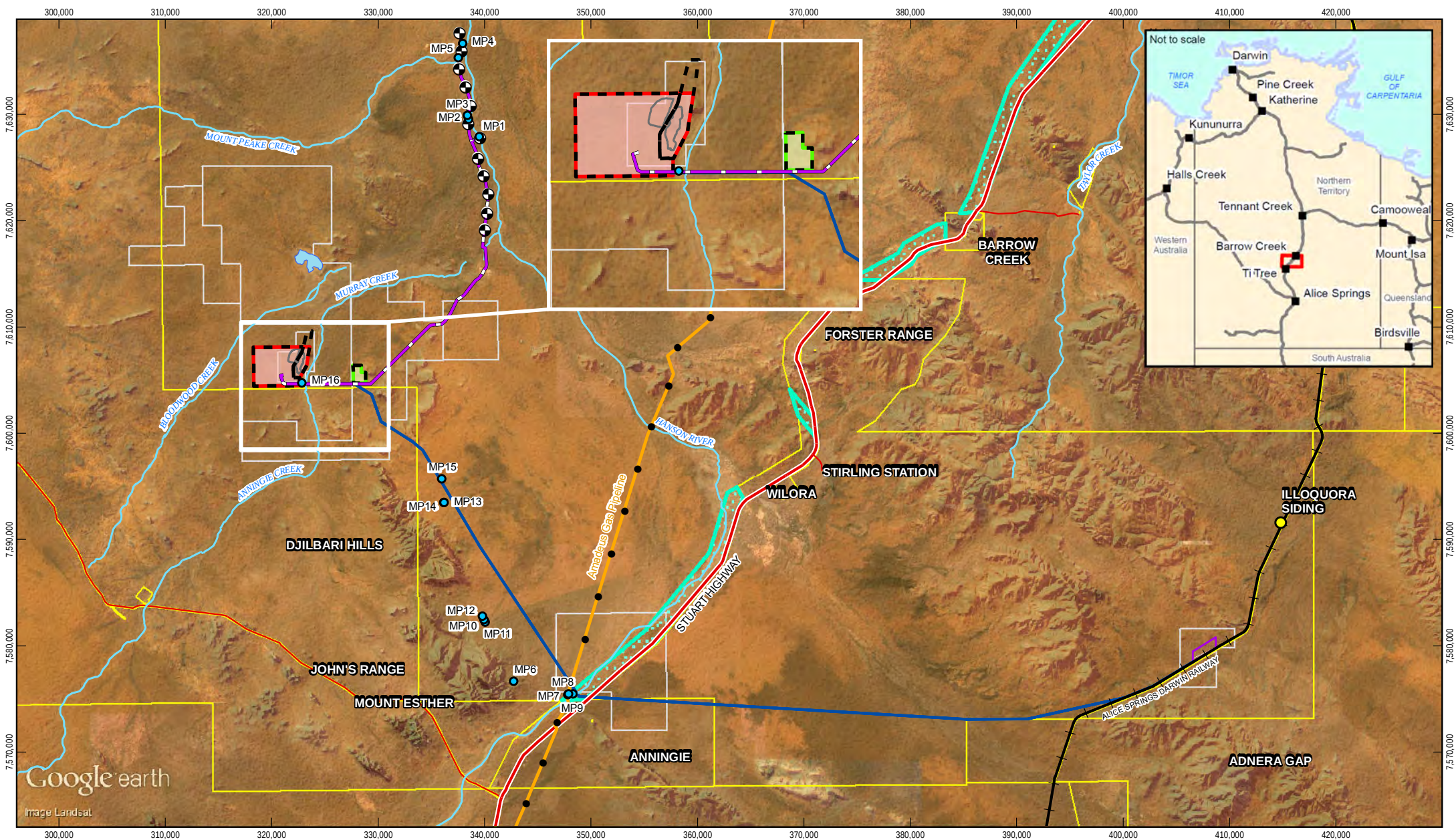
A summary of the survey results are provided in Table 2-1 and mapped on Figure 2-1.

No historic heritage structures, places or archaeological sites of known or potential significance were identified within the pipeline and access road corridors nor the mine site and associated infrastructure, or their immediate vicinity, during the field survey.

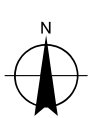
Table 2-1 Identified Cultural Heritage Sites – June 2015 (Source: Australian Museum Consulting 2015)

Site ID	Coordinates		Landform	Site Size (m ²)	Exposure	Site Description
	Easting	Northing				
Borefield						
MP1	339591	7627823	Flat/ River Bank	160	Sparsely vegetated, deflated flat on western bank of Hanson River	The scatter comprises a total of 18 stone artefacts, visible on the eroding creek bank and on the flat above. Artefacts observed comprised quartzite and quartz materials, including a symmetrical leaf-shaped retouched crystal quartz flake.
MP2	338594	7629462	Flat/ River Bank	25	Flat, deflated clearing on the western bank of Hanson River	The site comprises two stone artefacts on the open flat area, as well as three additional stone artefacts deposited in a disturbed context in the bed of the river. Artefacts were manufactured of quartzite and quartz.
MP3	338498	7629811	Flat/ River Bank	80	Flat, deflated open clearing on the western bank of Hanson River	The site comprises a total of twelve quartzite and quartz artefacts, including a quartzite bladelet and a quartz thumbnail scraper.
MP4	338031	7636588	Flat/ River Bank	20	Flat, partially deflated open clearing on the western bank of Hanson River	Two broken quartzite flakes were identified.
MP5	337647	7635247	Flat/ River Bank	44	Eroding, deflated banks of an ephemeral creek; a tributary of Hanson River	A unidirectional silcrete core with approximately 25% cortex and a mudstone thumbnail scraper was found at this site.
Haul Road (and adjacent land)						
MP6	342838	7576572	Flat/Creek bank	n/a	Open, deflated flat sparsely vegetated with low spinifex grass	An isolated silcrete flake with a crushed platform and less than 25% cortex was found at this site.
MP7	347906	7575295	Flat/ River Bank	311	Flat, open and well deflated bank of Hanson River	A total of 32 stone artefacts were recovered from the site, and were predominantly manufactured of quartz, quartzite and silcrete. While two silcrete and quartzite cores were found, the majority of artefacts were flakes.
MP8	348415	7575377	Upper Slope/Crest	373	Sparsely vegetated, partially deflated open upper slope and crest of Hanson River	The site comprises a total of 13 stone artefacts, comprised of quartz and quartzite flakes and scrapers, as well as a sandstone hammer stone with visible pitting.
MP9	347988	7575373	Flat/ River Bank	200	Flat open sandplain devoid of ground cover	A total of 18 mudstone, quartzite, quartz and silcrete artefacts were identified. The majority of the artefacts observed were flakes and scrapers, which included two mudstone thumbnail scrapers.

Site ID	Coordinates		Landform	Site Size (m ²)	Exposure	Site Description
	Easting	Northing				
MP10	340146	7582138	Lower Slope/Creek Bank	43	Open, sparsely vegetated lower slope of southern bank of an unnamed creek	A total of 25 stone artefacts were observed on the lower slope of the creek bank. The majority of artefacts were manufactured from mudstone, quartzite, silcrete and chert; one small quartz flake was recovered. This site contains two large silcrete and chert choppers, a blade, backed blade and bladelet.
MP11	340060	7582359	Flat	n/a	Open flat sparsely vegetated with low spinifex grass	Three stone artefacts were recovered from the site, which included a quartzite scraper with unifacial retouch, a quartz thumbnail scraper and a chalcedony core.
MP12	339892	7582673	Flat	n/a	Open flat sparsely vegetated with low spinifex grass	The site comprises one isolated mudstone artefact. The artefact is a flake/core with less than 25% cortex, negative flake scars and bifacial retouch along its distal end.
MP13	336250	7593385	Lower Slope/Creek Bank	805	Open, sparsely vegetated and well deflated lower slope of bank of an unnamed creek	A total of 9 stone artefacts were found comprised both flakes and cores and were manufactured of quartzite, chert, chalcedony and quartz.
MP14	336302	7593373	Lower Slope/Creek Bank	272	Open, sparsely vegetated and well deflated lower slope of bank of an unnamed creek	The site comprises a total of 10 stone artefacts. This included three chalcedony scrapers and a chalcedony flake, three quartzite flakes, a quartz scraper and flake and a mudstone flake.
MP15	336067	7595622	Flat/Creek Bank	n/a	Flat, relatively open clearing on bank of an unnamed creek	One isolated quartz stone artefact was identified.
Mine Site						
MP16	322940	7604635	Lower Slope/ River Bank	n/a	Small exposure on the lower slopes of the western bank of Murray Creek	The site comprises of one quartzite scraper.



Horizontal Datum: GDA 1994
Grid: GCS GDA 1994



LEGEND

Illoquora Siding	Major Watercourses	Rail Siding Loading Facility	Cadastral Boundaries
Potential Borefield	Railway	Mount Peake Mining Area	Access Road
Borefield Delivery Pipeline	Amadeus Gas Pipeline	Crown Land	Camp Facilities
Principal Road	Mine Site Facilities	Mount Peake Granted Tenements	Archaeological Site
Minor Road	Mud Hut Swamp	Mount Peake Mineral Leases	



TNG Ltd
Mount Peake EIS

Job Number 61-29057
Revision A
Date 22 Feb 2016

Cultural Heritage Locations

Figure 2-1

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239 Adelaide Terrace Perth WA 6004 Australia T 61 8 6222 8222 F 61 8 6222 8555 E permail@ghd.com.au W www.ghd.com.au

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Data source: TNG - Gas / Slurry Pipeline Study Corridor, Camp Facilities, Borefield Infrastructure, Transport Study Corridor, Mount Peake Mining Area, Mount Peake Granted Tenements (2015), Geoscience Australia - Waterways, mainland, placename, road (2008), Google Earth Pro - Imagery (Date extracted: 13/02/2014); AMC: Archaeological Sites - 20151203. Created by: RB

2.2 Central Land Council Clearance Certificate

The Mount Peake Exploration Leases (EL23074, EL23271, EL27070, EL27069, EL27706 and EL27787) have been surveyed by the Central Land Council (CLC) and Aboriginal Owners and custodians consulted. The CLC has produced a Clearance Certificate (2015-034) for all works associated with the construction and operation of a mine and associated infrastructure on these exploration leases.

A copy of the certificate is provided in Appendix A.

Certificate Conditions

The Clearance Certificate identifies 19 sites including 16 sacred sites where entry is prohibited and three RWA where activities and access is restricted. A summary of conditions pertaining to the certificate are summarised in Table 2-2.

Table 2-2 Mount Peake CLR Certificate Conditions

No.	Details
1	The information contained in this certificate is confidential and must not be disclosed to any person other than for the purpose of the proposed works.
2	This certificate is issued for the sole purpose of the proposed works and does not offer protection of the Applicant in relation to any work that is not in accordance with the proposed works.
3	The protection provided by this certificate extends to a person who enters the subject land on behalf of the Applicant to carry out the proposed works provided that person is aware of, and complies with, these conditions.
4	The Applicant must ensure that any person who enters the subject land on behalf of the Applicant to carry out the proposed works is aware of, and complies with, the conditions of this certificate.
5	Entry into exclusion zone identified on the map in Annexure A is prohibited.
6	Entry into restricted work areas identified on the map in Annexure A is subject to the special conditions below.
7	Aboriginal artefacts, stone arrangements, rock engravings or paintings, or human remains must not be removed or disturbed. If any of these items are found, then the Applicant must report the finding to the CLC together with sufficient information, including GPS coordinates, to enable the CLC to locate and identify the item.
8	Soakages, rock-holes, clay-plans, caves and mature trees that are not otherwise protected by the special conditions should be available if possible.
9	This certificate is valid for a period of 24 months after the date of issue (30/06/15).
-	Murray Creek and Hanson River RWA Construction of river crossing allowed for the Haul Road on the condition the road goes no deeper than existing levels and works are supervised by traditional Aboriginal owners.
-	Mud Hut Swamp RWA Transit only permitted along existing tracks within the RWA.

3. Cultural Heritage Management

Cultural heritage management refers to cultural heritage previously identified by the CLC, including sacred sites and RWAs, and those identified through DEIS baseline surveys. In addition, previously unidentified heritage will be managed in accordance with this management plan. The management of cultural heritage is structure below as follows:

- **Key Activities, Risks and Impacts:** A summary of the key activities being undertaken during the management period. The potential environmental impacts and residual risk levels are identified for each environmental aspect
- **Objective:** The guiding environmental management objective(s) and activities that apply to the element
- **Mitigation Measures:** The procedures to be employed to ensure that the relevant objectives are met
- **Responsibility:** Nominates the responsible position for implementing actions and monitoring
- **Trigger, Action, Response Plan (TARP):** The actions to be implemented in the case of non-compliance. This includes strategies of remediation and the person(s) responsible for the actions.

3.1 Key Activities, Risks and Impacts

The key activities and potential environmental impact have been identified for cultural heritage and are listed in Table 3-1. The risk matrix is provided in Appendix B.

Table 3-1 Key Activities, Risks and Impacts

Activity	Potential Environmental Impact	Residual Risk Level		
		Consequence	Likelihood	Risk
Ground disturbance and land clearing	Aboriginal archaeological sites adversely impacted.	3	3	M
	Historic cultural material adversely impacted.	2	1	L
	Sacred sites are adversely impacted by mine site construction and / or operations.	4	1	M
Major open pit slope failure	Major damage to any adjacent sacred or archaeological site.	4	1	M

The risk matrix is presented in Appendix B.

3.2 Objective

Cultural heritage management objectives have been established and are detailed in Table 3-2.

Table 3-2 Cultural Heritage Objectives

Objective	Target	Indicator
Protection and preservation of identified Sacred Sites and RWAs.	No occurrence of unapproved activities within Sacred Sites or RWAs.	Number of unapproved activities within Sacred Sites or RWAs.
Establish and maintain personnel and contractor awareness of the importance of cultural heritage.	All onsite personnel and contractors to complete site induction including the location of RWAs and cultural heritage sites.	Number onsite personnel versus the number of completed site inductions.
Protection of previously unidentified cultural heritage finds.	No removal or subsequent disturbance of unidentified cultural heritage finds.	Extent of subsequent disturbance of unidentified cultural heritage finds.

3.3 Mitigation Measures

Mitigation measures have been developed to minimise potential impacts associated to cultural heritage. The mitigation measures, timing and responsibilities are provided in Table 3-3.

Table 3-3 Mitigation Measures

ID	Mitigation Measure	Timing	Responsibility
Site Induction			
CH1	Site induction will include the following components for cultural heritage management: • Location of sacred sites and RWAs across the Project including a map • Summary RWA access requirements • Description of sacred site and RWA and associated consequences for entering and/or interfering • Example of installed fencing and signage at sacred sites and RWAs which are accessible / adjacent to Project infrastructure • Areas to be cleared are to be flagged and approved through a Ground Disturbance Permit System • Procedures if unidentified heritage is exposed / identified.	Site Induction	All personnel
General			
CH2	Lodge an 'Application to Carry Out Work on Heritage Place or Objective' to for the recording and relocation of stone artefacts within the access road footprint.	Prior to clearing	TNG Management Team
CH3	Notify the CLC of stone artefact recording and relocation activities.	At all times	TNG Management Team
CH4	No site works will be undertaken within CLC identified sacred site areas.	At all times	Construction and Site Manager
CH5	Site works at the RWA will be undertaken in accordance with the CLC Clearance Certificate conditions including: • Murray Creek and Hanson River RWA Construction of river crossing allowed for the Haul Road on the condition the road goes no deeper than existing levels and works are supervised by traditional Aboriginal owners. • Mud Hut Swamp RWA Transit only permitted along existing tracks within the RWA.	At all times	Construction and Site Manager
CH6	Installation of signage and fencing (where appropriate) at sacred sites adjacent to infrastructure including site identified A, B, C, D, E, F, L and Q.	Prior to construction	TNG Management Team
CH7	Installation of signage at RWAs summarising access requirements.	Prior to construction	TNG Management Team

ID	Mitigation Measure	Timing	Responsibility
CH8	If unidentified cultural heritage is exposed / identified the following procedures will be undertaken: - Cease works in/adjacent to the area - Install barrier/flagging to identify the area - Inform the Construction and/or Site Manager and provide the location of works (coordinates), nature and purpose and identified cultural heritage - Construction and/or Site Manager to contact the Department of Lands, Planning and the Environment Heritage Branch (08 8999 5039) and the Central Land Council (08 8951 6388) for details on how to proceed - Undertake Heritage Branch and Central Land Council requirements and complete/postpone works.	At all times.	Construction and Site Manager
CH9	Flagging to be installed at all clearing activities and a spotter is required where works are within 25 m proximity to sacred sites, RWAs or cultural heritage.	At all times	Construction and Site Manager
CH10	Maintain and develop relationships with the CLC, Aboriginal Owners and custodians through facilitating land access and organising annual site visits.	Operations	Site Manager
Monitoring and Inspections			
CH11	Prior to clearing the extents shall be inspected to confirm the works do not disturb identified sacred site, RWAs or cultural heritage in accordance with the Ground Disturbance Permit procedure.	Prior to clearing activities.	Environmental Manager
CH12	The flagging shall be inspected to ensure integrity.	Weekly	Environmental Manager
CH13	Sacred site and RWA signage and fencing (where installed) will be inspected to ensure they remain insitu and to establish if there is evidence of disturbance.	Quarterly	Environmental Manager
CH14	Establish a geotechnical stability monitoring program for sacred site A (situated near the north eastern edge of the pit).	Prior to pit expansion	TNG Management Team
CH15	Undertake additional monitoring and/or investigation if an issue is identified or complaint occurs.	At all times.	Environmental Manager
CH16	Annual Cultural Heritage Management Plan performance review (Section 4).	Annual	RBIOP Management Team

3.4 Trigger, Action and Response Plan

The Trigger, Action and Response Plan (TARP) outlines remedial actions and responses to the situation. The TARP is outlined in Table 3-4 for the following situations:

- Standard – all mitigation measures are installed and no disturbance/interference with cultural heritage is apparent
- Level 1 – potential for disturbance/interference with cultural heritage has been identified but has not occurred
- Level 2 – disturbance/interference of cultural heritage has occurred.

Table 3-4 Trigger, Action and Response Plan

Responsibility	Situation Standard	Level 1	Level 2
	Activities are contained within approved disturbances, outside of sacred site or RWA areas and flagging installed.	Trigger: Site inspection identifies activities have potential to disturb areas outside of approved disturbances, installed flagging or within sacred sites or RWAs.	Trigger: Activities are impacting areas outside of approved disturbances, installed flagging or within sacred sites or RWAs.
Site Personnel	Comply with: - Site Induction requirements - Ground Disturbance Permit Procedures.		Implement the Emergency Response Plan. Raise Alarm on UHF Channel 12 stating: - Your name - Location of the incident - Description of the incident scene - Extents of impact - Best route to be used to approach the incident location.
Environmental Manager	Weekly inspection of flagging installed and replacement where necessary. Monitor activities to ensure no disturbance or interference with cultural heritage occurs. Quarterly inspection of sacred site and RWA signage to ensure they remain insitu and to establish if there is evidence of disturbance.	Instruct personnel to cease works in/adjacent to the area. Re-evaluate potential disturbance / interference issues. Install additional barrier / flagging to eliminate risk to RWAs or cease works completely. Inform Site Manager with the location of works (coordinates), nature and purpose and potential impacts.	Attend incident location to undertake initial assessment of the incident. Establish if any short term remediation measures could be implemented.
Emergency Operations Officer	-	-	Implement the Emergency Response Plan. Attend incident location to undertake initial assessment of the incident. Establish if any short term remediation measures could be implemented. Summarise incident details and provide the Construction and Site Manager with: - Location of sacred site / RWA (grid reference) - CLC certificate pertaining to the site - Summary of damage; - Type and method of interferences (exposed and/or damaged) - Photograph of damage.

Responsibility	Situation Standard	Level 1	Level 2
Construction and Site Manager	Ensure the Cultural Heritage Management Plan is being implemented by all Site Personnel.	Toolbox talk with Contractor and/or personnel working in close proximity of RWAs.	Immediately notify the Central Land Council and Aboriginal Areas Protection Authority (CLC and AAPA) and provide the following details: • Name and organisation • Location of sacred site / RWA (grid reference) • CLC certificate pertaining to the site • Summary of damage • Type and method of interferences (exposed and/or damaged) • Photograph of damage.
	Activities are contained within approved disturbances, outside of RWA areas and flagging installed.	Trigger: Unidentified cultural heritage is exposed / identified.	-
Site Personnel	Comply with: • Site Induction requirements • Ground Disturbance Permit Procedures.	Cease works immediately and contact the Environmental Manager.	
Environmental Manager	Weekly inspection of flagging installed and replacement where necessary. Monitor activities to ensure no disturbance or interference with cultural heritage occurs. Quarterly inspection of sacred site and RWA signage to ensure they remain insitu and to establish if there is evidence of disturbance.	The following procedures will be undertaken: • Install barrier / flagging to identify the area • Inform Site Manager and provide the location of works (coordinates), nature and purpose and identified cultural heritage.	-
Construction and Site Manager	Ensure the Cultural Heritage Management Plan is being implemented by all Site Personnel.	Contact the Department of Lands, Planning and the Environment Heritage Branch (08 8999 5039) and the Central Land Council (08 8951 6388) for details on how to proceed. Undertake Heritage Branch and Central Land Council requirements and complete/postpone works.	

4. Previous Period Performance

No data from the previous period is available for review.

Appendices

Appendix A – Central Land Council Certificates

Confidential appendices to be provided to statutory bodies as requested – not for public consultation at the request of the Central Land Council.

Appendix B – Risk Matrix

An environmental risk assessment was undertaken for the Project during the EIS phase. The risk assessment identified the risk source (hazard and event), receptors and potential impact. The consequence and likelihood were determined using the descriptions identified in Table B1 and Table B2 respectively. The risk matrix is provided in Table B3.

Table B1 Consequence Description

Consequence	Insignificant	Minor environmental impact. Impacts are contained on-site and short term in nature. No detrimental effect on the environment.
	1	Minor repairable damage to common historic structures or sites. No disturbance of cultural heritage sites.
	Minor	Minor local habitat modification and / or lifecycle disruption for a listed species. No loss of individuals of listed species.
		Negligible soil impact. Chemical concentrations are above background but below EILs.
	2	No detectable change to background water quality. No exceedance of background and applicable Water Quality guidelines.
	Moderate	Moderate, unplanned localised environmental impact (may be of a temporary nature) or discharge contained on-site or with negligible off-site impact.
		Moderate but repairable damage to important historic structures or sites of cultural importance.
	3	Moderate local habitat modification and / or lifecycle disruption for a listed species. Minor local decrease in size of population(s) of listed species.
	Major	Localised soil impact. Low level <2 times exceedance of EILs.
		Local short-term minor exceedance of background and applicable Water Quality guidelines.
	Critical	Significant, unplanned environmental impact contained on-site or minor impact that is off-site.
		Considerable damage or infringement to sensitive historic structures or sites of cultural significance.
	4	Substantial local habitat modification and / or lifecycle disruption for a listed species. Moderate local decrease in size of population(s) of listed species.
		Localised long term or widespread short term soil impact. Chemical concentrations 2-5 times EILs.
	5	Local long-term or widespread short-term exceedance of background and applicable Water Quality guidelines.
		Major or widespread, unplanned environmental impact on or off-site. Could include substantial pollutant discharges. Significant resources required to respond and rehabilitate.
	Critical	Major damage or infringement to sensitive historic structures or sites of cultural significance.
		Moderate regional habitat modification and / or lifecycle disruption for a listed species. Substantial local decrease in size of population(s) of listed species.
	5	Widespread and / or long term impact to soils. Chemical concentrations 5-10 times EILs.
		Local, permanent or widespread, long-term exceedance of background and applicable Water Quality guidelines.
	Critical	Extensive long term environmental harm or harm that is very widespread. Could include extensive pollutant discharges. Impacts permanent or unlikely to be reversible within 10 years.
		Unsalvageable and permanent damage to sensitive historic structures or sites of cultural significance.
	5	Substantial regional habitat modification and / or lifecycle disruption for a listed species. Moderate or substantial regional decrease in size of population(s) of listed species.
		Irreversible and / or extensive impact to soils. Chemical concentrations >10 times the ecological investigation levels (EILs).
	5	Widespread, permanent exceedance of background and applicable Water Quality guidelines.
	5	
	5	

Table B2 Likelihood Description

Likelihood	Rare	Unlikely	Possible	Likely	Almost Certain
	1	2	3	4	5
Description	The event may occur only in exceptional circumstances.	The event could occur at some time.	The event might occur at some time.	The event will probably occur in most circumstances.	The event is expected to occur in most circumstances.
Occurrence Intervals	>10 years	5 – 10 years	2 – 5 years	1 – 2 years	1 year

Table B3 Risk Matrix

			Severity of Consequence				
			Critical	Major	Significant	Moderate	Minor)
			5	4	3	2	1
Likelihood of Consequence	Almost Certain	5	Extreme	Extreme	High	High	Medium
	Likely	4	Extreme	High	High	Medium	Medium
	Possible	3	Extreme	High	Medium	Medium	Low
	Unlikely	2	High	Medium	Medium	Low	Very Low
	Rare	1	Medium	Medium	Low	Low	Very Low

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Appendix E – Fire Management Plan



TNG Limited

Mount Peake Fire Management Plan

December 2015

Document Status

Version	Author	Reviewer	Approved by	Date	Status
Rev. 0	A. Koscielski	I. McCardle	I. McCardle		

Amendments

Section	Details
n/a	

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Appendices

Appendix A – Fire Register

Appendix B – Risk Matrix

1. Introduction

Frequent fires, particularly extensive fires late in the Dry season, pose a threat to environmental values across the Project area and in adjacent land. The threat of a fire can be categorised into three types of fires, which are bushfires, building fires and machinery / plant fire.

Large, intense fires can cause major threats to environmental values and potentially site personnel. Fire management is carried out across the Mount Peake Project to:

- Protection cultural heritage sites;
- Maintain staff safety;
- Protect infrastructure; and
- Protect biodiversity.

1.1 Legislation and Guidelines

The Bushfires Act establishes the legal framework and responsibilities for bushfire management in the Northern Territory. The fundamental principle established by the Act is that the responsibility for bushfire management rests with the landholder. A key consideration when clearing native vegetation is that there are minimum standards for firebreaks on boundary and internal fence lines.

The key legislation applicable to fire management at the Project includes:

- *Bushfire Act 2009*
- *Bushfire Regulation 2005*
- *Fire and Emergency Act 1996*
- *Fire and Emergency Regulations 2011.*

1.2 Definitions

1.2.1 Firebreak

Firebreaks are cleared trails around the perimeter of a property that enable vehicle access to fight fires. A firebreak can stop a fire itself in mild conditions, and they are essential as control lines from which to back burn to stop bushfires in extreme conditions. They can also provide a life-saving escape route if things go wrong.

1.2.2 Prescribed Burning

Prescribed burning to reduce fuel loads is a major component of the bushfire mitigation program across the Territory. Fuel reduction burning has proven highly effective in establishing areas of low or no fuel that contain the spread of bushfires and protect lives, property and the environment.

1.2.3 Ground Burning

Ground control burning is also carried out throughout the Northern Territory every year to reduce fuel loads and create strategic barriers against the spread of bushfires.

2. Fire Protocols

2.1 Fire Tracking

Several internet based systems provide details on the fire forecast, watch and act notices, official emergencies and tracking maps. The websites will be reviewed and information assessed to determine threat to site personnel. A summary of the fire tracking details are provided in Table 2-1

Table 2-1 Fire Tracking and Alert Systems

System	Website	Information
Bureau of Meteorology – Fire Forecast Simpson West	http://www.bom.gov.au/nt/forecasts/fire-forecast-summary.shtml	Fire forecast for the region on a daily basis.
Bushfires NT – Watch and Act Central Australia	http://www.lrm.nt.gov.au/bushfires/media	Department of Land Resource Management summary of fire locations and issues 'Watch and Act' procedures.
ABC Website – Summary of Alerts and Warnings	http://www.abc.net.au/news/emergency/state/nt/	Official warnings will be issued through the ABC as and when released.
North Australia Fire Information – Bushfire Map	http://www.firenorth.org.au/nafi3/	Mapping of hotspots and fire scars in the area.
Secure NT – Bushfire Map:	http://www.securent.nt.gov.au/	Bushfire tracking map.

2.2 Fire Danger Ratings

Fire danger ratings are a standardised scale used by the Bureau of Meteorology to indicate the danger of a fire should it occur or the difficult in putting out any fires. The level is based on wind, temperature, humidity and rainfall. A summary of the fire danger ratings are provided Table 2-2.

Table 2-2 Fire Danger Ratings

Key	Fire Rating	Fire Behaviour and Risks	BOM Recommendations
	Catastrophic	Fire will threaten without warning. It will be very hard to see, hear and breathe. Fire may be uncontrollable and fast moving. Embers will start spot fires, often kilometres ahead of the main fire. Strongly likely that unprepared people will suffer serious or life-threatening injury. Property in the fire's path is likely to be destroyed (even well-prepared homes). Wide-scale power, telephone and water supply failure likely. Do not expect a fire truck or firefighters to attend.	Leave your property early in the day. It is not safe to stay and defend even the best-prepared property in catastrophic conditions. Listen to a battery-powered radio tuned to ABC local radio to keep updated with the situation throughout the day.

Key	Fire Rating	Fire Behaviour and Risks	BOM Recommendations
	Extreme	Fire will threaten suddenly and it will be hot, windy and difficult to see, hear and breathe. Fires will be fast moving and very difficult to control. Burning embers will start spot fires. There is potential for property in the fire's path or homes under ember attack to be lost. People may suffer serious or life-threatening injury. Only very well-prepared homes that are solidly constructed will be likely to offer any safety. Expect power, telephone and water supply failure. Do not expect a fire truck or firefighters to attend.	If you are leaving your property, do so early in the day. If your bushfire survival plan permits the decision to stay and defend your home, only do so if it is prepared to the highest level and constructed to withstand bushfire, and you are physically able to do so. Listen to a battery-powered radio tuned to ABC local radio to keep updated with the situation throughout the day.
	Severe	Fires will burn unpredictably and may be difficult to control. Embers will be blown around. It will be dangerous and uncomfortable to be outside. There is potential for property in the fire's path or homes under ember attack to be lost. People may suffer serious or life-threatening injury. Only very well-prepared homes that are solidly constructed will be likely to offer any safety. Expect localised power, telephone and water supply failure. Do not expect a fire truck or firefighters to attend.	If you are leaving your property, do so early in the day. If your bushfire survival plan permits the decision to stay and defend your home, only do so if it is prepared to the highest level and constructed to withstand bushfire, and you are physically able to do so. Listen to a battery-powered radio tuned to ABC local radio to keep updated with the situation throughout the day.
	Very High	Fires can be difficult to control. Embers may be blown around. Loss of property and injury is less likely, but significant damage could occur. Well-prepared homes and substantial buildings can offer safe shelter. Some local infrastructure may be temporarily unavailable.	If you are leaving your property, do so early in the day. If your bushfire survival plan permits the decision to stay and defend your home, only do so if it is prepared to the highest level and constructed to withstand bushfire, and you are physically able to do so. Listen to ABC local radio to keep updated throughout the day.
	High	Fire can be controlled. Loss of property is unlikely but damage may occur. Well-prepared homes and substantial buildings can offer safe shelter.	Listen to ABC local radio to keep updated throughout the day. Know how and where to get further information if required.
	Very High	Fire can be easily controlled. Little risk to life and property.	Listen to ABC local radio to keep updated throughout the day. Know how and where to get further information if required.

2.3 Climate

The Bureau of Meteorology (BOM) Territory Grape Farm Station is situated approximately 80 km south of the Mine Site (BOM Site No. 015643).

The Station has collect temperature and rainfall from 1987 to 2015. The data indicates the climate of the region is arid to semi-arid with a mean annual rainfall of approximately 310 mm. Rainfall generally falls over 30 days across the year predominately between October and March. However, rainfall in the region is highly variable.

The average annual mean minimum and maximum temperature range from 21.1 to 36.3°C respectively. The higher temperatures are generally experienced from October to March (corresponding with rainfall in the region).

The winds at the Project are predominant south easterly wind direction throughout the year. The average wind speeds range from 2.50 to 3.17 m/s with an annual average of 2.86 m/s. Therefore, the threat to the Project area will be predominately from the southeast with the prevailing wind.

A summary of the climate data is provided in Table 2-3 and wind rose are provided in Figure 2-1.

Table 2-3 Mount Peak Climate Summary from 1987 to 2015 (Source: BOM, Territory Grape Farm Station No. 015643)

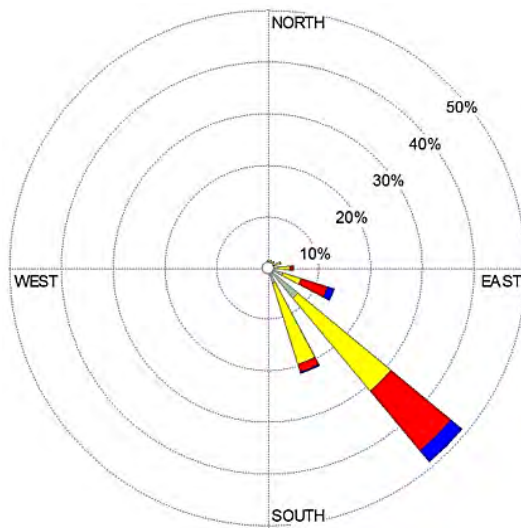
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
Temperature													
Mean Max (°C)	37.3	36.2	34.3	30.4	25.5	22.2	22.5	25.3	30.4	33.3	35.6	36.3	30.8
Mean Min (°C)	21.9	21.7	19.5	14.5	9.5	6.2	5.1	7.0	11.9	15.6	18.8	21.1	14.4
Rainfall													
Mean (mm)	62.4	65.8	21.0	18.0	22.5	8.6	4.7	4.6	10.0	14.7	30.9	50.5	312
Decile 5 (median) (mm)	44.2	33.8	10.2	3.0	1.0	1.6	0.0	0.0	1.6	7.1	19.1	40.7	298
Mean No. Days (≥1 mm)	4.3	4.7	2.1	1.5	2.2	1.2	0.7	0.8	1.0	2.7	3.9	4.9	30

2.4 Fire Equipment

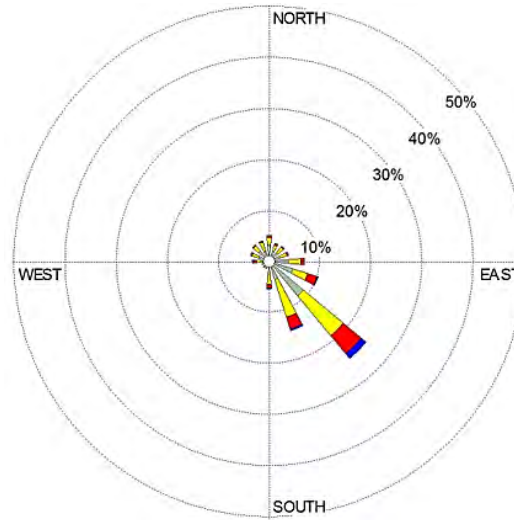
A summary of firefighting equipment at the Project is provided in Table 2-4.

Table 2-4 Summary of Firefighting Equipment

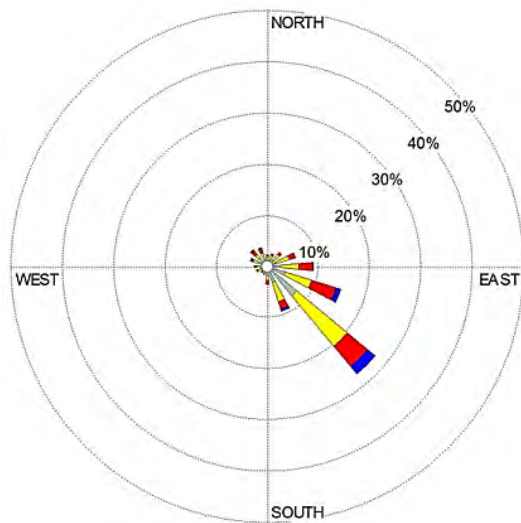
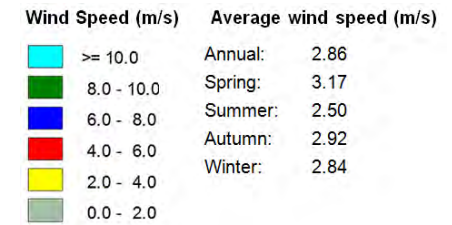
Item	Location	Capacity
Equipment to be detailed and updated prior to the commencement of construction activities.		



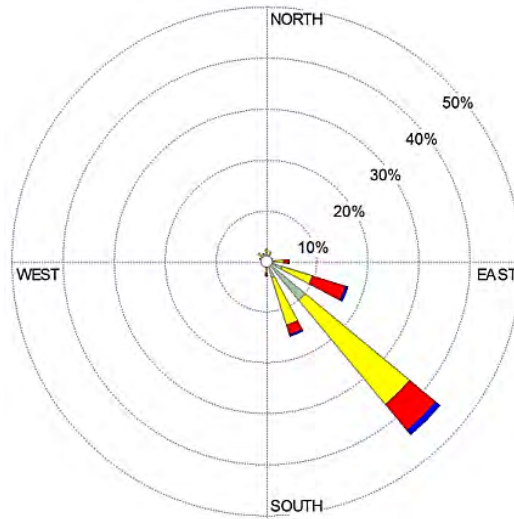
Spring (September – November)



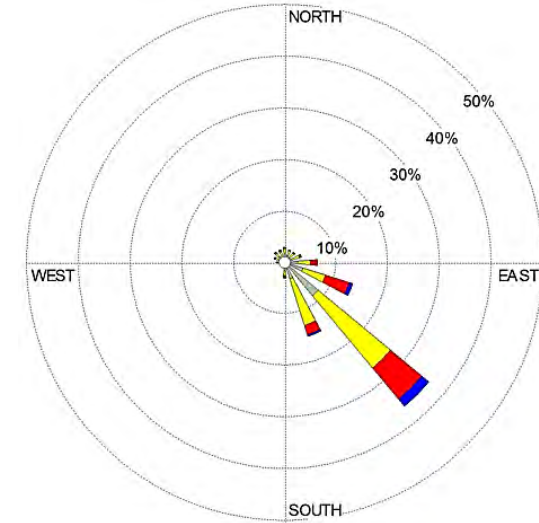
Summer (December – February)



Autumn (March – May)



Winter (June – August)



Annual

Figure 2-1 Annual and Seasonal Wind Roses (Source: BOM, Territory Grape Farm Station No. 015643)

3. Fire Management

Fire management refers to bushfires, building fires and machinery / plant fire at the Project. Management of fire is structured below as follows:

- **Key Activities, Risks and Impacts:** A summary of the key activities being undertaken during the management period. The potential environmental impacts and residual risk levels are identified for each environmental aspect
- **Objective:** The guiding environmental management objective(s) and activities that apply to the element
- **Mitigation Measures:** The procedures to be employed to ensure that the relevant objectives are met
- **Responsibility:** Nominates the responsible position for implementing actions and monitoring
- **Trigger, Action, Response Plan (TARP):** The actions to be implemented in the case of non-compliance. This includes strategies of remediation and the person(s) responsible for the actions.

3.1 Key Activities, Risks and Impacts

The key activities and potential environmental impact have been identified for fire and are listed in Table 3-1. The risk matrix is provided in Appendix B.

Table 3-1 Key Activities, Risks and Impacts

Activity	Potential Environmental Impact	Residual Risk Level		
		Consequence	Likelihood	Risk
Construction or operational activities such as hot works (welding or grinding) leading to uncontrolled fire.	Modify or inhibit ecological processes.	2	2	L
	Reduce the species diversity or modify the composition of plant communities.	2	2	L
	Fragment or damage habitat important for the conservation of biological diversity.	2	2	L
Uncontrolled events such as lightning strikes or arson leading to uncontrolled fire. Change in conditions leading to a controlled burn becoming out of control. Traditional Owner controlled burns / accidental community activities.	Cause a long term reduction in rare, endemic or unique plant populations or species.	4	1	M
Controlled burn of landfill waste.	Loss of control leading to bushfire and subsequent loss of flora and fauna.	2	2	L

3.2 Objective

The fire management objectives have been established and are detailed in Table 3-2.

Table 3-2 Fire Management Objectives

Objective	Target	Indicator
Reduction of bushfire risk prior to bushfire season.	Maintain clear, continuous firebreaks around infrastructure prior to the commencement of the Dry Season.	Percentage of firebreaks cleared of vegetation regrowth.
Effectively manage potential risks from offsite bushfires or incidental onsite fires.	Zero incidents of uncontrolled incidental fires or impacts to infrastructure or personnel.	Number of fires which impact Project infrastructure or onsite personnel.
Minimise fuel loads adjacent to Project infrastructure.	Undertake controlled burns when required. Ensure compliance with NT Bushfires permitting requirements and appropriate notification and liaison with relevant parties, including the landholder.	Number of controlled burns and uncontrolled / uncontrollable burns across the Project.

3.3 Mitigation Measures

Mitigation measures have been developed to minimise potential impacts associated with fire management. The mitigation measures, timing and responsibilities are provided in Table 3-3.

Table 3-3 Mitigation Measures

ID	Mitigation Measure	Timing	Responsibility
Site Induction			
F1	Site induction includes the following components for fire management: - Awareness of potential bushfire risks across the Project - Requirements for reporting bushfires or incidental fires in close proximity to the Mine Site - Hot works permitting system - Management procedures/stop work requirements.	Site Induction	All personnel
General Management			
F2	Permanent site personnel to undertake fire control training, including the correct use of extinguishers.	At all times	All personnel
F3	All vehicles to carry fire extinguishers and UHF radios.	At all times	All personnel
F4	Pre-fire season planning between Mount Peak Management Team, Traditional Owners and Bushfires NT (Alice Springs Office 08 8952 3066).	Prior to April	Site Manager
F5	Annually collaborate controlled burns activities with stakeholders including: - Central Land Council (Traditional Owners) - Stirling Pastoral Lease - Anningie Pastoral Lease - Northern Territory Emergency Service – Ti Tree Volunteer Unit.	Prior to April	Site Manager
F6	Storage of flammable and combustible materials will be in accordance with the Hazardous Substances Management Plan. Open flame or other ignition sources are prohibited within 20 m of bulk flammable storage areas, fuel dispensing vehicles or refuelling operations and activities in hazardous atmospheres.	At all times	Construction Manager Site Manager
F7	If “hot work” is to be undertaken in any area where a potential fire hazard exists or in areas designated as a potential fire risk by Contractor in the risk assessment, a ‘Hot Works’ permit is required. In addition, a fire watcher or fire warden shall remain on watch for a minimum of 30 minutes after completion of the hot works. The “hot work” risk assessment will use Australian Standard AS 1674.1 Safety in welding and allied processes – Fire precautions to determine the required controls to be implemented.	At all times	Contractor Construction Manager Site Manager

ID	Mitigation Measure	Timing	Responsibility
F8	Firefighting equipment will be inspected, maintained and tested annually.	Monthly	Site Manager
F9	Inspections of landfill and waste management practices to identify potential accumulation of combustible materials and associated risks prior to April.	Prior to April	Site Manager
Bushfire			
F10	Monitor the fire Danger Rating for Simpson West (http://www.bom.gov.au/nt/forecasts/fire.shtml).	At all times	Construction Manager Site Manager
F11	In the event of a bushfire the following measures should be taken: • If you see smoke or fire in the immediate area, alert all onsite personnel and provide regular updates • Contact the Site Manager / Construction Manager who will monitor the radio for any changes and determine best course of action, whether to work or not work • If the bushfire is threatening, ensure your own safety and Contractors by evacuating to the Gatehouse • If injuries have occurred attend to and assist injured personnel • Contact the Site Manager using the Emergency Communication Procedure as follows: - o Call "Emergency, Emergency, Emergency" over UHF channel 12 - o Response is given directly to the reportee acknowledging the call - o Describe the nature of the emergency including number of people involved, details of accident and nature of the injuries - o Continue to stay close to your source of communication. • Site Manager to determine response and fire management plan.	At all times	All personnel
Building Structure Fire			
F12	In the event of a building fire, the following measures should be taken: • If you hear a smoke alarm or see smoke, raise the alarm and evacuate the building • Assist other personnel in evacuating the building to the muster point • Contact the Site Manager using the Emergency Communication Procedure as follows: - o Call "Emergency, Emergency, Emergency" over UHF channel 12 - o Response is given directly to the reportee acknowledging the call - o Describe the nature of the emergency including number of people involved, details of accident and nature of the injuries - o Under direction of the Site Manager attempt to extinguish the fire with fire hoses and fire extinguishers, if safe to do so. • Site Manager to attend with onsite firefighting equipment.	At all times	All personnel

ID	Mitigation Measure	Timing	Responsibility
Machinery / Plant Fire			
F13	In the event of plant fire, the following measures should be taken: • If you see smoke or fire and it's safe to do so, turn off plant. • Ensure your own safety by evacuating plant and moving yourself to a safe distance • Alert people working in the area of the fire • Attempt to extinguish the fire with fire suppression system and fire extinguishers, if safe to do so • Contact the Site Manager using the Emergency Communication Procedure as follows: - o Call "Emergency, Emergency, Emergency" over UHF channel 12 - o Response is given directly to the reportee acknowledging the call - o Describe the nature of the emergency including number of people involved, details of accident and nature of the injuries - o Under direction of the Site Manager attempt to extinguish the fire with fire hoses and fire extinguishers, if safe to do so. • Site Manager to attend with onsite firefighting equipment.	At all times	All personnel
F14	Vehicles maintained and serviced at regular intervals to reduce potential of fire related to engines or exhausts.	At all times	Construction Manager Site Manager
F15	No machinery left running unattended.	At all times.	All personnel
Firebreaks			
F16	Maintain a clear and continuous firebreak of 10m minimum around infrastructure including: • Processing Plant • Gatehouse • Explosives Magazine • Mine Camp • Adhera Loadout Facility.	Prior to April	Site Manager
Landfill Burning			
F17	Controlled burns are held at the landfill site as necessary to control amount of putrescible and windblown waste. The impacts of burning wastes are reduced by: • Transferring of recyclable products to an appropriate licenced facility for recycling offsite • Transfer of hazardous wastes including chemical waste, paints, solvents, gas bottles, waste oil and batteries to an appropriately licenced offsite facility for disposal • Storage of tyres onsite in a stable form and outside of potential impact from bushfires • Burning waste within the designated fire pit with maintain firebreaks to control potential spread to the surrounding area.	At all times	Site Manager
Controlled Burns			
F18	Identify areas with high fuel loads requiring controlled burns. Liaise with Traditional Owners, Landholders and Bushfires NT prior to burning.	Prior to May	Site Manager
F19	Implementing patchy prescribed fires of low scorch height wherever practicable.	At all times	Site Manager
F20	No fire to be lit during designated fire bans. Fire ban status can be checked at: http://www.bom.gov.au/nt/warnings/index.shtml .	At all times	All personnel
Monitoring and Inspections			
F21	Fire register to be completed following any fire related incident.	At all times	All personnel
F22	Firefighting equipment will be maintained, inspected and tested.	Monthly	Site Manager
F23	Firebreaks, active working areas and fuel storage locations will be regularly inspected to determine if they are increasing fire risk.	As required or Monthly	Site Manager
F24	Inspections of landfill and waste management practices to identify potential accumulation of combustible materials and associated risks during the bushfire season.	Prior to April	Site Manager
F25	Annual Fire Management Plan performance review.	Annual	Site Manager

3.4 Trigger, Action and Response Plan

The Trigger, Action and Response Plan (TARP) outlines remedial actions and responses to the situation. The levels of incidents are outlined in Table 3-4.

Table 3-4 Trigger, Action and Response Plan

Responsibility	Situation			
	Standard	Level 1	Level 2	Level 3
	Firebreaks maintained. Equipment sufficiently maintained. No bushfires or planned fires within the vicinity of the Project.	Trigger: Inspection identifies elevated risk due to activities or firebreaks not maintained.	Trigger: Bushfire within the vicinity of the Project.	Trigger: Unplanned fire at the Project.
Site Personnel	Maintain awareness of potential bushfire risks across the Project. Maintain vigilance against potential outbreaks of fire in work areas.	The onsite personnel should: • If a work specific risk the Contractor should mitigate the situation to reduce/eliminate the risk • Notify the Site Manager of the elevated risk on UHF Channel 12.	The onsite personnel should: • Maintain safe distance from bushfire • Report bushfire to Site Manager on UHF Channel 12.	Contact the Site Manager using the Emergency Communication Procedure as follows: • Call "Emergency, Emergency, Emergency" "over UHF Channel 12 • Response is given directly to the reportee acknowledging the call • Describe the nature of the emergency including number of people involved, details of accident and nature of the injuries • Under direction of the Site Manager attempt to extinguish the fire with fire hoses and fire extinguishers, if safe to do so.

Responsibility	Situation			
	Standard	Level 1	Level 2	Level 3
Site Manager	Maintain a clear and continuous firebreak of 10 m minimum around infrastructure. Vehicles maintained and services at regular intervals. Continue controlled burns of landfill. Firefighting equipment will be inspected, maintained and tested annually. Inspections of landfill and waste management practices to identify potential accumulation of combustible materials. Active working areas and fuel storage locations regularly inspected to determine if they are increasing fire risk.	Maintain a clear and continuous firebreak of 10 m minimum around infrastructure. Firefighting equipment will be inspected, maintained and tested. Log incident.	Monitoring bushfires through Table 2-1 and on ground inspection to determine risk to site personnel. Provide updates to personnel within vicinity of the bushfire and inform of requirements (i.e. stop work). Log incident.	Utilise firefighting equipment at incident. Undertake incident investigation and support the implementation of corrective and preventive actions.

4. Performance Review

No previous period data is available for review.

Appendices

Appendix A – Fire Register

Date	Location Description	Approximate Area Burnt (m ²)	Controlled / Uncontrolled Burn	Firefighting Equipment Used	Personnel who Attended Fire	Infrastructure Impacted

Appendix B – Risk Matrix

An environmental risk assessment was undertaken for the Project during the EIS phase. The risk assessment identified the risk source (hazard and event), receptors and potential impact. The consequence and likelihood were determined using the descriptions identified in Table B1 and Table B2 respectively. The risk matrix is provided in Table B3.

Table B1 Consequence Description

Consequence	Insignificant	Minor environmental impact. Impacts are contained on-site and short term in nature. No detrimental effect on the environment.
	1	Minor repairable damage to common historic structures or sites. No disturbance of cultural heritage sites.
	Minor	Minor local habitat modification and / or lifecycle disruption for a listed species. No loss of individuals of listed species.
		Negligible soil impact. Chemical concentrations are above background but below EILs.
	2	No detectable change to background water quality. No exceedance of background and applicable Water Quality guidelines.
	Moderate	Moderate, unplanned localised environmental impact (may be of a temporary nature) or discharge contained on-site or with negligible off-site impact.
		Moderate but repairable damage to important historic structures or sites of cultural importance.
	3	Moderate local habitat modification and / or lifecycle disruption for a listed species. Minor local decrease in size of population(s) of listed species.
	Major	Localised soil impact. Low level <2 times exceedance of EILs.
		Local short-term minor exceedance of background and applicable Water Quality guidelines.
	Critical	Significant, unplanned environmental impact contained on-site or minor impact that is off-site.
		Considerable damage or infringement to sensitive historic structures or sites of cultural significance.
	4	Substantial local habitat modification and / or lifecycle disruption for a listed species. Moderate local decrease in size of population(s) of listed species.
		Localised long term or widespread short term soil impact. Chemical concentrations 2-5 times EILs.
	5	Local long-term or widespread short-term exceedance of background and applicable Water Quality guidelines.
		Major or widespread, unplanned environmental impact on or off-site. Could include substantial pollutant discharges. Significant resources required to respond and rehabilitate.
	Critical	Major damage or infringement to sensitive historic structures or sites of cultural significance.
		Moderate regional habitat modification and / or lifecycle disruption for a listed species. Substantial local decrease in size of population(s) of listed species.
	5	Widespread and / or long term impact to soils. Chemical concentrations 5-10 times EILs.
		Local, permanent or widespread, long-term exceedance of background and applicable Water Quality guidelines.

Table B2 Likelihood Description

Likelihood	Rare 1	Unlikely 2	Possible 3	Likely 4	Almost Certain 5
Description	The event may occur only in exceptional circumstances.	The event could occur at some time.	The event might occur at some time.	The event will probably occur in most circumstances.	The event is expected to occur in most circumstances.
Occurrence Intervals	>10 years	5 – 10 years	2 – 5 years	1 – 2 years	1 year

Table B3 Risk Matrix

			Severity of Consequence				
			Critical	Major	Significant	Moderate	Minor)
			5	4	3	2	1
Likelihood of Consequence	Almost Certain	5	Extreme	Extreme	High	High	Medium
	Likely	4	Extreme	High	High	Medium	Medium
	Possible	3	Extreme	High	Medium	Medium	Low
	Unlikely	2	High	Medium	Medium	Low	Very Low
	Rare	1	Medium	Medium	Low	Low	Very Low

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Appendix F – Hazardous Substances Management Plan



TNG Limited

Mount Peake

Hazardous Substances Management Plan

December 2015

Document Status

Version	Author	Reviewer	Approved by	Date	Status
Rev. 0	A. Koscielski	I. McCardle	I. McCardle		

Amendments

In accordance with section 41(3) of the Mining Management Act, an MMP reviewed and amended under section 41(1) is to clearly identify amendments made. All amendments throughout a revised MMP must be clearly marked in the document by applying “underlining” and a coloured font to all insertions, and “strikethrough” to all deletions.

Section	Details
n/a	

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Appendices

Appendix A – Hazardous Substances Inventory

Appendix B – Safety Data Sheet Register

Appendix C – Spill Register

Appendix D – Fuel Inventory

Appendix E – NT EPA Section 14 Incident Report

Appendix F – DME Section 29 Notification of Environmental Incident

Appendix G – NT WorkSafe Sections 35 to 39 Incident Notification Form

Appendix H – Risk Matrix

1. Introduction

1.1 Purpose

The Mount Peake Project involves several processes where the use of hazardous substances are required. The use of chemicals (herein referred to as hazardous substances) has the potential to impact upon site personnel and/or the surrounding environment.

Hazardous substances are chemicals or other materials that can cause acute or chronic harm to health. Hazardous substances are defined as any substance, mixture or article which is:

- Listed in National Occupational Health and Safety Commission (NOHSC):10005 or
- Classified as a hazardous substance by the manufacturer or importer in accordance with NOHSC:1008 or
- Meets the criteria for hazard classification set out in Part 3 (Health Hazards) of the Globally Harmonized System of Classification and Labelling of Chemicals (GHS).

The purpose of the Hazardous Substances Management Plan (HSMP) is to provide a framework for the management of hazardous substances. The management includes storage, handling, inventory, spill management measures and disposal requirements.

1.2 Objectives

The HSMP has been created to minimise the potential impact on human health and/or the surrounding environment from the Project. The main objectives are to:

- Provide a management hierarchy for hazardous substances
- Ensure handling and storage of hazardous substances are in accordance with relevant standards
- Detail hazardous substances inventory requirements
- Detail fuel inventory and investigation requirements
- Provide spill response procedures and subsequent investigation requirements.

1.3 Legislation, Standards and Guidelines

Northern Territory

In the Northern Territory, hazardous chemicals and dangerous goods are regulated under the *Work Health and Safety (National Uniform Legislation) Act* and the *Work Health and Safety (National Uniform Legislation) Regulations* Administered by NT WorkSafe. The act and regulations are based on the *Model Work Health and Safety Regulations* and make direct reference to the Australian Dangerous Goods Code.

The Australian Dangerous Goods Code 2007 relates primarily to the transport of dangerous goods although it provides relevant information on segregation and compatibility of different classes of dangerous goods.

A summary of NT legislation relating to hazardous substances and management are provided below:

- Dangerous Goods Act 2012 (NT)
- Dangerous Goods Regulations 2012 (NT)
- Environmental Offences and Penalties Act 2010
- Waste Management and Pollution Control Act 2009
- Waste Management and Pollution Control (Administration) Regulations
- Work Health and Safety (NUL) Act 2011 (NT), Division 2 Primary Duty of Care
- Work Health and Safety (NUL) Regulation 2012 (NT), Chapter 7, Hazardous Chemicals
- National Environment Protection Council (Northern Territory) Act 1994.

Australian Standards

Two Australian Standards relate directly to the storage or flammable, combustible and toxic substances including:

- AS/NZS 1940:2004 *The storage and handling of flammable and combustible liquids* provides minimum acceptable safety requirements for storage facilities, operating procedures, emergency planning and fire protection for the storage and handling of flammable liquids
- AS/NZS 4452:1997 *The storage and handling of toxic substances* provides minimum acceptable safety requirements for storage facilities, operating procedures, emergency planning and fire protection for the storage and handling of toxic substances.

Additional Australian Standards applicable to the HSMP include:

- AS 4332:2004 *The storage and handling of gases in cylinders*
- AS 4360:1999 *Risk Management*
- AS 2187.1: 1998 *Explosives – Storage, transport and use*
- AS/NZS 2444:2001 *Portable Fire Extinguishers and Fire Blankets - Selection and Location*
- AS/NZS 3833:1998 *Storage and Handling of Mixed Classes of Dangerous Goods in Packages and Bulk Containers*
- AS 2430.3:1997 *Classification of Hazardous Areas – Examples of Area Classification – General.*

Codes of Practice

Several Codes of Practice (CoP) covering the management of hazardous substances within the workplace are available through Safe Work Australia (<http://www.safeworkaustralia.gov.au>). The Project will be operated in general accordance with the codes of practice including:

- Code of Practice: Managing Risks of Hazardous Chemicals in the Workplace. Safe Work Australia, July 2012.
- Code of Practice: Labelling of Workplace Hazardous Substances. Safe Work Australia, March 2015.
- National Code of Practice for the Control of Workplace Hazardous Substances. NOHSC:2007(1994).
- Storage and Handling of Workplace Dangerous Goods. NOHSC:1015(2001).
- Code of Practice for the safe storage of solid ammonium nitrate. Department of Mines and Petroleum, 2013.

2. Management

2.1 Management Hierarchy

The management of hazardous substances at the Project is undertaken in general accordance with the hierarchy of control. The hierarchy of control for hazardous substances is as follows:

- **Elimination and removal**
Eliminating either the substance or the activity which gives rise to the risk is the most effective form of risk reduction.
- **Substitution**
Substituting high risk products or activities with alternative lower risk products or activities will reduce overall risk exposure.
- **Isolation, enclosure or sealing**
Hazards may be isolated by distance or barriers or a combination of both.
- **Engineering controls**
Engineering controls involve making engineering changes to a process or piece of equipment used to store or handle hazardous substances.
- **Safe work practices (administrative controls)**
Administration controls consist of properly designed and implemented work practices and procedures.
- **Personal protective equipment (least preferred)**
PPE is considered the last line of defence against hazardous substances. Material Safety Data Sheets (MSDS) normally contain recommendations on the selection and use of PPE for the particular materials being used.

2.2 Materials Summary

2.2.1 Construction Phase

Construction materials include hazardous and non-hazardous materials. They will be transferred to the site by vehicle. Some deliveries could occur via rail following the construction of the Adnera Loadout Facility. A summary of construction phase hazardous substances are provided in Table 2-1.

Table 2-1 Construction Phase Hazardous Substances

Product	Use	Proposed Storage Location	Approximate Volume
Cement	Construction requirements.	Mine site – location to be confirmed.	To be confirmed.
Diesel	Fuel for machinery and vehicles.	Self bunding storage tanks at the Mine Site and Adnera Loadout Facility.	15 MLpa.
Unleaded Petrol	Fuel for machinery and vehicles.		To be confirmed.
Lubricants	Process plant, machinery and vehicles.	Chemical Storage Shed at the Mine Site within internal bunding.	To be confirmed.
Sodium hypochlorite	Water treatment plant disinfection.		5 tpa
Antiscalent	Water treatment plan descaling.		1 tpa
Miscellaneous cleaning products	Site maintenance.		To be confirmed.

2.2.2 Operations Phase

Hazardous substances during operations will be stored at predefined locations across the Project to facilitate control and management. A summary of the operations phase hazardous substances are provided in Table 2-2.

Table 2-2 Operations Phase Hazardous Substances

Product	Use	Proposed Storage Location	Approximate Volume
Diesel	Fuel for machinery and vehicles.	Self bunding storage tanks at the Mine site and Adnera Loadout Facility.	3.5 ML/annum
Unleaded petrol	Fuel for machinery and vehicles.		To be confirmed
Natural gas (60 – 80% methane)	Power station fuel supply.	Adjacent to the power station in bulk storage tanks.	1.8 PJpa
Explosives components (ammonium nitrate, emulsion)	Extraction operations.	Explosives Magazine.	2,200 tpa
Cement	Maintenance construction requirements.	Chemical Storage Shed at the Mine Site within internal bunding.	To be confirmed.
Flocculent (Nalco 83372)	Settlement of tailings		300 tpa
Lubricants (transmission fluid, engine oil, air compressor oil)	Process plant, machinery and vehicles.		To be confirmed.
Sodium hypochlorite	Water treatment plant disinfection.		5 tpa
Antiscalent	Water treatment plant descaling.		1 tpa
Engine Coolant	Machinery and vehicles.		To be confirmed.
Drill road grease	Drill and blast and exploration drilling		To be confirmed.
Waste oil and waste oil filters	-		To be confirmed.
Miscellaneous cleaning products	Site maintenance.		To be confirmed.

2.3 Management and Monitoring

2.3.1 Labelling

Most hazardous substances will be stored in the container provided at sale. Diesel and unleaded petrol will be transferred into above ground self bunding tanks onsite. In accordance with the *Code of Practice for Labelling of Workplace Hazardous Chemicals* all hazardous substances will have labels which include the following:

- Written in English
- Product identified and chemical ingredients
- Name, Australian address and business telephone number (manufacture or importer)
- Hazard pictograms
- Hazard statement (may not be included on small containers)
- Hazard, first aid and emergency procedures (may not be included on small containers)
- Expiry date (if applicable) (may not be included on small containers).

2.3.2 Hazard Pictograms and ADG Code Class Labels

The Globally Harmonised System (GHS) specifies hazard pictograms in relation to the hazardous substances potential impact to physical, health and/or the environment. Hazard pictogram will be located on all hazardous substance containers (including waste oil and/or waste oil filters). A summary of hazardous pictograms and associated dangerous goods class labels are provided in Table 2-3.

Table 2-3 Hazardous Pictograms and Dangerous Goods Code Class Labels
(Source: Safe Work Australia, 2015)

Hazard Pictograms	GHS Hazard	Dangerous Goods class labels (pictograms)	Dangerous goods classes
	Explosives Self-reactives Organic peroxides	   	Explosive
	Flammables Self-reactives Pyrophorics Self-heating Emits flammable gas in contact with water Organic peroxides	     	■ Flammability (Liquid, Solid or Gas) ■ Pyrophoric, ■ Emits Flammable Gas ■ Organic Peroxide
	Oxidisers	 	■ Oxidiser ■ Oxidising gas
	Gases under pressure	   	Non-toxic non-flammable gas, flammable gas, oxidising gas, toxic gas
	Acute toxicity	 	■ Acute toxicity ■ Acute Toxic gas
	Acute toxicity Skin irritants Eye irritants Skin sensitisers	No equivalent	

	Carcinogens Respiratory sensitisers Reproductive toxicants Target organ toxicants Germ cell mutagens	No equivalent	
	Eye corrosion Skin corrosion Corrosive to metal		Corrosive to metals
	Aquatic toxicity. Not covered within the scope of workplace hazardous chemicals requirements		Environmental hazard
No equivalent hazard pictogram			Miscellaneous dangerous goods

2.3.3 Hazardous Substances Inventory

Data Collected

The inventory template for hazardous substances used during the construction and operations phases of the Project is provided in Appendix A and will be updated/completed at Project commencement. The inventory includes the following information:

- Site and location
- Name, position and date
- Commercial Name
- Chemical Composition
- Volume (L/kg/m³)
- State (solid, liquid or gas)
- Safe fill volume (L/kg/m³)
- Maximum capacity (L/kg/m³)
- Container type
- Hazardous substance / dangerous goods classification.

Frequency

Hazardous substance inventories will be undertaken:

- Monthly (during construction and operations) or
- When new substances not previously listed in the most recent inventory are brought to site.

2.3.4 Safety Data Sheets Register

In addition to hazardous substance inventories, all product Safety Data Sheets (SDSs) will be maintained at storage locations and the Site Office. The SDS register will form Appendix B of this management plan during construction and operations.

The SDS register will be supplemented when new hazardous substances are brought to site.

2.3.5 Fuel Inventory (Loss Management)

A fuel inventory system will be implemented including the following:

- Product level measurements compared with dispenser meter readings, deliveries, removals and internal transfers (Appendix D)
- Reconciliation conducted fortnightly for each individual tank product added to/or removed
- Inventory control computations of any loss or gain of product recorded and included with a monthly summary of cumulative losses or gains of product.

Leak Identified

Should a leak, spill or other cause of discrepancy be detected the following will be undertaken:

- If required, take action as soon as practicable to prevent any further release of product or used oil into the environment
- Identify and mitigate any fire, explosion or vapour hazards
- Take all reasonable steps to prevent migration of product or used oil that has leaked or spilled
- Take all reasonable steps to recover or remove product or used oil that has leaked or spilled so that the site does not pose any threat to the environment or human health and safety
- Remove or, where practical to do so, repair any leaking components of the AST.

2.4 Spill / Incident Statutory Notification Procedures

Spills and/or incidents in relation to hazardous substances at the site will be reported to the required regulatory body as detail in Table 2-4.

Table 2-4 Regulatory Body Reporting Requirements

Entity	Trigger	Timeframe and Contact Details	Incident Reporting Details
Northern Territory Environment Protection Authority (NT EPA)	Incident which causes, or is threatening or may threaten to cause pollution resulting in material environmental harm or serious harm.	< 24 h post incident ntepea@nt.gov.au pollution@nt.gov.au	The Section 14 Incident Report Form requires the following details: • Incident causing or threatening to cause pollution • Location occurred and area impacted; • Date and time • How the pollution has occurred, is occurring or may occur • Attempts made to prevent, reduce, control, rectify, investigation and/or clean up the pollution or resultant environmental harm caused or threatening to be caused by the incident • Operator details. The form is to be signed by the Emergency Response Coordinator (Mine Manager) for submission. A blank form is provided in Appendix E.

Entity	Trigger	Timeframe and Contact Details	Incident Reporting Details
Department of Mines and Energy (DME)	Incident which causes minor environmental impact with some minor actual or potential hard to the environment.	As soon as practicable. Mineral.Info@nt.gov.au	The Section 28 Notification of Environmental Incident Form requires the following details: • Site and operator details • Location occurred and area impacted (GPS coordinates) • Date and time • Description of incident • Emergency and remedial actions taken • Nature of impact and severity • Current situation • Details of sampling undertaken • Notification status internally and externally. The form is to be signed by the Emergency Response Coordinator (Mine Manager) for submission. A blank form is provided in Appendix F.
NT WorkSafe	Incident which results in either: • Death of a person • Serious injury or illness • Dangerous incident.	Immediate verbal communication via 1800 019 115 Written notification < 48 h post incident. ntworksafe@nt.gov.au	The NT WorkSafe Incident Notification Form requires the following details: • Person submitting details • Incident details including date, time and human injury details • Work activity being undertake at the time of incident • Witness(es) details • Details of injured / deceased persons • Summary of injury or illness • Future remedial actions. The form is to be signed by the Emergency Response Coordinator (Mine Manager) for submission. A blank form is provided in Appendix G.

3. Hazardous Substances Management

Hazardous substance management will be undertaken in accordance with Section 2 of this plan. Management of hazardous substances risk is structured below as follows:

- **Key Activities, Risks and Impacts:** A summary of the key activities being undertaken during the management period. The potential environmental impacts and residual risk levels are identified for each environmental aspect
- **Objective:** The guiding environmental management objective(s) and activities that apply to the element
- **Mitigation Measures:** The procedures to be employed to ensure that the relevant objectives are met
- **Responsibility:** Nominates the responsible position for implementing actions and monitoring
- **Trigger, Action, Response Plan (TARP):** The actions to be implemented in the case of non-compliance. This includes strategies of remediation and the person(s) responsible for the actions.

3.1 Key Activities, Risks and Impacts

The key activities and potential environmental impacts have been identified for hazardous substances are listed in Table 3-1. The risk matrix is provided in Appendix G.

Table 3-1 Key Activities, Risks and Impacts

Activity	Potential Environmental Impact	Residual Risk Level		
		Consequence	Likelihood	Risk
Construction and operational activities including refuelling, vehicle maintenance, cleaning, weed management, waste water treatment processes, extractive and processing operations.	Uncontrolled release of hazardous substance from normal use impacting: • Soil/sediment, surface water (fresh and marine) or groundwater • Flora and fauna • Air quality or • Aesthetical value.	2	2	L
Ineffective containment of hazardous substances leak	Spill or leak leading causing an impact to: • Soil/sediment, surface water (fresh and marine) or groundwater • Flora and fauna • Air quality or • Aesthetical value.	3	2	M
Storage, transport and disposal of non-hazardous substances at the onsite landfill.	Incorrect assessment/classification of a hazardous substances as a non-hazardous substance leading to: • Pollution of adjacent vegetation and/or groundwater • Odours • Increased fire risk or • Reduced visual amenity.	3	1	L

Activity	Potential Environmental Impact	Residual Risk Level		
		Consequence	Likelihood	Risk
Storage of hazardous wastes at the landfill.	Uncontrolled release of hazardous substance impacting: • Soil/sediment, surface water (fresh and marine) or groundwater • Flora and fauna • Air quality or • Aesthetical value.	3	1	L

3.2 Objective

Hazardous substances management objectives have been established and are detailed in Table 3-2.

Table 3-2 Hazardous Substances Objectives

Objective	Target	Indicator
Protection of the surrounding environment from hazardous substances.	No long term impact and/or environmental harm occurring from the release of hazardous substances.	Number of incidents reported leading to potential long term impact and/or environmental harm.
	Fuel to be stored appropriately and in accordance with legislative standards.	Number of fuel storage locations in breach of legislative standards.

3.3 Mitigation Measures

- AS/NZS 1940:2004 *The storage and handling of flammable and combustible liquids* provides minimum acceptable safety requirements for storage facilities, operating procedures, emergency planning and fire protection for the storage and handling of flammable liquids.
- AS/NZS 4452:1997 *The storage and handling of toxic substances* provides minimum acceptable safety requirements for storage facilities, operating procedures, emergency planning and fire protection for the storage and handling of toxic substances.

Additional Australian Standards applicable to the HSMP include:

- AS 4332:2004 *The storage and handling of gases in cylinders*
- AS/NZS 1940:2004 *The storage and handling of flammable and combustible liquids*;
- AS/NZS 4452:1997 *The storage and handling of toxic substances*;
- AS 4360:1999 *Risk Management*;
- AS 2187.1: 1998 *Explosives – Storage, transport and use*;
- AS/NZS 2444:2001 *Portable Fire Extinguishers and Fire Blankets - Selection and Location*;
- AS/NZS 3833:1998 *Storage and Handling of Mixed Classes of Dangerous Goods in Packages and Bulk Containers*; and
- AS 2430.3:1997 *Classification of Hazardous Areas – Examples of Area Classification – General*.

Mitigation measures have been developed to minimise potential impacts associated with hazardous substances. The mitigation measures, timing and responsibilities are provided in Table 3-3.

Table 3-3 Mitigation Measures

ID	Mitigation Measure	Timing	Responsibility
Site Induction			
HS1	Site induction includes the following components for hazardous substances: - Summary of hazardous substance at the Project and associated locations - Summary of hazardous pictograms and dangerous goods code class labels and what they mean - Requirements for handling and utilising fuel infrastructure - No hot works or naked flames allowed within 20 m of flammable substances - Procedure for reporting and/or managing a spill.	Site Induction	All personnel
General			
HS2	Management of hazardous substances in accordance with Australian Standards including: - AS 4332:2004 The storage and handling of gases in cylinders - AS/NZS 1940:2004 <i>Storage and handling of flammable and combustible liquids</i> - AS/NZS 4452:1997 <i>Storage and handling of toxic substances</i>; - AS 4360:1999 <i>Risk Management</i> - AS 2187.1: 1998 <i>Explosives – Storage, transport and use</i> - AS/NZS 2444:2001 <i>Portable Fire Extinguishers and Fire Blankets - Selection and Location</i> - AS/NZS 3833:1998 <i>Storage and Handling of Mixed Classes of Dangerous Goods in Packages and Bulk Containers</i> - AS 2430.3:1997 <i>Classification of Hazardous Areas – Examples of Area Classification – General.</i>	Construction and Operation	HSE Manager
HS3	Hazardous substances to be stored in Chemical Storage Shed with internal bunding to collect spills and ventilation to prevent the build-up of fumes. These are used for drum storage of oil, petrol and similar materials.	Construction and Operation	HSE Manager
HS3	Waste oil and oil filters are to be stored in appropriately labelled Intermediate Bulk Containers (IBC). IBCs are determined as small containers, drums (up to 205 litres) and storage up to 1000 litres. All IBS labelled and hazard it poses listed on container. The IBC are to be removed from site by a suitably licensed contractor and delivered to a licensed depot.	Construction and Operation	HSE Manager
HS4	Storage of IBCs at the landfill will not exceed 1,000 L at any one time.	Construction and Operation	HSE Manager
HS5	Fuel (diesel) storage tanks will be double skinned and self bunded and meet environmental guidelines for the safe storage of bulk fuel (AS1692-2006 Steel Tanks for Flammable and Combustible Liquids) and AS 1940:2004: The Storage and handling of combustible and flammable liquids.	Construction and Operation	Site Manager
HS6	Fire extinguishers fitted in site vehicles.	Construction and Operation	HSE Manager
HS7	Hazardous substances stored minimum of 10 m from surface water and 50 m from groundwater wells.	Construction and Operation	HSE Manager
HS8	Storage of flammable and combustible materials will be in accordance with the Hazardous Substances Management Plan. Open flame or other ignition sources are prohibited within 20 m of bulk flammable storage areas, fuel dispensing vehicles or refuelling operations and activities in hazardous atmospheres.	Construction and Operation	All personnel
Spill Management			
HS9	Spill kits are located at all hazardous substance storage locations in addition to area supervisors having mobile spill kits. In addition, spill kits are available to be relocated to specific areas in accordance with scopes of work.	Construction and Operation	HSE Manager / Supervisors
HS10	Monthly inspections of hazardous substance storage location to ensure spill kits are present/contain sufficient materials for potential spillages.	Monthly	Site Caretaker

ID	Mitigation Measure	Timing	Responsibility
HS11	In the event of a spill follow the spill management procedure within the Emergency Response Plan including: - Isolate and contain the spill utilising the spill kit - Evacuate from the area if potential danger - Notify the Emergency Operations Officer (HSE Manager) on UHF Channel 12 and provide location, extents, substance type, quantity, environments impact (soils, surface water courses and groundwater) and spill kit contents used - Emergency Operations Officer, Emergency Field Team Member and Environmental Manager to attend and assess the significance and flag the area - Emergency Operations Officer, Emergency Field Team Member and Environmental Manager to manage insitu engineering work to capture and control the spill - Where spill cannot be controlled regularly monitoring flow, extents and sample (upstream, adjacent and downstream at consistent locations) - Environmental Manager to commence investigation in soil, surface and/or groundwater impacts from the spill. The investigation will detail the spill quantity, determine extent and significance of the impact to human health and the ecosystem (including upstream / control samples as required) - Where relevant, excavate and appropriately dispose of contaminated sediments with validation samples taken and disposal certification provided - Emergency Response Coordinator (Site Manager) to provide Department of Mines and Energy with Section 29 Notification (Appendix F) and Northern Territory Environmental Protection Authority with Section 14 Incident Report Form (Appendix E) within 24 hours of the incident occurring if the incident caused or is threatening or may threaten to cause pollution resulting in minor or serious environmental harm - Spill to be logged with the spill register (Appendix C) - Clean-up of spill location including spill kit consumables and replace.	At all times	All personnel
Inspection and Monitoring			
HS12	Monthly hazardous substances inventory. The inspection is to update the hazardous substances inventory (Appendix A). In addition, any new hazardous substances will be included when they are brought to site.	Monthly /As required	HSE Manager
HS13	Safety Data Sheets (SDSs) register will be maintained at storage locations and the Site Office. The register will be supplemented when new hazardous substances are brought to site.	As required	HSE Manager
HS14	Spill kits to be inspected on a monthly basis to ensure kits contain adequate equipment.	Monthly	HSE Manager
HS15	Fuel inventory control system including: - Product level measurements compared with dispenser meter readings, deliveries, removals and internal transfers (Appendix D) - Reconciliation conducted fortnightly for each individual tank product is added to or removed - Inventory control computations of any loss or gain of product recorded and included with a monthly summary of cumulative losses or gains of product.	At all times	HSE Manager

ID	Mitigation Measure	Timing	Responsibility
HS16	If the daily inventory identifies a leak, spill or other cause of discrepancy the following will be undertaken: • If required, take action as soon as practicable to prevent any further release of product or used oil into the environment • Identify and mitigate any fire, explosion or vapour hazards • Take all reasonable steps to prevent migration of product or used oil that has leaked or spilled • Take all reasonable steps to recover or remove product or used oil that has leaked or spilled so that the site does not pose any threat to the environment or human health and safety • Remove or, where practical to do so, repair any leaking components of the AST.	Daily	HSE Manager
HS17	Annual Hazardous Substances Management Plan performance review (Section 4).	Annual	Site Caretaker

3.4 Trigger, Action and Response Plan

The Trigger, Action and Response Plan (TARP) outlines remedial actions and responses to the situation. The levels of incidents are outlined in Table 3-4 and TARP in Table 3-5.

Table 3-4 Spill Trigger Levels

Substance	Spill Volume (L)		
Hazardous substance	<10	10 – 20	>20
Hydrocarbon	<50	50 – 500	>500
Stormwater (retention pond discharges)	<1,000	1,000 – 10,000	>10,000
Receiving Environment	Trigger Level		
Bund / impermeable area	n/a	n/a	Level 1
Permeable surface or stormwater retention pond	Level 1	Level 2	Level 3
Surface water or groundwater	Level 1	Level 3	Level 3

Table 3-5 Trigger, Action and Response Plan

Responsibility	Situation		
	Level 1	Level 2	Level 3
Personnel who identify spill	Isolate and contain the spill utilising the spill kit. Evacuate from the area if potential danger. Notify the Emergency Operations Officer (HSE Manager) on UHF Channel 12 and provide location, extents, substance type, quantity, environments impact (soils, surface water courses and groundwater) and spill kit contents used.	Isolate and contain the spill utilising the spill kit. Evacuate from the area if potential danger. Notify the Emergency Operations Officer (HSE Manager) on UHF Channel 12 and provide location, extents, substance type, quantity, environments impact (soils, surface water courses and groundwater) and spill kit contents used.	Isolate and contain the spill utilising the spill kit. Evacuate from the area if potential danger. Notify the Emergency Operations Officer (HSE Manager) on UHF Channel 12 and provide location, extents, substance type, quantity, environments impact (soils, surface water courses and groundwater) and spill kit contents used.

Responsibility	Situation		
	Level 1	Level 2	Level 3
Emergency Operations Officer (HSE Manager)	Attend and assess the significance and flag the area. Re-commence operations where possible, excluding the area of the incident. Replenish spill kit consumables. Undertake and/or manage investigation into spill incident which is to be provided to the Emergency Response Coordinator (Site Manger) within 24 hours of the incident occurring. Spill to be logged with the spill register (Appendix C). Produce a 'Safety Moment' to onsite personnel within 1 week of incident occurring. Review and implement recommendations.	Attend and assess the significance and flag the area. Re-commence operations where possible, excluding the area of the incident. Replenish spill kit consumables. Undertake and/or manage investigation into spill incident which is to be provided to the Emergency Response Coordinator (Site Manger) within 24 hours of the incident occurring. Spill to be logged with the spill register (Appendix C). Produce a 'Safety Moment' to onsite personnel within 1 week of incident occurring. Review and implement recommendations.	Attend and assess the significance and flag the area. Manage insitu engineering works to capture and control the spill. Re-commence operations where possible, excluding the area of the incident. Replenish spill kit consumables. Undertake and/or manage investigation into spill incident which is to be provided to the Emergency Response Coordinator (Site Manger) within 24 hours of the incident occurring. Spill to be logged with the spill register (Appendix C). Produce a 'Safety Moment' to onsite personnel within 1 week of incident occurring. Review and implement recommendations.
Environmental Officer	Attend and assess the significance and potential requirement for further assessment (laboratory samples).	Attend and assess the significance and potential requirement for further assessment (laboratory samples). Commence investigation in soil, surface and/or groundwater impacts from the spill. The investigation will detail the spill quantity, determine extent and significance of the impact to human health and the ecosystem (including upstream / control samples as required).	Attend and assess the significance and flag the area. Regularly monitor flow, extents and sample (upstream, adjacent and downstream at consistent locations). Commence investigation in soil, surface and/or groundwater impacts from the spill. The investigation will detail the spill quantity, determine extent and significance of the impact to human health and the ecosystem (including upstream / control samples as required). Excavate and appropriately dispose of contaminated sediments with validation samples taken and disposal certification provided.

Responsibility	Situation		
	Level 1	Level 2	Level 3
Emergency Response Coordinator (Site Manager)	Provide Department of Mines and Energy with Section 29 Notification (Appendix F) and Northern Territory Environmental Protection Authority with Section 14 Incident Report Form (Appendix E) within 24 hours of the incident occurring if the incident caused or is threatening or may threaten to cause pollution resulting in minor or serious environmental harm. Notify NT WorkSafe as required in Table 2-4.	Provide Department of Mines and Energy with Section 29 Notification (Appendix F) and Northern Territory Environmental Protection Authority with Section 14 Incident Report Form (Appendix E) within 24 hours of the incident occurring if the incident caused or is threatening or may threaten to cause pollution resulting in minor or serious environmental harm. Notify NT WorkSafe as required in Table 2-4.	Provide Department of Mines and Energy with Section 29 Notification (Appendix F) and Northern Territory Environmental Protection Authority with Section 14 Incident Report Form (Appendix E) within 24 hours of the incident occurring if the incident caused or is threatening or may threaten to cause pollution resulting in minor or serious environmental harm. Notify NT WorkSafe as required in Table 2-4.

4. Previous Period Performance

No data available for previous period performance.

Appendices

Appendix A – Hazardous Substances Inventory

Hazardous Substances Inventory

Site	
Location	
Date	
Name	
Position	

Commercial Name	Chemical Composition	Volume (L / kg / m³)	State (solid, liquid or gas)	Safe Fill Volume (L / kg / m³)	Maximum Capacity (L / kg / m³)	Container Type	Hazardous Substance / Dangerous Goods Classification

Commercial Name	Chemical Composition	Volume (L / kg / m ³)	State (solid, liquid or gas)	Safe Fill Volume (L / kg / m ³)	Maximum Capacity (L / kg / m ³)	Container Type	Hazardous Substance / Dangerous Goods Classification

Appendix B – Safety Data Sheet Register

Include Safety Data Sheets when available.

Appendix C – Spill Register

Spill Register

[illegible]

Appendix D – Fuel Inventory

Fuel Inventory

Location:	
Tank ID:	
Product:	

Month:	

Day	Month	Dispensed (L)	Delivery (L)	Book Stock (L)	Dip Reading (L)	Loss or Gain	Cumulative Loss / Gain
Instructions				Previous Day Dip Reading + Delivery - Dispensed		Book Stock - Dip Reading	
Previous Month		-	-				
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							
29							
30							
31							
TOTAL						Loss / Gain	

Appendix E – NT EPA Section 14 Incident Report

SECTION 14 INCIDENT REPORT (*Waste Management and Pollution Control Act*)

Date and Time of Notification:	
Person / Company:	
Incident:	

(a) the incident causing or threatening to cause pollution	
(b) the place where the incident occurred	
(c) the date and time of the incident	
(d) how the pollution has occurred, is occurring or may occur	
(e) the attempts made to prevent, reduce, control, rectify or clean up the pollution or resultant environmental harm caused or threatening to be caused by the incident	
(f) the identity of the person notifying the NT EPA	

Appendix F – DME Section 29 Notification of Environmental Incident

Notification of an Environmental Incident

Section 29 of the Mining Management Act

Forward completed form to: Mining Compliance Division,
Department of Mines and Energy

Email: mineral.info@nt.gov.au (preferred) or Fax: (08) 89996527

PLEASE TYPE OR PRINT CLEARLY

Please ensure that you have read the [Draft Guideline - Environmental incident reporting under Section 29 of the Mining Management Act \(July 2012\) \[167kb\]](#)

NAME OF MINING SITE	
NAME OF OPERATOR	
DATE & TIME OF INCIDENT	
NAME OF PERSON NOTIFYING	
POSITION/TITLE	
CONTACT PERSON	
CONTACT DETAILS	Business: Mobile
	Fax: E-mail:
INCIDENT LOCATION (use GPS co-ordinates, attach map, etc as appropriate)	
DESCRIPTION OF INCIDENT	
EMERGENCY & REMEDIAL ACTIONS TAKEN	

ENVIRONMENTAL DETAILS

NATURE OF IMPACT AND SEVERITY (Volume/ of spillage, area impacted, wildlife/vegetation/ erosion, etc) DME severity classification: 1 2 3 4 <i>Refer to pages 3 to 5 of the Draft Guideline - Environmental incident reporting under Section 29 of the Mining Management Act (July 2012) [167kb]</i>	
CURRENT SITUATION (Potential / ongoing / ceased / etc)	
DETAILS OF ANY SAMPLES TAKEN (when / where / type / number / time for results /etc)	

OPERATOR INTERNAL REPORTING

Has the incident been reported internally? YES / NO If so, to whom	Name:
	Position:
Operator reference number (where applicable/available)	

HAS THE DEPARTMENT BEEN NOTIFIED EARLIER?	☐ YES ☐ NO
WHO WAS NOTIFIED	
HOW (phone/email/fax)	
WHEN (date & time)	
BY WHOM	

Signed: _____ Date: _____

NAME: _____

POSITION: _____

OFFICE USE ONLY	
RECEIVED BY	
DATE	TIME

Appendix G – NT WorkSafe Sections 35 to 39 Incident Notification Form

Incident Notification Form

Witnesses

Name of person(s) who saw the incident or was first on the scene

Details of Injured/Deceased Person(s)

Full Name:					
Date of Birth:		Occupation/Job Title:			
Direct Worker ☐	Contractor ☐	Member of public ☐	Other ☐		
Address:					
Suburb:		State:		Postcode:	
Work number:		Mobile number:			
Email:					

Injury/Illness

Provide a description of any injury or illness

Did the person receive treatment following the injury/illness? If yes, describe treatment below

Yes ☐ No ☐

Action

Describe any Action taken/intended, if any, to prevent recurrence of the incident

Declaration

Date form submitted:		Signed:		I have submitted this form electronically (signature is not required)	☐

Appendix H – Risk Matrix

An environmental risk assessment was undertaken for the Project. The risk assessment identified the risk source (hazard and event), receptors and potential impact. The consequence and likelihood were determined using the descriptions identified in Table H1 and Table H2 respectively. The risk matrix is provided in Table H3.

Table H1 Consequence Description

Consequence	Insignificant	Minor environmental impact. Impacts are contained on-site and short term in nature. No detrimental effect on the environment.
	1	Minor repairable damage to common historic structures or sites. No disturbance of cultural heritage sites. Minor local habitat modification and / or lifecycle disruption for a listed species. No loss of individuals of listed species. Negligible soil impact. Chemical concentrations are above background but below EILs. No detectable change to background water quality. No exceedance of background and applicable Water Quality guidelines.
	Minor	Moderate, unplanned localised environmental impact (may be temporary in nature) or discharge contained on-site or with negligible off-site impact.
	2	Moderate but repairable damage to important historic structures or sites of cultural importance. Moderate local habitat modification and / or lifecycle disruption for a listed species. Minor local decrease in size of population(s) of listed species. Localised soil impact. Low level <2 times exceedance of EILs. Local short-term minor exceedance of background and applicable Water Quality guidelines.
	Moderate	Significant, unplanned environmental impact contained on-site or minor impact that is off-site.
	3	Considerable damage or infringement to sensitive historic structures or sites of cultural significance. Substantial local habitat modification and / or lifecycle disruption for a listed species. Moderate local decrease in size of population(s) of listed species. Localised long term or widespread short term soil impact. Chemical concentrations 2-5 times EILs. Local long-term or widespread short-term exceedance of background and applicable Water Quality guidelines.
	Major	Major or widespread, unplanned environmental impact on or off-site. Could include substantial pollutant discharges. Significant resources required to respond and rehabilitate.
	4	Major damage or infringement to sensitive historic structures or sites of cultural significance. Moderate regional habitat modification and / or lifecycle disruption for a listed species. Substantial local decrease in size of population(s) of listed species. Widespread and / or long term impact to soils. Chemical concentrations 5-10 times EILs. Local, permanent or widespread, long-term exceedance of background and applicable Water Quality guidelines.
	Critical	Extensive long term environmental harm or harm that is very widespread. Could include extensive pollutant discharges. Impacts permanent or unlikely to be reversible within 10 years.
	5	Unsalvageable and permanent damage to sensitive historic structures or sites of cultural significance. Substantial regional habitat modification and / or lifecycle disruption for a listed species. Moderate or substantial regional decrease in size of population(s) of listed species. Irreversible and / or extensive impact to soils. Chemical concentrations >10 times the ecological investigation levels (EILs). Widespread, permanent exceedance of background and applicable Water Quality guidelines.

Table H2 Likelihood Description

Likelihood	Rare 1	Unlikely 2	Possible 3	Likely 4	Almost Certain 5
Description	The event may occur only in exceptional circumstances.	The event could occur at some time.	The event might occur at some time.	The event will probably occur in most circumstances.	The event is expected to occur in most circumstances.
Occurrence Intervals	>10 years	5 – 10 years	2 – 5 years	1 – 2 years	1 year

Table H3 Risk Matrix

			Severity of Consequence				
			Critical	Major	Significant	Moderate	Minor)
			5	4	3	2	1
Likelihood of Consequence	Almost Certain	5	Extreme	Extreme	High	High	Medium
	Likely	4	Extreme	High	High	Medium	Medium
	Possible	3	Extreme	High	Medium	Medium	Low
	Unlikely	2	High	Medium	Medium	Low	Very Low
	Rare	1	Medium	Medium	Low	Low	Very Low

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Appendix G – Non-mineralised Waste Management Plan



TNG Limited
Mount Peake
Non-mineralised Waste Management Plan

December 2015

Document Status

Version	Author	Reviewer	Approved by	Date	Status
Rev. 0	A Koscielski	I. McCardle	I. McCardle		

Amendments

Section	Details
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Appendix A – Waste Management Guidelines for Small Communities

Appendix B – Risk Matrix

1. Introduction

Non-mineralised waste generation (waste) and management are considered to be a potential environmental risk at the Mount Peake Project. The majority of waste is managed onsite at the landfill but hazardous wastes and recyclables will be removed to appropriated licenced facilities.

The objectives of this management plan are to:

- Prevent environmental impact from waste generation
- Prevent increased environmental risk by the removal of hazardous substances from storage at the landfill prior to the Wet Season.

1.1 Legislation and Guidelines

A summary of waste management legislation and guidelines for the Mount Peake Project are provided in Table 1-1.

Table 1-1 Waste Management Legislation and Guidelines

Legislation and Guidelines	Relevance
Waste Management and Pollution Control Act and Regulations.	Provides for the protection of the environment by encouraging effective waste management and pollution prevention and control practices. The removal of hazardous wastes from the Project is managed under this Act. The subcontractor is required to hold an Environmental Protection Licence through the NT EPA. A summary of approved Listed Waste Handlers is provided as follows: http://www.ntepa.nt.gov.au/waste-pollution/approvals-licences/ep-licences . In addition, locations at the Project which have potential to caused pollution off the lease will be investigated and managed in accordance with the requirements of the contaminated land provisions of the Act.
Waste Management Guidelines for Small Communities in the Northern Territory (LGANT)	Guidelines for the management of waste in remote/small communities in the Northern Territory. The guidelines were developed in consultation with councils and municipals in the Northern Territory and various government agencies. Guidance on hazard reduction, environmental protection, service delivery and ongoing site management are provided. Due to the size and location of the Project it operates in general accordance with these guidelines.
Guidelines for the Siting, Design and Management of Solid Waste Disposal Sites in the Northern Territory (NT EPA)	The guideline provides recommendations for visual amenity, nuisance control, fire prevention, water management, landfill gas, closure and monitoring. The siting of landfill will be in general accordance with the guidelines. However, management of the landfill will be undertaken in accordance with the Waste Management Guidelines for Small Communities in the Northern Territory.

1.2 Waste Categories

The Waste Management Plan provides a strategy for the management of hazardous waste, non-hazardous waste and recyclables. These streams are further defined below.

1.2.1 Hazardous waste

Hazardous wastes are wastes that pose a threat or risk to public health, safety or the environment. They include substances which may be toxic, infectious, mutagenic, carcinogenic, explosive, flammable, corrosive, oxidising or radioactive. Hazardous wastes include medical waste, excess or spent chemicals, contaminated scrap metals or drums, oily rags and absorbents, solvents, batteries, fluorescent tubes, oily sludge, paints and paint drums, oil filters, sewage and contaminated soil.

1.2.2 Non-hazardous waste

Non-hazardous wastes are wastes composed of, or containing, materials which are not harmful to humans and which would not have a serious impact on the environment. Non-hazardous wastes include putrescible solids and liquids, and inert solids, including paper, food waste, domestic waste, scrap metal, plastics, wood, glass, concrete and cardboard.

1.2.3 Recyclables

Recycle/recovery is the conversion of wastes into usable materials and/or extraction of energy or materials from wastes. Recyclable materials include paper and cardboard, plastics, glass, metal, wood, tyres and vegetation and organic matter.

Waste receptacles will be strategically located around the Site and temporary facilities as required.

1.3 Management Hierarchy

The management of waste at the Project are undertaken in general accordance with the hierarchy of control. The hierarchy of control for hazardous substances already on site are as follows:

- **Elimination and removal**
Eliminating either the substance or the activity which gives rise to the risk is the most effective form of risk reduction.
- **Substitution**
Substituting high risk products or activities with alternative lower risk products or activities will reduce overall risk exposure.
- **Isolation, enclosure or sealing**
Hazards may be isolated by distance or barriers or a combination of both.
- **Engineering controls**
Engineering controls involve making engineering changes to a process or piece of equipment used to store or handle hazardous substances.
- **Safe work practices (administrative controls)**
Administration controls consist of properly designed and implemented work practices and procedures.
- **Personal protective equipment (least preferred)**
PPE is considered the last line of defence against hazardous substances. Material Safety Data Sheets (MSDS) normally contain recommendations on the selection and use of PPE for the particular materials being used.

2. Existing Conditions

A landfill will be located at the Mount Peake Project for the disposal of inert (clean waste) and municipal solid waste. Hazardous wastes and recyclables will be stored at the landfill site prior to removal from the Project.

2.1 Title Details

The title details will be updated following the siting of the landfill.

2.2 Soils

The soil details will be updated following the siting of the landfill.

2.3 Surface Water

The surface water details will be updated following the siting of the landfill.

Table 2-1 Landfill Surface Water Sampling Locations

Watercourse	Location		Status	
	Distance	Direction	Upstream	Downstream

2.4 Groundwater

The groundwater details will be updated following the siting of the landfill.

Table 2-2 Landfill Groundwater Sampling Locations

Groundwater Well	Location		Status	
	Distance	Direction	Upstream	Downstream

2.5 Landfill Design

No landfill design is available. The location, size and layout of the landfill will be determined during the initial construction phase. However, the siting will be in general accordance with the Guidelines for the Siting, Design and Management of Solid Waste Disposal Sites in the Northern Territory (NT EPA). The site will be operated in accordance with the Waste Management Guidelines for Small Communities in the Northern Territory (LGANT).

3. Waste Management

Waste management refers to non-hazardous waste, hazardous waste and recyclables at the Project. Management of waste is structured below as follows:

- **Key Activities, Risks and Impacts:** A summary of the key activities being undertaken during the management period. The potential environmental impacts and residual risk levels are identified for each environmental aspect
- **Objective:** The guiding environmental management objective(s) and activities that apply to the element
- **Mitigation Measures:** The procedures to be employed to ensure that the relevant objectives are met
- **Responsibility:** Nominates the responsible position for implementing actions and monitoring
- **Trigger, Action, Response Plan (TARP):** The actions to be implemented in the case of non-compliance. This includes strategies of remediation and the person(s) responsible for the actions

3.1 Key Activities, Risks and Impacts

The key activities and potential environmental impacts have been identified for waste management are listed in Table 3-1. The risk matrix is provided in Appendix B.

Table 3-1 Key Activities, Risks and Impacts

Activity	Potential Environmental Impact	Residual Risk Level		
		Consequence	Likelihood	Risk
Burning of landfill waste.	Loss of control leading to bushfire and subsequent loss of flora and fauna.	2	2	L
Operation of a non-hazardous waste landfill.	Production of leachate leading to groundwater contamination.	3	2	M
	Attraction of native and pest animals to landfill and waste collection locations.	2	2	L
Storage, transport and disposal of non-hazardous waste at the onsite landfill.	Incorrect assessment/classification of a hazardous substances as a non-hazardous substance leading to: • Pollution of adjacent vegetation and/or groundwater • Odours • Increased fire risk • Reduced visual amenity.	3	1	L
Storage of hazardous wastes at the landfill.	Uncontrolled release of hazardous substance impacting: • Soil/sediment, surface water (fresh and marine) or groundwater • Flora and fauna • Air quality • Aesthetical value.	3	1	L

3.2 Objective

The waste management objectives have been established and are detailed in Table 3-2.

Table 3-2 Waste Management Objectives

Objective	Target	Indicator
Prevent of environmental impact from waste generation.	Zero environmental incidents associated with the landfill and waste collection sites.	Number of incidents which occur in relation to the landfill and waste generation sites.
Prevent increased environmental risk by the removal of hazardous substances from storage at the landfill prior to the Wet Season.	Zero hazardous substances stored at the landfill at the commencement of November.	Number of hazardous substances stored at the landfill.

3.3 Mitigation Measures

The waste hierarchy is utilised to guide onsite management of wastes. In addition, mitigation measures have been developed to minimise potential impacts associated with any waste related incidents. The mitigation measures, timing and responsibilities are provided in Table 3-3.

Table 3-3 Mitigation Measures

ID	Mitigation Measure	Timing	Responsibility
Site Induction			
W01	Site inductions will include the following specific waste management components: - Waste hierarchy - Identification of waste types and associated disposal requirements - Handling requirements in accordance with SDS - Waste burning health implications - All waste/items brought to Mine Landfill for appropriate disposal.	Site Induction	All personnel
Waste Hierarchy			
W02	A waste hierarchy will be implemented on site including: - Elimination and removal - Substitution - Isolation, enclosure or sealing - Engineering controls - Safe work practices (administrative controls)	At all times	All personnel
Hazardous Wastes			
W03	Waste oils are to be stored in Intermediate Bulk Container (IBC) to be removed from site by a suitably licensed contractor and delivered to a licensed depot	At all times	Environmental Manager
W04	Intermediate bulk container (IBC) used to store waste oil and other hydrocarbon waste located in designated areas. IBCs are determined as small containers, drums (up to 205 litres) and storage up to 1,000 L. All IBCs to be labelled and hazard it poses listed on container.	At all times	Environmental Manager
W05	Hazardous substances stored minimum of 10 m from surface water and 50 m from groundwater wells.	At all times	Environmental Manager
W06	Spill kits are located at all hazardous substance storage locations. In addition, spill kits are available to be relocated to specific areas in accordance with scopes of work.	At all times	Environmental Manager
W07	Quarterly inspections of hazardous substance storage location to ensure spill kits are present/contain sufficient materials for potential spillages. The quarterly inspection is to update the hazardous substances inventory (within the Hazardous Substances Management Plan).	Quarterly	Environmental Manager
W08	Removal of hazardous substances from storage at the landfill prior to the Wet Season to reduce potential offsite migration risks.	Prior to October	Environmental Manager

ID	Mitigation Measure	Timing	Responsibility
W09	In the event of a spill follow the spill management procedure within the Emergency Response Plan including: - Isolate and contain the spill utilising the spill kit - Evacuate from the area if potential danger - Notify the Emergency Operations Officer (HSE Manager) on UHF Channel 12 and provide location, extents, substance type, quantity, environments impact (soils, surface water courses and groundwater) and spill kit contents used - Emergency Operations Officer, Emergency Field Team Member and Environmental Manager to attend and assess the significance and flag the area - Emergency Operations Officer, Emergency Field Team Member and Environmental Manager to manage insitu engineering work to capture and control the spill - Where spill cannot be controlled regularly monitoring flow, extents and sample (upstream, adjacent and downstream at consistent locations) - Environmental Manager to commence investigation in soil, surface and/or groundwater impacts from the spill. The investigation will detail the spill quantity, determine extent and significance of the impact to human health and the ecosystem (including upstream / control samples as required) - Where relevant, excavate and appropriately dispose of contaminated sediments with validation samples taken and disposal certification provided - Emergency Response Coordinator (Site Manager) to provide Department of Mines and Energy with Section 29 Notification) and Northern Territory Environmental Protection Authority with Section 14 Incident Report Form within 24 hours of the incident occurring if the incident caused or is threatening or may threaten to cause pollution resulting in minor or serious environmental harm - Spill to be logged with the spill register in the Hazardous Substance Management Plan - Clean-up of spill location including spill kit consumables and replace.	At all times	All personnel
General			
W10	Materials to be recycled at site include paper, cardboard, aluminium tins/cans, metal, electronics, plastics and glass. The items are to be stored at the landfill and/or waste collection points and removed from site monthly.	Monthly	Construction Manager Site Manager
W11	Cleared vegetation will be mulched, stockpiled and/or used for rehabilitation.	At all times	Construction Manager Site Manager
W12	Litter sweep of the Landfill on a monthly interval to collect any windblown waste.	Monthly	Environmental Manager
W13	Monthly inspection of burn pit cage (used to restrict access to vermin and/or other pests).	Monthly	Environmental Manager
W14	All Project waste is to be disposed of at the Landfill.	At all times	All personnel
W15	The landfill will be fenced with a single entry / exit which will be kept closed.	At all times	All personnel
Waste Burning			
W16	Controlled burns will be held at the landfill site as necessary to control amount of putrescible and windblown waste. The impacts of burning wastes are reduced by: - Transferring of recyclable products to an appropriate licenced facility for recycling offsite - Transfer of hazardous wastes including chemical waste, paints, solvents, gas bottles, waste oil and batteries to an appropriately licenced offsite facility for disposal - Storage of tyres onsite in a stable form and outside of potential impact from bushfires - Burning waste within the designated fire pit with maintain firebreaks to control potential spread to the surrounding area.	At all times.	Environmental Manager

ID	Mitigation Measure	Timing	Responsibility
W17	Controlled burns on low wind days at the landfill as necessary to control the amount of putrescible and windblown wastes. Hazardous waste and recyclables are kept out of the burn.	At all times	Environmental Manager
W18	Routine monitoring of the controlled burn and firefighting equipment within close proximity.	At all times	Environmental Manager
W19	Close landfill during the burning of wastes to reduce impact to human health (related to dioxins, sulphur dioxide, lead and mercury).	At all times	Environmental Manager
Uncontrolled Burn			
W20	Management of an uncontrolled burn at the landfill will be managed as follows: • If you see smoke or fire in the immediate area, alert all onsite personnel and provide regular updates • If the bushfire is threatening, ensure your own safety and Contractors by evacuating to Mining Services area • Contact the Site Manager using the Emergency Communication Procedure as follows: - o Call "Emergency, Emergency, Emergency" over UHF channel 12 - o Response is given directly to the reportee acknowledging the call - o Describe the nature of the emergency including number of people involved, details of accident and nature of the injuries/incident - o Continue to stay close to your source of communication. • Site Manager to attend with onsite firefighting team and equipment.	At all times	All personnel
Hazardous Waste Transport			
W21	Hazardous waste being removed from site will be undertaken by licenced contractor who holds an Environmental Protection Licence through the NT EPA for Listed Waste Handlers (http://www.ntepa.nt.gov.au/waste-pollution/approvals-licences/ep-licences).	At all times	Construction Manager Site Manager
W22	Certificates of disposal will be stored and provided within the Waste Management Plan revisions.	At all times	Environmental Manager
Inspection and Monitoring			
W23	Monthly burn pit cage inspection and litter sweep.	Monthly	Environmental Manager
W24	Spill kits to be inspected on a monthly basis to ensure kits contain adequate equipment	Monthly	Site Environmental Manager
W25	Annual Waste Management Plan performance review (Section 4).	Annual	Environmental Manager

3.4 Trigger, Action and Response Plan

The Trigger, Action and Response Plan (TARP) outlines remedial actions and responses to the situation. The TARP is provided in Table 3-4.

Table 3-4 Trigger, Action and Response Plan

Responsibility	Situation		
	Standard	Level 1	Level 2
	Landfill and waste collection sites containing wastes with limited interaction with vermin/pests.	Trigger: Waste incorrectly disposed of resulting in potential cross contamination of other wastes within the burn pit.	Trigger: Spill of Hazardous waste causing environmental harm.
Site Manager	Conduct monthly inspections of burn cage, hazardous substance storages, wastes within the burn pit and litter sweep. Monthly removal of recyclables at site include paper, cardboard, aluminium tins/cans, metal, electronics, plastics and glass. Quarterly inspections of hazardous substance storage location to ensure spill kits are present/contain sufficient materials for potential spillages. Removal of hazardous substances from storage at the landfill prior to the Wet Season.	Remove and segregate hazardous waste, plastics, tyres and recyclable wastes from the burn pit. Removal of hazardous substances from storage at the landfill prior to October.	Isolate and contain the spill utilising the spill kit; Evacuate from the area if potential danger; Notify Site Manager on UHF Channel 12. Monitor and determine if spill kit response has been effective in containing and managing spill. Undertake an investigation of soils and potentially install groundwater wells to determine extent of impact.
	Controlled burn to reduce amount of putrescible and windblown waste	Trigger: Uncontrolled burn at the landfill within the burn pit.	Trigger: Uncontrolled burn at the landfill outside of the burn pit.
Site Manager	Transferring of recyclable products to an appropriate licenced facility for recycling offsite. Transfer of hazardous wastes including chemical waste, paints, solvents, gas bottles, waste oil and batteries to an appropriately licenced offsite facility for disposal. Storage of tyres onsite in a stable form and outside of potential impact from bushfires. Burning waste within the designated fire pit with maintain firebreaks to control potential spread to the surrounding area. Controlled burns on low wind days at the landfill as necessary to control the amount of putrescible and windblown wastes. Hazardous waste and recyclables are kept out of the burn. Routine monitoring of the controlled burn and firefighting equipment within close proximity. Close landfill during the burning of wastes to reduce impact to human health (related to dioxins, sulphur dioxide, lead and mercury).	Management of an uncontrolled burn at the landfill will be managed as follows: • If you see smoke or fire in the immediate area, alert all onsite personnel and provide regular updates • If the bushfire is threatening, ensure your own safety and Contractors by evacuating to Mining Services area • Contact the Site Manager using the Emergency Communication Procedure as follows: - o Call "Emergency, Emergency, Emergency" over UHF Channel 12 - o Response is given directly to the reportee acknowledging the call - o Describe the nature of the emergency including number of people involved, details of accident and nature of the injuries/incident - o Continue to stay close to your source of communication. • Site Manager to attend with onsite firefighting team and equipment.	

4. Previous Period Performance

No data available for the previous period.

Appendices

Appendix A – Waste Management Guidelines for Small Communities

Waste Management Guidelines for Small Communities

Waste Management Guidelines for Small Communities in the Northern Territory

Working Towards Best Practice
2009



Executive Summary

These Guidelines were developed as part of the Northern Territory Government Program 'Re-Thinking Waste' – Waste Management Standards for Local Government in the Northern Territory. The project was made possible due to financial support provided by the Packaging Stewardship Forum.

Under the Northern Territory *Waste Management and Pollution Control Act*, communities with populations over 1,000 are required to have a licensed landfill and an Environmental Management Plan for the operation of the site. The Department of Natural Resources, Environment, The Arts and Sport (NRETAS) and the NT Environment Protection Authority (EPA) have developed Guidelines for the Siting, Design and Management of Solid Waste Disposal Sites in the Northern Territory.

The guidelines included in this document are focused on improving the delivery of waste management services to communities with less than 1,000 people. Waste management in small and remote communities has very specific challenges for community managers, and it is important that these challenges are met and waste management services are not at a lower standard than would be expected in more populated areas. These guidelines are intended to provide support to community managers and technical service operators in working towards best practice and ensuring that waste management in small and remote communities is safe for staff, the community and the environment. Given this, these guidelines focus on:

- Reducing the hazards associated with waste in small communities
- Working towards improved environmental management of waste
- Allowing communities to assess their current situation and provide some initial steps in how to improve waste management in their community
- Providing guidance on the service delivery standards that should be aspired towards under the new council structure.

While these guidelines have been developed for waste management services and landfill site management, they only provide broad advice and should not be considered as a technical manual, but rather as an operational guide to be used on a daily basis. Each community's needs and circumstances are unique and site-specific investigation, design, operation and management plans will be required in each case to achieve the best outcomes. Working with your council, LGANT and Government Agencies will help you to develop more strategic plans to guide the future direction of your community waste management plan.

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These guidelines have been prepared by the Local Government Association of the Northern Territory (LGANT) with thanks to the Re-Thinking Waste Program jointly funded by Department of Natural Resources, Environment, The Arts and Sport (NRETAS) and the Packaging Stewardship Forum.

NOTE: THIS DOCUMENT IS TO BE CONSIDERED AS A GUIDE ONLY AND IT IS IMPORTANT TO BE AWARE THAT THERE MAY BE LEGISLATIVE REQUIREMENTS ABOVE WHAT IS SUGGESTED HEREIN. AS SUCH, THESE GUIDELINES **HAVE NOT** BEEN FORMALLY ENDORSED BY THE DEPARTMENT OF NATURAL RESOURCES, ENVIRONMENT, THE ARTS AND SPORT.

LGANT and the funding bodies accept no liability for activities undertaken as a result of what is set out in this document.

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INTRODUCTION: Why Use These Guidelines

These guidelines aim to address the most immediate issues of waste management first – hazard reduction. It is not intended that any one section has priority over the others, however many small communities have hazardous waste management processes, and addressing these issues is generally the first challenge. The key waste management performance areas addressed in these guidelines are:

1. Hazard Reduction
2. Environmental Protection
3. Service Delivery
4. Ongoing Site Management

The management of waste is an important role for local government. It has benefits for community health, preventing environmental harm, amenity management, and community morale. Waste management can be a difficult and complex task for remote communities, so a planned strategy of management is a useful tool in assisting councils.

The most important consideration in waste management is community health. Poorly managed waste services can have significant impacts on community health and so planned management is essential.

The challenge for solid waste management is to adopt an integrated approach, including avoidance, recycling, minimisation, treatment and disposal. Under this integrated management approach, councils and the community should determine what options will best fit the community. This may mean that a landfill is not actually needed, and a transfer facility system is preferable. Transfer of some or all waste to a landfill serving other communities may be a more economically viable option than developing a new landfill. Transferring waste also minimises environmental impact by reducing the number of waste disposal sites across a region. Under such a system, waste is either transported directly to the landfill serving the area's communities or deposited in a transfer station before being taken to the landfill. Use of transfer stations and sharing landfill facilities in this manner can help reduce costs for all the communities involved.

While these guidelines are given as expected best practice, they are not legally binding or statutory in nature. They have been developed in consultation with the councils and municipalities in the NT, as well as various government agencies (such as the Departments of Health and Families, Local Government and Housing and NRETAS) and non government stakeholders.

Definitions and Abbreviations

Abbreviation	Definition
BIITE	Batchelor Institute of Indigenous Tertiary Education
CDU	Charles Darwin University
Clinical waste	Such wastes include, but are not restricted to, wastes arising from medical, nursing, dental, veterinary, laboratories, pharmaceutical, podiatry, tattooing, body piercing, emergency services, blood banks, mortuary practices and other similar practices, and wastes generated in health care facilities or other facilities during the investigation or treatment of patients or in research projects
DHF	Northern Territory Department of Health and Families
FAHCSIA	Australian Government Department of Families, Housing, Community Services and Indigenous Affairs
Hazardous waste	Any waste that has significant quantities of a substance that might present a danger to the life or health of people or the environment. This includes clinical and radioactive wastes.
HAZMAT	Hazardous Material
Health Care Facility	Includes a health centre, health clinic, or mobile surgery, e.g. dental or eye
HR Licence	Heavy Rigid Vehicle Licence (A rigid motor vehicle or an articulated motor omnibus that has 3 or more axles and a gross vehicle mass (GVM) greater than 8 tonnes)
KABC	Keep Australia Beautiful Council
Landfill	Site where waste is disposed of. A licensed landfill has been checked by the Department of Natural Resources, Environment, The Arts and Sport.
LGANT	The Local Government Association of the Northern Territory
MGB	Mobile Garbage Bin
MSDS	Materials Safety Data Sheet
NRETAS	Northern Territory Department of Natural Resources, Environment, The Arts and Sport
OHS	Occupational Health and Safety
PPE	Personal Protective Equipment
RTO	Registered Training Organisation
Small communities	For the purpose of this document, a 'small community' is that which has less than 1,000 permanent residents
SWMS	Safe Work Method Statement

Applicable Legislation

The *Waste Management and Pollution Control Act* is the main legislation regarding waste disposal, however there are other legislation, guidelines and standards that are applicable. Table 1 below lists these documents and they should also be consulted to ensure compliance.

Table 1 **Related legislation and guidelines and the relevant agency, as it relates to Waste Management in the Northern Territory**

Related Legislation and Guidelines	Enforcement Agency
• <i>Waste Management and Pollution Control Act 2007</i> • <i>Waste Management and Pollution Control (Administration) Regulations 2004</i> • <i>Water Act 2004</i>	Department of Natural Resources, Environment, The Arts and Sport (NRETAS) (www.nt.gov.au/nreta).
• <i>Public Health (Nightsoil, Garbage, Cesspits, Wells and Water) Regulations</i> • <i>Public Health (General Sanitation, Mosquito Prevention, Rat exclusion and Prevention) Regulations</i> • <i>Environmental Health Standards for Remote Communities in the Northern Territory 2001</i>	Department of Health and Families (DHF) (www.nt.gov.au/health/envirohealth)
• <i>Local Government Act 2007</i>	Department of Local Government and Housing (www.dlgh.nt.gov.au)
• <i>Workplace Health and Safety Act 2007</i> • <i>Workplace Health and Safety Regulations 2008</i>	NT WorkSafe (www.worksafe.nt.gov.au)

How to use these Guidelines

These guidelines have been divided into four “Key Performance Areas” that are based on the main aspects of waste management in small communities. Within each performance area, there are a number of “focus” points that break down the main waste management activities within that area.

Each focus point has a best practice statement. This best practice statement may not be achievable in your community; however it is a goal that you can work towards. The most important thing about these waste management guidelines is continual improvement. Small steps can make big changes.

Each focus point also describes three scenarios, which you can use as an assessment of where your community is in terms of waste management. The box below explains the format.

These scenarios include an ‘unacceptable’ scenario or standard that should be addressed as a point of urgency. If you think this is where your community is at, you should address it immediately.

The next is a ‘manageable’ scenario – where it is not as urgent, and you have some systems and infrastructure in place to work with. The final scenario is ‘better practice’, where it is not quite BEST practice, but very close. If you are at this stage, you probably don’t need to change anything at this stage, and could focus attention on other aspects.

There is a photo to help illustrate the practice, and a section for taking notes. It is highly recommended that users of the manual actively record comments and notes in this section, that can be used to improve the guidelines and to feed into council record keeping.



Best Practice Statement: “This is an aspirational goal statement. It is not always going to be achievable in every community, however it does set a position that is considered to be the most ideal across the broadest range of communities”



Unacceptable Scenario: This describes a situation that is considered unacceptable in any situation. If any aspects of your waste management fall within this scenario, it is recommended that it be given urgent attention. A key goal would be to ensure that all aspects of waste management do not fall within this scenario.



Manageable Scenario: This situation is considered standard. It is by no means ideal, but doesn’t require urgent attention. Once you reach this level of waste management, you should have a reasonably good situation for waste, and be able to work on improving specific aspects of waste management as opportunities arise.



Better Practice Scenario: This is the situation that is considered achievable by pretty much all communities. It is a goal to have all aspects of your waste management fall within this scenario.

1. Hazard Reduction

The first priority when looking at waste management in your community is to reduce the risk of harm to your community and your staff. To do this, you need to consider dangerous practices and dangerous materials.

There is legislation that relates to the management of dangerous or hazardous materials (like asbestos), and also to dangerous or hazardous practices (like burning waste). Due to the remoteness and lack of resources in smaller communities, it might not be possible to comply with the legislation best practice; however there are good practices that can help reduce the amount of harm when dealing with these materials or practices.

Generally, hazardous waste can be described as any waste that has significant quantities of a substance that might present a danger to the life or health of people or the environment. This includes clinical and radioactive wastes.

Some hazardous wastes that you probably have in your community are:

- Car batteries;
- Waste oil;
- Clinical waste;
- Chemical waste;
- Paints and solvents;
- Building materials;
- Car tyres (water holding waste);
- Fridges and freezers;
- Lockable boxes;
- Gas bottles; and
- Animal carcasses.

Best practice when dealing with hazardous waste is to ensure that they are not included in the general waste disposal. Hazardous wastes should be stored under controlled conditions for recycling or removal from the community, and with liquid wastes (such as paints and oil) they should be removed by a contractor.

The number one hazardous practice that is most common in communities is the burning of waste. People burn waste for many reasons, including reducing the amount of litter, odour, and chance of pests getting into the waste. These factors can usually be dealt with in a safer manner, and the burning of waste is dealt with in more detail in the Section 1.05 - Burning of Waste.

Key Performance Area:

1. HAZARD REDUCTION



Notes:

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Focus: 1.01 Hazardous Waste

Hazardous waste can generally be defined as any of the following:

Materials that have ANY of these characteristics:

- Explosive
- Flammable Liquids/Solids
- Poisonous
- Toxic
- Ecotoxic
- Infectious Substances.

ANY waste materials that include:

- Clinical wastes
- Waste oils/water, hydrocarbons/water mixtures, emulsions
- Wastes which contain certain compounds such as: copper, zinc, cadmium, mercury, lead.



Best Practice Statement: “Hazardous wastes are not sent to landfill. They are dealt with according to Australian Government Standards. Storage areas for Hazardous Waste have appropriate HAZMAT signage Those responsible for the generation of hazardous wastes are held accountable for the safe disposal.”



Unacceptable Scenario: Hazardous waste is not identified by council staff or community members. Hazardous wastes are mixed in amongst other household wastes or present within the community, in yards and houses.



Manageable Scenario: Hazardous wastes are identified by council staff and sometimes community members. Hazardous wastes are generally not mixed in with household waste, but may be present within the community.



Better Practice Scenario: Hazardous wastes are collected separately from households or dropped off at the council depot, where there is a designated storage place. Contractors carrying out work in the community are aware of the drop off point, and use it or take their wastes out of the community. Period collections from the council depot have been arranged to remove hazardous wastes from community.

Steps for Achieving Best Practice

1. Educate staff on what hazardous wastes are, and the dangers of dealing with hazardous wastes.
2. Ensure infrastructure to deal with hazardous wastes is in place – especially a storage site for hazardous materials.
3. Educate community on the importance of dealing with hazardous wastes separately.
4. Arrange for a separate collection or clean out of hazardous wastes from community and households.
5. Ensure all contractors working in the community are aware of separate drop off point for hazardous wastes, and advise them they should be removing wastes from the community.

1. HAZARD REDUCTION



Common household items can become hazardous when they are disposed of. For example, gas cylinders, fluorescent tube lights, car batteries, cleaning products, paint and thinners

[illegible]

Focus:

1.02 Chemical Wastes

When some chemicals are mixed with others, they can catch fire or explode. Be especially careful with swimming pool chlorine which is an oxidising agent and may cause a fire when mixed with petrol, diesel or oil. Set up a chemical storage area in a way so people do not mix different chemicals together. Educate staff and the community on the dangers of chemical disposal and what they can do to protect themselves.

Most chemicals and compounds have what is called a Material Safety Data Sheet. An MSDS is a document containing important information about a hazardous substance and must state:

- A hazardous substance's product name
- The chemical and generic name of certain ingredients
- The chemical and physical properties of the hazardous substance
- Health hazard information
- Precautions for safe use and handling
- The manufacturer's or importer's name, Australian address and telephone number
- The MSDS provides employers, self-employed persons, workers and other health and safety representatives with the necessary information to safely manage the risk from hazardous substance exposure.

It is important that staff working with chemicals know how to read and interpret a MSDS. You can generally access MSDS for chemicals online, or your council should be able to provide this information.



Best Practice Statement: "Chemical wastes are clearly labelled and stored separately to other materials in a secured, controlled area. Each chemical has a Material Safety Data Sheet (MSDS) present onsite. Council staff is trained in the safe handling of chemicals. Chemical clean out happens monthly where they are taken out of the community to the nearest licensed facility for disposal"



Unacceptable Scenario: Labels on containers known to hold chemicals are faded and illegible. Liquid wastes are mixed together into one large drum. No separate collection of chemicals means they go into general waste stream (and landfill) or are tipped down the drain. Council staff is not trained in the handling of chemicals



Manageable Scenario: Trained council staff aims to identify chemicals as part of community chemical clean up. At least one chemical clean up has been held to educate community. Not all MSDS are present, but in the process of acquiring MSDS for chemicals onsite. MSDS storage and disposal guidelines are generally followed. Chemicals are stored in secured area and the empty containers are punctured so that they can't be used as water container.



Better Practice Scenario: Have most relevant MSDS for chemicals onsite, and staff follow MSDS storage and disposal guidelines for all chemicals. Chemical containers removed from community (ie contractors). Any service providers in the community (contractors) have clause included in contract specifying the removal from chemicals and containers from community

Steps for Achieving Best Practice

1. Train council staff in the management of chemicals, and also the identification of chemical wastes. Introduce the concept of MSDS for chemicals. You can view MSDS online at www.msds.com.au and other websites.
2. Contact NT WorkSafe about the safe storage of chemicals.
3. Designate specific chemical storage area, either at waste disposal site or at central place at the depot etc. Disposal site should be clearly signed with instructions on how to dispose of chemicals.
4. Identify existing chemicals in the community. For those that aren't identified, treat as hazardous waste.
5. Gather MSDS information for all known and potential chemicals in the community.
6. Hold a chemical clean out with the community to educate community and staff on importance of disposing of chemicals in a safe manner. Ideally clean outs should be held regularly to reduce the build up of chemicals in the community.
7. Any old containers that have been used to store chemicals that will no longer be used for chemicals should be punctured to ensure they aren't used for gathering or storing water.
8. Contractors to notify council before entering communities with chemicals.
9. Contracts to include container removal clauses.
10. Community managers to inspect dump sites on a regular basis.

1. HAZARD REDUCTION

The following measures need to be in place where dangerous goods are stored in sheds.

-

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Focus:

1.03 Medical and Clinical Wastes

Clinical waste has the potential to cause injury, infection or public offence, and includes sharps, human tissue waste, laboratory waste, animal waste resulting from medical, dental or veterinary research or treatment that has the potential to cause disease. Clinical waste includes the following:

- Discarded sharps
- Human tissue, bone, organ, body part or foetus
- A vessel, bag or tube containing a liquid body substance
- An animal carcass discarded in the course of veterinary research or medical practice or research
- A specimen or culture discarded in the course of medical, dental or veterinary practice or research and any material that has come into contact with such a specimen or culture
- Heavily bloodstained bandages and dressings and those from infectious sources
- Cytotoxic waste
- Pharmaceuticals
- Any other article or matter that is discarded in the course of medical, dental or veterinary practice or research and that poses a significant risk to the health of a person who comes into contact with it.



Best Practice Statement: “Clinical waste is not disposed of in landfills or burnt in drums at health care facility. Clinical waste is managed by the health care facility, and is either removed from the community as part of a registered disposal program or incinerated onsite with appropriate incinerator facilities.”



Unacceptable Scenario: Health care facility staff is unaware of correct disposal procedures and often clinical waste is being disposed with general household waste, or being incinerated at the health care facility in 44 gallon drums or improvised incinerator. Sharps are disposed in landfill, not necessarily in a sharps container, often just loose.



Manageable Scenario: Clinical waste is stored in yellow wheelie bins and incinerated onsite using an incinerator endorsed by the Department of Health and Families.

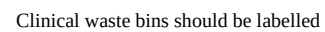
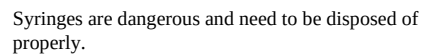


Better Practice Scenario: Clinical waste is stored onsite in yellow wheelie bins and removed by health care facility via a contracted service. All sharps containers are removed from health care facility to regional centres for disposal.

Steps for Achieving Best Practice

1. Meet with health care facility to discuss current disposal practices.
2. Ensure health care facility has contracts in place to remove clinical wastes.
3. Train council staff on the identification and handling of clinical wastes.
4. Ensure council staff has received necessary vaccinations.
5. Ensure health facility staff understands best practice for disposal of clinical wastes.

1. HAZARD REDUCTION



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Focus:

1.04 Prohibited and Other Special Wastes

The following should be prohibited from disposal in small communities :

- Pesticides and pesticide containers which have not been cleaned in accordance with the *Agsafe Standard for Effective Rinsing of Farm Chemical Containers* (<http://www.drummuster.com.au/category.php?id=28>);
- Commercial quantities of hazardous wastes including :
 - o “dangerous goods” under the provisions of the *Dangerous Goods Act* (<http://www.nt.gov.au/lant/hansard/hansard.shtml>); and
 - o any material scheduled as a “listed waste” under the *Waste Management and Pollution Control (Administration) Regulations* (<http://www.nt.gov.au/lant/hansard/hansard.shtml>)
 - o Radioactive waste under the provisions of the *Radiation Protection Act*.



Best Practice Statement: “Prohibited materials are not brought into the community without prior notification to shire service manager. Any prohibited materials are dealt with solely by licensed contractor and wastes are removed from the community, without exception. No prohibited wastes are left in community for disposal. “



Unacceptable Scenario: No wastes have been identified as prohibited, or there is no communication on standard prohibited wastes to council staff or the community, resulting in all sorts of wastes being disposed of in and near the landfill.



Manageable Scenario: Some materials are generally understood to be prohibited from the landfill, but many still end up being disposed of with general waste. There is no documentation or signage to explaining what is prohibited. Council staff has not been trained about identifying prohibited waste.



Better Practice Scenario: A list of prohibited wastes is defined and made available within the community. Council staff is aware of what is prohibited waste and there are procedures in place to separate out prohibited wastes so they don't get into the landfill.

Steps for Achieving Best Practice

1. Create a list of prohibited wastes.
2. Make this list available within the community and make sure all council staff is aware of these wastes.
3. Designate an area for the removal of identified prohibited wastes (for example ‘special wastes ‘drop off point’).
4. Any contractors working in the community should be made aware of prohibited wastes and their responsibility to remove from the community any prohibited waste that they generate.

1. HAZARD REDUCTION



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Focus:

1.05 Burning of Waste

Burning wastes changes otherwise safe materials (such as plastic) into dangerous toxic emissions and ash, including: dioxins; sulphur dioxide; lead; and mercury which may adversely impact on public health and the environment. Toxic emissions can cause immediate and long-term damage to the lungs, kidneys, liver, nervous system, and reproductive or developmental disorders. The damage is especially a problem for children, the elderly, and those with pre-existing respiratory conditions. Children can also accidentally swallow contaminated dirt on their hands while playing near discarded ash.

Open burning of household waste creates significant amounts of dioxins due to the low combustion temperatures, poor air distribution, and the presence of chlorine, which is found in almost all household waste components. The products of incomplete combustion will include dioxins, furans and other potentially carcinogenic (cancer-causing) organic compounds. Although some of these compounds will be carried off into the atmosphere with the smoke plume, some will remain in the ash left behind after the fire has gone out.

It is important to educate the community these dangers of backyard burning. It is also important to provide alternatives to rubbish burning by establishing solid waste collection programs and encouraging community members to compost and reduce, reuse, and recycle.



Best Practice Statement: "Waste is not burnt in communities"



Unacceptable Scenario: Individual households burn waste in barrels or drums, with no control or monitoring from council or community managers



Manageable Scenario: Waste is burned at the landfill site, although lack of separation of materials from the tip face means all sorts of materials are being burned.



Better Practice Scenario: Controlled burns are held at the landfill site as necessary to control amount of putrescible and windblown waste. Plastics, construction materials, whitegoods etc are all kept out of the controlled burn site.

Steps for Achieving Best Practice

1. Ban the burning of waste in the community and develop a communication plan to ensure your community understands why burning waste is banned.
2. Schedule the removal of burn barrels from community and provide wheelie bins and regular waste service.
3. Extend the communication plan to include labelling on bins and around the community indicating "no burning."
4. If it is necessary in your community, develop waste burn plan for scheduled burns on low wind days to reduce the amount and volume of putrescibles waste.

If burning has been chosen as an operational technique, you need to consider the following:

- *How human health and safety and the environment will be protected during burning operations*
- *The frequency of burning*
- *Measures to be taken to meet the requirements of the local fire authority*
- *Steps to be taken to ensure refuse is all burnt or extinguished before personal conducting the burning leave the site*
- *The training to be undertaken by staff conducting the burning operations.*

1. HAZARD REDUCTION

Safe Burn Plan:

- as short, clean and smoke-free burns as possible;
- protection of your community;
- prevention of the spread of fire from the burn to areas outside the landfill;
- ensuring that the personnel who carry out the burns are well trained;
- integral involvement of the local fire authority with planning and approving burns;
- minimise the burning of plastics (especially PVC) which reduces smoke toxicity;
- to only burn wastes only downwind of homes; and
- prevent people from entering waste disposal site during burn days.



Burning waste even at the landfill site is not ideal, as it can alter the chemical make up of otherwise safe items, and leave toxic residue. If you must burn waste, follow the safe burn plan guidance given here.

Notes:

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Focus:

1.06 Animal Carcasses

Improper disposal of dead animals (such as feral animals, domestic pets and livestock) can lead to infection of other animals and humans. Animal carcasses should not be disposed of at the landfill without approval from the shire service manager.

Animal carcasses should be disposed of in an area separate from the working face of the landfill. They should not be burnt with other waste. Disposal should be carried out under supervision and immediate burial with protection from animal scavengers.

The use of lime or composting techniques to hasten the decomposition of carcasses is recommended.



Best Practice Statement: "All animal carcasses are buried at a separate pit at the landfill site at a minimum depth of 1m using hydrated lime or similar to expedite decomposition. This separate pit is fenced to prevent other animals scavenging"



Unacceptable Scenario: Animal carcasses are left to decompose at landfill site or within community causing public health risk.



Manageable Scenario: Carcasses are removed from the community, but still disposed of in general pit at landfill. Other animal scavengers are often present in the area and could be accessing carcasses.



Better Practice Scenario: Carcasses are buried in a separate pit, but there are no supplies of lime to help the breakdown process.

Steps for Achieving Best Practice

1. Develop a dedicated pit at landfill for burial of animal carcasses. Fence and sign the area to reduce chance of pit being used for other wastes. Ensure that pit is deep enough to prevent other animals digging it up.
2. Council staff conducts regular monitoring within and around community to identify and collect carcasses.
3. Council staff has been trained in the appropriate handling of carcasses.
4. Set a defined timeline from detection to burial in dedicated pit. Aim for 24 hours, but 3 days is acceptable (depending on climate).
5. Make contact details for immediate collection of carcasses known within community.
6. Investigate supplies of lime to hasten the breakdown of carcasses.
7. You may like to try some innovative ways to deal with animal carcasses on a longer term basis, some suggestions include:
 - Plant a tree on the grave site, to mark it so that the site isn't dug up again.
 - Cut the bottom out of a cement (water) tank, and bury it into the ground. Carcasses can be disposed of into the tank, and the top of it covered with a steel plate – making it inaccessible to other pests and reducing harm to the community.

1. HAZARD REDUCTION



Notes:

[illegible]

Focus:

1.07 Car Batteries

Acid from car batteries easily leak out and potentially:

- Burn skin;
- Injure eyes;
- Corrode metals;
- Contaminate soil; and
- Pollute waterways.

It is important to dispose of car batteries properly, and make sure they aren't left around the community where children may come into contact. Car batteries need to be stored in leak-proof containers that are preferably made of corrosion resistant material (e.g. heavy duty plastic, not metal).



Best Practice Statement: "All car batteries are stored separately at the depot or designated place at the landfill. A separate collection for batteries is in place, as well as community members being able to drop batteries off at facility. Processes are in place for car batteries to be taken off the community as part of a buy-back scheme. Money from the buy back process goes into a shared community fund."



Unacceptable Scenario: The storage of car batteries is uncontrolled as they are present throughout the community, around houses, play grounds and stores. Some car batteries are visibly leaking acid. Car batteries that are disposed end up in general waste and are often burnt at the landfill.



Manageable Scenario: Car batteries are generally not left around the community. They often end up in with household waste, but council staff knows to look for them and will keep them separate. If burning is taking place, council staff looks out for car batteries and remove them before burning.

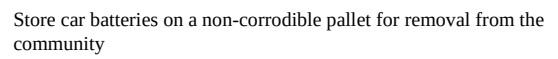
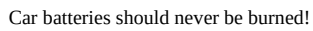


Better Practice Scenario: A specific area is designated for car batteries, where they are stored until such time that they can be removed from the community. Storage place is not well signposted, and overloaded with car batteries because no removal collection has been arranged. Community know to bring their car batteries to this site, and council staff rapidly removes any car batteries from the community.

Steps for Achieving Best Practice

1. Designate separate area for storage of car batteries, preferably on a plastic or wooden pallet and fenced off on three sides to prevent knocking over. Site should be well sign posted.
2. Train staff in the importance of separating out and safe handling car batteries.
3. Educate community on process for disposal of car batteries, and importance of keeping them separate from household waste.
4. Conduct regular collection / clean up of car batteries in community.
5. Engage contractor for regular removal / recycling of car batteries.

1. HAZARD REDUCTION

[illegible]

Focus:

1.08 Asbestos

Asbestos is a hazardous waste that can be extremely dangerous to human health if it is not properly managed. Breathing in the loose fibres can cause serious or fatal lung disease. In any situation where there is asbestos identified, or where maintenance involves one metre of friable asbestos, a licensed asbestos removalist must be employed to remove it. Asbestos waste should be buried at an approved licensed asbestos disposal site. This ensures that its location is recorded and it does not create contamination issues in the future.

If asbestos is identified in your community, the most important action you can take is to secure the site and prevent anyone from accessing it – particularly children, who are unlikely to understand the risk this material poses.

For further information about asbestos go to the NT Government's Asbestos Alert website: <http://www.asbestos.nt.gov.au/> and for up-to-date information contact NT WorkSafe on 1800 019 115.

When removing asbestos materials, be sure to wet the material with water to stop the fibres coming loose. Material should be wrapped in thick plastic and taken to authorised disposal area for burying straight away.



Best Practice Statement: "No asbestos is disposed outside of a licensed landfill site; all is removed by licensed contractors. Asbestos is identified before moving from any sites. Council staff is trained in the identification and associated hazards of asbestos. The council maintains an asbestos register and known asbestos sites are clearly marked, signposted and fenced off. Contractors undertaking demolition in the community remove asbestos as part of their contract."



Unacceptable Scenario: Asbestos is dumped in general waste stream or left as rubble at site; Dumping on site, staff dealing with asbestos. The location and extent of asbestos disposed of at site is unknown



Manageable Scenario: Locations of asbestos dump sites in the community are known, however there is uncertainty on the extent / amount of asbestos. Signage is old and faded, or non-existent. Some containment and isolation of asbestos happens at the site.



Better Practice Scenario: Location and extent of asbestos at site is known. Signage is old and faded and needs repairing. GPS coordinates need confirming. Council Asbestos Register is out of date. New demolition work will ensure that future asbestos is taken off site by contractor

Steps for Achieving Best Practice

1. Ensure all staff working at the site is trained in the identification and safe handling of asbestos.
2. Assess existing visible wastes to determine if asbestos is present in your landfill.
3. Review any records of previous housing to estimate extent of construction wastes disposed of at site, and if asbestos likely to be present.
4. Record GPS coordinates of any known asbestos dump sites – inform your council of these coordinates.
5. Fence off any known asbestos disposal sites and ensure coverage is at least 1m deep over these areas.
6. The area should be clearly signposted with "Danger Asbestos" and the GPS coordinates.
7. If you come across exposed and potentially dangerous asbestos in your community, you need to restrict access to the area, cover the material if possible and contact your council for more information on how to get it disposed of safely.
8. Any newly identified asbestos material is to be removed by a licensed contractor and transported by a licensed waste contractor. This is likely to be quite expensive, and it is important you talk to your council before taking this action – they may need to identify the responsible body for the asbestos and coordinate with government agencies for the removal of the asbestos.
9. Before dealing with asbestos always consult with your council, NT WorkSafe, DHF, FaHCSIA (prescribed communities only) and NRETAS.

1. HAZARD REDUCTION



Asbestos should be buried, signposted and the GPS coordinates recorded

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Focus:

1.09 Tyres

Tyres are dangerous when burned or if water pools inside them mosquitoes are likely to breed rapidly. However, if separated out from general waste, tyres can be quite useful for reuse within the landfill or in your community.



Best Practice Statement: “Tyres are separated from general waste and stockpiled in signposted areas, not disposed of in the landfill. Tyres are punctured to prevent water pooling, and where possible are reused at the landfill site or in the community for traffic control, landscaping etc. Tyre shredding equipment and recycling initiatives are being investigated.”



Unacceptable Scenario: Tyres are mixed in with general waste and disposed of at landfill, occasionally burnt at landfill or in the community.



Manageable Scenario: Tyres are separated from general waste, and not put into landfill or burnt. No reuse program is in place, and tyres tend to pool water and breed mosquitoes.

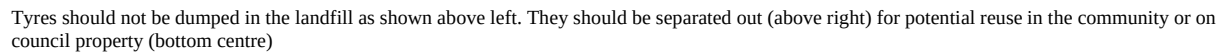


Better Practice Scenario: Tyres are stockpiled in a dedicated area and punctured to prevent water gathering. Reuse at the landfill and the community deals with some of the tyres, but really need a recycling service to deal with large stockpile.

Steps for Achieving Best Practice.

1. Designate a specific area at the landfill site for the separation of tyres.
2. Train council staff in correct storage procedure for tyres (puncture tyres).
3. Educate community in importance of separating and storing tyres carefully.
4. Conduct a clean up in the community to collect old tyres and remove them to the landfill.
5. Assess and monitor numbers of tyres generated per month, quarter, and year.
6. Investigate opportunities for reuse of tyres at the landfill and in the community
7. Investigate opportunities for recycling by external contractors etc, using estimated numbers of tyres generated in community.

1. HAZARD REDUCTION



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2. Environmental Protection

If planning new landfill or trench sites, you should contact your council Director of Infrastructure to make sure that any new construction is approved. A new landfill site requires environmental approval under the *NT Waste Management and Pollution Control (WMPC) Act*, but may also require EA as well, and so it is important that you let the council know if you need to make these big changes.

Poor practices such as contractors dumping large volumes of materials into pits, not separating out furniture and whitegoods and lack of compaction will all reduce the life of your trench or landfill. Through improved management, the lifetime of each trench and your whole landfill can be extended considerably.

Particularly when there is a large amount of construction, renovation or clean up happening in your community, you should be aware of where the materials are being disposed. Your council might have by laws or a policy on the disposal of contractors' waste. Contractors and visitors to the community must dispose of materials appropriately.

Although you don't require a licensed landfill if your community is smaller than 1,000 people, the Department of Natural Resources, Environment, The Arts and Sport (NRETAS) has environmental guidelines on tip management that may be useful for planning your landfill.

This section is focused on reducing the damage to the environment from waste management. This includes things like groundwater contamination, littering, pest and weed control and options for waste minimisation and recycling.

Included in this section:

- 2.01 Waste Minimisation, Reuse and Recycling
- 2.02 Groundwater and Leachate
- 2.03 Litter Control
- 2.04 Pest Control
- 2.05 Weed Control

Key Performance Area: 2 ENVIRONMENTAL PROTECTION



Before



After

Notes:

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Key Performance Area: 2. ENVIRONMENTAL PROTECTION

Focus: 2.01 Waste Minimisation, Reuse and Recycling

Reducing the waste you send to your landfill by reuse and recycling. Waste minimisation through reuse and recycling can save money, make your landfill last longer, reduce pollution and save wear and tear on your equipment.

Some simple first steps that can be taken are the separation and storage of large items - such as cars, whitegoods tyres; and making available containers for depositing smaller items - such as glass, aluminium, car batteries, paper, plastics and waste oil. Green (vegetation) waste can also be a major component of the wastes going to landfill. Where this is the case, you should consider recycling vegetation, possibly by mulching or storing it for use as firewood.

It is important to have a further use for materials that are separated for reuse and recycling, because excessive storage of materials may soon become a health hazard unless materials are kept dry and crushed to prevent the breeding of mosquitoes, cockroaches and similar insects.

Some features of a small recover and recycling facility are:

- A defined area for the unloading and loading of items
- An open fronted roofed area
- Colour coded bins, crates or defined bays where selected items can be placed
- A small hand operated crushing device for cans, or a baling machine for paper/cardboard.



Best Practice Statement: “Materials are reused or recycled as much as possible before disposal to landfill. Recycling programs are designed to target materials such as steel, aluminium, plastics, paper and construction materials. Household items, such as whitegoods and furniture are kept separate at the landfill site for repair and reuse within the community. The sale of these goods provides a small source of income for the maintenance of the reuse storage facility.”



Unacceptable Scenario: All materials go to landfill without any option for reuse or recycling.



Manageable Scenario: Bulky household items and some green wastes are separated from the landfill site for potential reuse. There is no real system in place yet to actually get reused items repaired or suitable for sale etc. Green wastes are collected either for use in gardens or for firewood.



Better Practice Scenario: Bulky items, including household and construction materials and green waste are separated out from the landfill, and separate drop off facilities are used by the community to place their materials in the appropriate place. Some container, paper and metal recycling is also taking place through a deposit scheme. The ability to have these things recycled is still a bit unsure because it is still costly to have these things transported into town.

Steps for Achieving Best Practice

1. Conduct a waste audit or a visual assessment to determine which materials in the landfill could be recovered, and which materials are taking up the most room in the landfill.
2. Work with the local businesses to see if you can limit the amount of packaging wastes
3. Designate separate areas for bulkier items for reuse, green waste, and construction materials.
4. Educate staff on the potential for reuse, and identify some areas or projects in the community that might benefit from this (e.g. using furniture in a community centre, construction materials to create an outdoor meeting place etc.)
5. Discuss with community members what priorities exist for a community based recycling program – such as a local container deposit scheme, drop off facilities, providing recycling bins, creating fuel ‘briquettes’ from recycled paper, use of green waste for composting and mulch.
6. Investigate options to work with nearby communities and the council to share resources, and nominate a shared drop off facility to accumulate a greater volume of recyclables for collection by a contractor or other. Discuss these options with the council.
7. Large items, like cars, whitegoods and tyres, can be grouped neatly by type to save space and help recovery. Areas for smaller recycled materials like glass, paper, plastic and waste oil should be checked and serviced regularly to ensure that they remain neat and tidy, and that bins and storage tanks do not

Focus: 2.02 Groundwater and Leachate

The pollution of surface and groundwater by leachate is a big concern for existing and new landfills. If any of the following are near or within your landfill site, you need to take extra care or even consider relocating:

- Water supply catchments or ground water recharge areas
- Wetlands or coastal and estuarine areas subject to tidal inundation or storm surge
- Areas which may be seasonally inundated, or are likely to be flooded in a major rain event
- Water bodies, watercourses or open drains.

Depending on the circumstances, high water table conditions may make your site unsuitable for use as a landfill. Relocating your landfill is incredibly costly, so careful management of what is disposed there and generally minimising the amount of waste can help to reduce the risk of contamination of groundwater by leachate.

To help achieve these goals the landfill site design should specify that the site be:

- Graded to drain water away from the waste disposal area or provided with a system of drains or diversion bunds to achieve the same effect
- Graded or drained to prevent water from ponding
- Provided with a final cover of low permeability soil that is compacted and graded to shed water.

For larger landfill sites groundwater protection, such as a layer of compacted clay or a synthetic liner, may also be required to prevent leachate from contaminating the groundwater.

In general, drains and diversion bunds should be capable of withstanding a 1 in 20 year rainfall event. Further advice on water management system design and on construction and maintenance of bunds, drains and leachate control works is available from NRETAS (contact details at the back of these guidelines).



Best Practice Statement: "Groundwater courses are known and waste run off is contained and well separated from groundwater sources. Landfill has been sited correctly. Not on high ground or on groundwater recharge area. Monitoring processes are in place to ensure any contamination can be detected early. Landfill is designed to the NRETAS specifications to reduce leachate and groundwater contamination."



Unacceptable Scenario: Extent of leachate and relationship to underground water courses is unknown, or landfill is known to be sited on a groundwater recharge area. Run off during wet periods is visibly going into creeks and waterways, and most likely into the groundwater. Trenches often fill with water as they are dug down.



Manageable Scenario: Groundwater courses are known, but the degree to which waste run off is contaminating them is unknown and leachate is probably still getting in there during high rain periods. No monitoring is in place to check run off and contamination.



Better Practice Scenario: Groundwater courses are known. Run off and leachate from the waste site are believed to be contained and managed through bunding and settling ponds; however no monitoring is in place at this time. A hydrologist or other 'expert' has given advice on location of landfill site.

Steps for Achieving Best Practice

1. Assess landfill site for run off and leachate. Try to map out where run off starts and ends up.
2. If trenches constantly fill up with water when dug, reconsider if this method is the best for your situation – could be better to use a cell method above ground
3. Channel water to control run off and direct it away from nearby water courses. This could be by digging channels down, or creating watercourses with clean materials to create an above ground 'bund'
4. Contact the council and investigate the options of engaging an 'expert' on siting of new landfills
5. Investigate long term monitoring around the landfill site (there are devices that can detect leachate before it gets to the groundwater).

Key Performance Area: 2 ENVIRONMENTAL PROTECTION



If water flow is not taken into consideration, trenches can fill up with water and overflow into nearby watercourses, creating contamination and pollution problems



Even in dry areas, trenches should be placed carefully so that they do not fill up with water or interfere with existing water courses. This trench (above) frequently fills up with water and silt as it has been dug in a creek bed.

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Focus: 2.03 Litter Control

Litter is a problem because it can attract pests and encourage fly borne disease and it pollutes the environment. Littering in communities is related to a number of factors, and one key thing is having bins that are put in the right place and are emptied often enough. You can conduct a litter survey and should work with your community to develop an education campaign. Keep Australia Beautiful Council (KABC) has a number of resources that might help with managing litter. Contact details are included at the back of this guide.

Litter is also a problem at all landfills; it is ugly and pollutes surrounding areas. Mesh fencing at the site perimeter and moveable fencing at the disposal area can be used to catch and reduce blowing litter. Litter fences should be maintained in good repair and the moveable fences should be checked periodically to ascertain whether they are working effectively, since changes in the orientation of the disposal area or in the direction of prevailing winds may significantly change the situation. This primary control should be followed up by regular patrols of the site, access road and adjacent properties to remove accumulated litter and return it to the disposal area.

Fencing around stores and households can also help to reduce litter and stop it blowing around the community. It also indicates which material the council is responsible for, and what the householders are responsible for.



Best Practice Statement: “Adequate bins are well placed in public areas as well as at households. Bins are emptied regularly and council staff maintains litter collection in public areas. Waterways and creeks are regularly cleaned up to remove any incidental litter, and as part of frequent community awareness campaigns. Supporting measures are in place to reduce the likelihood of litter.”



Unacceptable Scenario: There are no litter bins in the community; even household bins are inadequate – with no lids on those that exist. There’s no fencing at the landfill site nor any dedicated dump sites. Litter blows all around the community and gets stuck in trees and waterways.



Manageable Scenario: Some bins are in public areas but their collection is irregular and the bins have no lid, which means litter blows out all the time. There is a large perimeter fence at the landfill but it is poorly maintained and not high enough to capture litter.



Better Practice Scenario: Public areas have bins that are emptied regularly but they seem to be placed in areas that people don’t use them. Perimeter fencing at the landfill seems to be capturing a lot of litter but an internal fence would help to keep it even more contained.

Steps for Achieving Best Practice

1. Conduct a litter survey (contact KABC for more information and resources on litter surveys) to determine how much of a problem litter is in the community, and where it is a problem.
2. Work with the community to hold a community clean up or “emu bob” as an initial way to get rid of lots of litter, and as a regular (maybe monthly) activity to help maintain the area. It is a good idea to make it a bit more fun with a sausage sizzle or sporting event as well.
3. Ensure landfill site has a boundary fence, as well as internal moveable fences to help control litter inside the tip.
4. Work with your community to ensure households have boundary fences, to make it clear who is responsible for what litter, and to further reduce windblown wastes.
5. Look into planting some trees in and around the community and the landfill to work as windbreaks to reduce windblown litter.
6. Investigate the whole waste cycle – look at reducing packaging waste from the community store
7. Work with the community to develop education and communication activities around litter

Key Performance Area: 2 ENVIRONMENTAL PROTECTION



Without litter control, public amenity is damaged and windblown materials can pollute waterways and the community (above)



A perimeter fence (above) at your landfill site can reduce the amount of windblown litter in your community



Litter bins (left) placed in strategic locations can help to reduce the amount of litter dropped in the community

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Key Performance Area: 2. ENVIRONMENTAL PROTECTION

Focus: 2.04 Pest Control

Vermin and other pest animals (like rats and cats) often hang around landfill sites and rubbish bins. These pests seriously threaten local native animal populations and can transfer diseases to humans, either directly, or through contamination of food or other animals.

To protect public health and minimise harm to native animals an operational plan for animal control should be developed and implemented. Elements of the plan should include:

- Installation of appropriate fencing to prevent animals from gaining access to the wastes disposed of at the site
- Implementation of other controls (such as baiting and trapping programs and covering wastes with soil) to eradicate pests and to prevent animals from gaining access to, and harbouring in, the landfill.

DHF and NRETAS can provide advice on monitoring and control of vermin and feral animals. Contact details are at the back of this document



Best Practice Statement: “Material is covered with 120 mm designated fill cover daily. Bulky items are separated out to reduce the amount that needs to be covered. Organic waste is also separated out for composting to reduce putrescible waste at the landfill site. Landfill is well fenced to prevent dogs and larger pests from entering. Baiting or trapping is undertaken as needed to periodically eradicate pests. Bins in the community are emptied frequently and have lids.”



Unacceptable Scenario: There is no fencing on site and animals enter waste site freely and wander back around community. Putrescible waste remains uncovered for long periods, encouraging flies, rats and dogs to the area. Bins in community are rarely emptied on time, have no lids, and tend to harbour pests.



Manageable Scenario: Site is fenced although not well maintained. Bins in the community are generally emptied quite regularly, however many don't have lids and need repairing. Occasional baiting or trapping is undertaken, but only when situation becomes quite extreme and pests are well established.



Better Practice Scenario: Landfill fence is well maintained but seems to not be excluding pests. Have baiting or trapping in place, but might need to look at management practices because don't have enough fill to cover often enough.

Steps for Achieving Best Practice

1. Ensure bins in the community are well maintained, have lids and are regularly emptied.
2. Assess your landfill for the types of pests that you need to control, if the fencing is appropriate and what other methods might be needed to control
3. Make sure you have adequate fill at the landfill to cover putrescible waste and options for if you have an unusual event (such as an animal cull, see Section 1.06 – Animal Carcasses for more information) that could attract a lot of pests.
4. Work with community to ensure people are aware of the importance of pest control and how they can help reduce it by wrapping putrescible wastes and nappies prior to disposal.
5. [Clarify about the most appropriate type of fill]

Key Performance Area: 2 ENVIRONMENTAL PROTECTION



Feral animals are often attracted to materials disposed of at the landfill. Good management can help prevent feral animals from visiting your landfill and fences should be made durable enough to keep them out.

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Key Performance Area: 2. ENVIRONMENTAL PROTECTION

Focus: 2.05 Weed Control

Declared weeds disposed of at a landfill (e.g. mission grass) can readily spread from the site and cause problems with native plant populations and/or be poisonous to animals. Declared weeds should not be disposed of at a landfill unless the facility has been declared a designated weed disposal area under the *Weeds Management Act* but also note that the *Weeds Management Act* prohibits transportation of declared weeds over public roads, or from one property to another, without a permit.

Where weeds are found growing at the landfill they should be treated and destroyed in accordance with the requirements of the NRETAS Weeds Branch (contact details at the back of these guidelines). Staff maintaining the landfill should be able to identify the various types of declared weeds which may exist in the region so that they can monitor for their presence at the facility and undertake appropriate treatment and destruction action.



Best Practice Statement: "Weeds are identified in the community and at the landfill site. There is a special composting disposal area for weeds, where they are composted at high temperatures and turned into a useful resource to be used around the community. There is a weed management plan for the community"



Unacceptable Scenario: Council staff does not know how to identify weeds and therefore uncontrolled vegetation growth occurs at the landfill site. All green waste including potential weeds are disposed of with general waste.



Manageable Scenario: Staff can identify declared weeds and have a basic weed management plan in terms of a schedule of activities. Composting is done where possible but generally weeds are chemically sprayed or burnt.



Better Practice Scenario: Vegetation at the landfill site is monitored for weed activity but there are insufficient resources for weed control. Weeds are mostly removed within sufficient time (before seeding etc.) and are generally composted rather than burning. Weeds management plan although simple is well followed and updated, although could be made a bit more detailed.

Steps for Achieving Best Practice

1. Contact council or NT Weeds branch to see what weeds are problematic in your area and if there are any existing programs for weed control.
2. Assess your community and landfill to identify any weed infestations.
3. Designate a separate weed disposal area and set it up for composting.
4. Educate staff and community on identification and disposal of weeds.

Key Performance Area: 2 ENVIRONMENTAL PROTECTION



Weeds can quickly get out of control if they are not disposed of carefully at your landfill

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3. Service Delivery

Waste management is core business of local government, and this is supported in the *Local Government Act 2008*. Aside from the responsibilities under the act, waste management is also an essential community service and an area that you can really work closely with your community to develop some positive outcomes.

Waste management services extend to your role to provide training to council staff, a safe working environment and general good public amenity.

Engaging your community is important for successful waste management programs, and to help you deliver the best service. Local stores, businesses and licensed premises are important contributors to any litter control plan and can play a responsible role in community litter awareness and education.

Involving the community in the program, and generating community awareness around waste management will result in increased community pride, improved quality of life and living areas, promote community safety and reduce the risk of injuries to staff and community, reduction in vermin and pests, it could even create opportunities for business enterprises, such as reuse, arts, crafts and markets.

You can use these benefits when planning their awareness campaigns. When a community has a litter problem there are usually four basic issues that could be contributing to the cause:

- Infrastructure – number of bins in the right location, signage and educational material
- Service frequency
- Awareness of the impact and consequences of littering
- Education about the correct disposal of rubbish.

There are contact details in the back of these guidelines for Keep Australia Beautiful Council (NT) who can provide more information and support on community awareness and education campaigns.

Included in this section:

- 3.01 Education and Community Awareness
- 3.02 Occupational Health and Safety
- 3.03 Staff Training
- 3.04 Bins
- 3.05 Collection Vehicles
- 3.06 Collection of Waste
- 3.07 Frequency

Key Performance Area: 3. SERVICE DELIVERY



Notes:

[illegible]

Focus: 3.01 Education and Community Awareness

An important part of waste management is community awareness and education. You should conduct community liaison throughout the life of any waste management programs to ensure local communities are informed and aware of the program. Community liaison should be conducted in an open and timely fashion, and allow local knowledge to be obtained.

It is important that the community is able to readily contact an informed representative of the council regarding waste management and that queries are dealt with in a timely fashion. It is also important to gather local knowledge when determining the location of a new waste disposal site or any significant change to waste management services. A record of community comments regarding waste management programs should be maintained.

Community awareness campaigns can be targeted to sections of the community, such as school children or businesses, or they can involve the whole community. Awareness of waste problems can be generated by an event, or built up over time through news items and announcements in local and regional media.



Best Practice Statement: "Education campaigns have been specifically designed for the community, and address the specific needs of our community in waste management."



Unacceptable Scenario: There is little or no signage and the community is not kept informed about waste management programs and priorities. Education campaigns in the past have been developed without community input.



Manageable Scenario: Educational materials have been developed with limited input from the community



Better Practice Scenario: Community has been involved in some of the development of materials, however it could be done better.

Steps for Achieving Best Practice

Each community will be different when it comes to education and awareness, however when planning a community awareness campaign, consider how you can best achieve the following:

- Ensure everyone is aware of a problem and the solution you have in mind.
- Encourage community members to suggest ideas for running the project.
- Provide opportunities for people to get directly involved in solving the problem:
 - o choose times and days that will suit most people
 - o Break the project into tasks that can be done by various members of the community, such as school children, people with cars, older people, etc.
 - o perhaps arrange a child care centre for small children to free up their parents
- Provide the means to solve the problem (collection bins and bags, a vehicle to pick up waste, gloves, shovels, etc.)
- Acknowledge the efforts and achievements of your community (individuals, groups, or the community generally)
- Publicise the results so that people are aware of changes, improvements, and benefits (make announcements at gatherings, on local radio, or in local newspaper stories).

Key Performance Area: 3. SERVICE DELIVERY



Simple signage at your landfill will inform people of what restrictions there are on activities and penalties that may apply. Depending on your audience, you might need your signs to be in English or language, and pictures are helpful too.



A recycling station like this one above has a dual function, both as a place to dispose of recyclable materials and as education – it tells people what recycling is.

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Focus: 3.02 Occupational Health and Safety

You must provide a working environment that is safe for staff. You must also ensure that the health and safety of any other person is not adversely affected by the work. Some of the things you must do in complying with this requirement are:

- Providing and maintaining plant and equipment so that it is safe
- Developing, implementing and maintaining safe systems of work
- Ensuring the safe use, handling, storage and transporting of dangerous goods and hazardous substances
- Maintaining workplaces under your control and management in a condition that is safe and without risk to health
- Providing information, instruction, training and supervision to workers
- Ensuring visitors to your community are aware of the safety requirements.

An important aspect of safety when dealing with waste is correct Personal Protective Equipment (PPE). Appropriate PPE for all staff working with waste includes solid boots, thick gloves, long pants and long sleeved shirt, high visibility vests or markings if possible and eye protection such as goggles. Sun safety gear is also recommended as many staff will be working out in the sun for extended periods.

Another aspect of any operational position, such as working with waste, is developing Safe Working Method Statements (SWMS). These are simple statements that explain each step in a task or work method, and how to do it safely.

Further information about workplace safety from is available from the NT WorkSafe website:
<http://www.worksafe.nt.gov.au/>



Best Practice Statement: "All council staff is routinely and regularly trained in safe work methods. PPE is available for all council staff. At any time there is at least one council staff member who has first aid training on duty. Safe Work Method Statements exist for all processes. In the event of an OHS incident, there is an incident reporting strategy to ensure any OHS incidents are investigated and followed up. Council staff has been vaccinated as necessary for handling waste."



Unacceptable Scenario: Council staff has never been trained in their work tasks; they just turn up and follow basic instructions. No safety gear is provided; council staff is expected to wear adequate clothing. Contractors and anyone can access the tip site, without any control or guidance as to the safety requirements.



Manageable Scenario: Council staff is generally using safe working methods but they don't have adequate equipment. There is some makeshift signage talking about safety, but it isn't comprehensive. Safety breaches or incidents don't usually get reported.



Better Practice Scenario: Council staff has been trained early on, although this hasn't been well recorded or updated. There is no strategic plan targeted skill sets or safety requirement. There is some incident reporting, but outcomes are not really followed up.

Steps for Achieving Best Practice

1. Develop Safe Work Method Statements (SWMS) for each work task that council staff is involved in.
2. Train in safe use of equipment and use of SWMS.
3. Supply and maintain PPE for all council staff
4. Ensure at least one permanent council staff member, preferably the supervisor, has a current first aid certificate.
5. Develop an incident reporting processes to monitor any safety breaches.

3. SERVICE DELIVERY



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Focus: 3.03 Staff Training

Council staff involved in waste management need to be trained in the safe working methods and operational requirements of the job, including operating any equipment. Depending on the size of your community, you may decide to have council staff presents at the landfill site during operational hours. Council staff can perform tasks such as sorting materials as they are delivered or assisting residents and other users in putting materials in the right place. Council staff should also have training in personal occupational health and safety and suitable personal protective equipment should be provided. This should include steel cap safety boots, leather work gloves, and coverall clothing. It is recommended that council staff also be trained in fire suppression if burning of waste is to take place. Training in weed identification and control would also be useful for effectively managing the site. Other levels of training relevant to waste management operations include that listed in the table below.

There are Registered Training Organisations (RTOs) that provide specialised training for waste management workers in the Northern Territory. This includes the Batchelor Institute of Indigenous Tertiary Education (BIITE) who offer different level Certificates in Indigenous Environmental Health and Charles Darwin University (CDU) who have a school for Remote Indigenous Knowledge. Contact details are at the back of these guidelines



Best Practice Statement: “All council staff has been trained in the necessary aspects of waste management. A council staff training register is used to plan out future training and make sure that there are no gaps in skills or qualifications. Training is scheduled for review annually or as necessary.”



Unacceptable Scenario: Council staff has not received any waste management or OHS training, or there are no records to support past training efforts.



Manageable Scenario: Council staff has received some *ad hoc* OHS training but not a lot of specific waste management training, and there are some out of date records of this. No training plan is in place to plan and track progression.



Better Practice Scenario: Council staff has received OHS and some specific waste management training, there are records of who and when this occurred. There is no training plan yet, but one is being developed.

Steps for Achieving Best Practice

1. Start a training register – this doesn't have to be a complex document, just a list of names, dates of training and type of training.
2. Conduct initial OHS training for all Council Staff – if you aren't sure how to do this, contact your council.

Key Performance Area: 3. SERVICE DELIVERY

Areas For Waste Management Council Staff Training

Topic	Subjects
Waste acceptance	- Identification of wastes and hazards - Accepted wastes - Covering waste loads - Recording waste data
Emergency and safety	- OHS requirements and safety plan - Emergency response plan - Manual handling of waste - First Aid - Personal Protective Equipment - Risk identification and management processes
Operating Systems	- Policy/management systems/procedures - Use of site plant and equipment - Storage and covering of wastes - Site maintenance requirements
Customer Service	- Customer inquiries and complaints procedures - How to educate the public about waste management issues
Environment	- Environmental management systems and strategies - Potential environmental impacts from operations and appropriate controls

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Focus: 3.04 Bins

In small communities and outstations, modified 44 gallon drums are often used as garbage bins. These bins are increasingly not considered to be ideal for disposing of waste, for several reasons. These include the safety risk to workers lifting and emptying bins, the lack of lid, and the increased likelihood for community members to burn waste at the household level.

Mobile Garbage Bins (MGB) or “Wheelie Bins” are widely accepted as being the best storage container for household waste for the following reasons:

- its long service life (>10 years)
- storage capacity (up to 240L)
- close fitting lid (fly proof)
- stability
- portability (wheeled to where it is required)
- Price (bins are affordable).

Lockable posts can also be obtained for MGBs that secure the bin upright. The Australian Standards for bin design indicate that household waste bins should have a red lid, while recycling bins should have a yellow lid. If provided, garden vegetation (green waste) bins should have a green lid.



Best Practice Statement: “Wheelie bins are used by households and in public places. Households store their own bin on their property, and bring it out for collection on the nominated day. Bins are regularly emptied, and there are spare bins kept at the depot for replacements and public events.”



Unacceptable Scenario: Houses have drums and regularly burn their waste. Council workers have to empty out the remaining rubbish and ash. No lids on the bins means lots of flies and odour around bin areas, litter often blows out of bins.



Manageable Scenario: There are some wheelie bins in the community, but still many drums being used. Bins are poorly maintained, with no spares. Bins are also not very compatible with trucks or collection vehicles, meaning that collection staff is emptying them unsafely.



Better Practice Scenario: All houses have wheelie bins, although there still seems to be some drums being used occasionally. The wheelie bins are pretty well suited for the collection vehicle, but they are often damaged. Some education and community awareness could be needed for improving community use of bins.

Steps for Achieving Best Practice

1. Investigate options for acquiring wheelie bins for your community.
2. Talk to the community about the benefits of wheelie bins instead of drums; try to get some wheelie bins to demonstrate the difference.
3. Find out whether your collection vehicle will work with wheelie bins, and what is necessary to adapt it to the wheelie bins.
4. Once you have wheelie bins for your community, work on community awareness as you roll them out.
5. You may need to install lockable posts to stop your bins being knocked over.

Key Performance Area: 3. SERVICE DELIVERY



Often old metal drums are used as bins, and the waste is burned. This is now generally considered to be an inadequate bin and should be phased out, along with the burning of waste



Mobile Garbage Bins (MGBs) or “Wheelie” bins are widely used across Australia, and the world. They are durable, environmentally sound, safe and easy to use. These bins should be brought into communities where infrastructure exists to empty them.

Notes:

[illegible]

Focus: 3.05 Collection Vehicles

The type of collection vehicle which your community needs depends is dependant on things like garbage bin type and status of local roads. A four-wheel-drive vehicle may be required to negotiate difficult roads during the wet season. A rear lifter garbage truck allows collection of bulky items such as mattresses, whereas a side arm lifter does not.



Best Practice Statement: "Collection vehicles are appropriate to the task, are well maintained and meet OHS requirements. Vehicle is a trailer that can be connected to other vehicles and has a hydraulic lift and tipper. It is simple to use and easy to maintain, and is easily and effectively charged (for hydraulic lifter). There is a secure storage place onsite and an alternate, back up vehicle available in case of breakdowns."



Unacceptable Scenario: There isn't really a proper collection vehicle, just use an open trailer, where rubbish is dumped in from bins. Staff has to manually lift bins into it. There are no ramps to make it easier to wheel up. Staff is not adequately licensed or trained in using larger vehicles.



Manageable Scenario: The collection vehicle is difficult to use but has a ramp or a basic lifter. Collection vehicle is not very versatile or might be too big for community needs. Collection vehicle needs a HR or other additional licence, which few if any people in the community have. Breakdowns are common and there is no back up collection vehicle.



Better Practice Scenario: Collection vehicle is fine but no there is back up available. There is no secure vehicle storage and maintenance is not as frequent as it could be.

Steps for Achieving Best Practice

1. Find out how many of each bin type are in the community (drums and wheelie bins).
2. Examine existing collection vehicles to determine if they are appropriate to the bins that you have, and what modifications might be necessary to increase compatibility. Don't necessarily upgrade your drum collection vehicle for a wheelie bin collection vehicle if there are still lots of drums in the community.
3. Contact the council to see if there are other vehicles you can use
4. Assess other community vehicles, such as trailers to determine if they can be used or modified for a back up vehicle.
5. Train council staff in how to use your various collection vehicles SAFELY so they don't injure themselves or damage the vehicles.
6. Make sure council staff has the correct licences to drive the collection vehicles. If some collection vehicles require a special licence, make sure there's more than one person in the community with that type of licence.
7. Review maintenance schedule for collection vehicles to ensure regular maintenance.

Key Performance Area: 3. SERVICE DELIVERY



Collection vehicles in your community should be “fit for purpose”. It is important that they are compatible with the bins you have in your community and are easily maintained. The trailer (top left) is good if you still have old drums in your community, and can be attached to a variety of vehicles, but if you are thinking to upgrade to wheelie bins, you might need a rear loader (top right) that can take both drums and wheelie bins.

Notes:

[illegible]

Focus: 3.06 Collection of Waste

There are a number of factors that contribute to your waste collection service and your community needs, including:

- Population – and how much it changes with seasons
- The average number of residents per house
- What are the consumption characteristics, and what things are sold in your community store
- Climate (for green waste generation)
- Bin size and type
- Waste reduction activities such as recycling
- Non resident waste generation (e.g. tourists, tour operators, local industries).

You should consider having separate and regular collections for rubbish, recycling, and green waste and bulky items.



Best Practice Statement: “Waste is collected from households on a weekly basis, using ‘wheelie’ bins and loaded into the truck on a mechanised system, e.g. a ‘rear loading’ truck. Waste is sorted at household / source for specific collections which are well advertised and coordinated. There is clear signage and education to support the different types of collections and drop off points.”



Unacceptable Scenario: Waste is rarely collected from households and so many people burn waste or take it to the landfill themselves, where it is poorly disposed.



Manageable Scenario: Household collections happen, although pretty sporadic. There is only one type of collection (for household waste) although occasionally special collections are done on request (for bulky items etc.). Collection vehicle is often in poor working condition.



Better Practice Scenario: Household collections are regular and reliable, although there is only a collection for waste, not for special materials. Special collections are arranged periodically to collect bulky items, green waste, dangerous goods. Collection vehicle is in relatively good condition, and there is a back up option for break down days.

Steps for Achieving Best Practice

1. Talk with community members about what kind of waste collection they prefer.
2. Assess waste for volume and component to determine how often and what kinds of materials can be collected.
3. Ensure community has a reliable collection vehicle (with possible back up option).
4. Provide community with appropriate bins (appropriate in size, number and type).
5. Make collection schedules well known in the community, as well as what to do if there’s been a problem with the service.
6. Monitor numbers of collections and schedule maintenance of vehicles.
7. Be mindful of special events in the community that might require additional collections.

Key Performance Area: 3. SERVICE DELIVERY



Notes:

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Focus: 3.07 Collection Frequency

Collection frequency is determined by the number of residents and the amount of waste generated. In some remote communities more frequent pick ups better than having larger bins. But, if the collection service is too frequent residents may leave bins out on the roadside permanently which can attract animals, encourage vandalism and littering. Over-servicing of bins adds unnecessary expense to the community in terms of fuel, vehicle, wear and tear costs, and labour costs. Under-servicing can result in overflowing bins with rubbish spilled on the ground. Collection services should be explained to residents and users and include details on:

- Garbage collection days
- Recycling collection days and what is accepted
- Bin placement for ease of service.

Many councils also offer an annual large item collection service. In the Top End of the Northern Territory, this is an important service as it allows people to dispose of large items before the cyclone season when such objects can potentially become dangerous debris during storms. It is still a useful service in non cyclone areas as it encourages people to do a cleanup of bulky items.



Best Practice Statement: "Waste is collected from households once per week (or as determined to be appropriate), on the nominated day. When collected, bins are generally close to full, but not overflowing. Occasional clean up or once off collections are arranged to target specific types of waste such as green waste, or chemical waste."



Unacceptable Scenario: Collection of waste is completely unmonitored and random, usually only happening once bins are overflowing and messy. Community has no idea when to put bins out for collection, so they are left out all the time, get knocked over by wind and animals and cause a mess.



Manageable Scenario: Collection definitely occurs in community, but is not regular. Some bins are really full, and others are really empty when they are emptied.



Better Practice Scenario: Collection is regular, a few times per week. Bins are generally quite empty when they are picked up. Might need to reduce the number of collections or look at smaller bins

Steps for Achieving Best Practice

1. Conduct a waste audit or assessment of your community; monitor how full the bins are over a period of time. This will give you an idea of how much waste you are generating in the community.
2. If bins are always empty upon collection then maybe you need to decrease the frequency of your collection. If they are always very full, you might want to consider having more frequent collections.
3. Decide on which day/s you will be collecting household waste, and publicise this in the community. Make sure people know when to expect the collection, and how often.
4. If you decide to have collections for other things (e.g. bulky items or chemical clean outs) make sure that they are often enough that people don't dispose of them in the normal waste, or dump them at the landfill themselves.

Key Performance Area:

3. SERVICE DELIVERY



Notes:

[illegible]

4. Ongoing Site Management

Landfill siting requires detailed investigation and you should not start a new site in your community without consulting with the council and the relevant agencies, for example NRETAS and DHF. When deciding where to locate a new site, you will need to consider the following: site capacity; hydrology; local topography and soils; adjacent land uses; aboriginal and heritage issues; climate; local flora and fauna; and road access. NRETAS has developed guidelines on the siting and management of landfill facilities; they can be accessed at www.nt.gov.au/nreta/environment/waste/guidelines/pdf/landfillguidelines.pdf.

You need to consider the local climatic conditions when siting a waste disposal facility. For example: during heavy rainfall events which occur in the Territory, even sites with minimal slopes can have severe erosion (through sheetflow runoff). Additional care should be taken with drainage works and sites that are not protected from prevailing winds that will require extra provisions in order to control litter and dust.

Landfill boundaries need to be clearly identified to ensure that the landfill does not extend beyond its 'footprint' or onto any adjoining allotments.

As much as possible, you should try to have a landfill site that you can use for decades into the future. Aside from good siting of your landfill, you can extend the life of your current site with good management. Extending the life of your landfill will also save you money and help to protect your local environment. Ideally the landfill should be big enough to have enough trenches or area to hold waste for at least ten years. Usually for design purposes in smaller communities, it is assumed that each person produces about 800 to 1000 kg of waste a year. The amount of waste that is generated in your community might vary significantly from this depending on the following:

- Availability of transport to and from the community – which determines how many people visit your community and how you can move things around
- Closeness to source of supplies – will affect what kinds of materials you have in your community, and what packaging is used to transport things
- Social structure of community
- Standard of housing which include the age of housing, likely quantity of demolition and new housing waste materials.

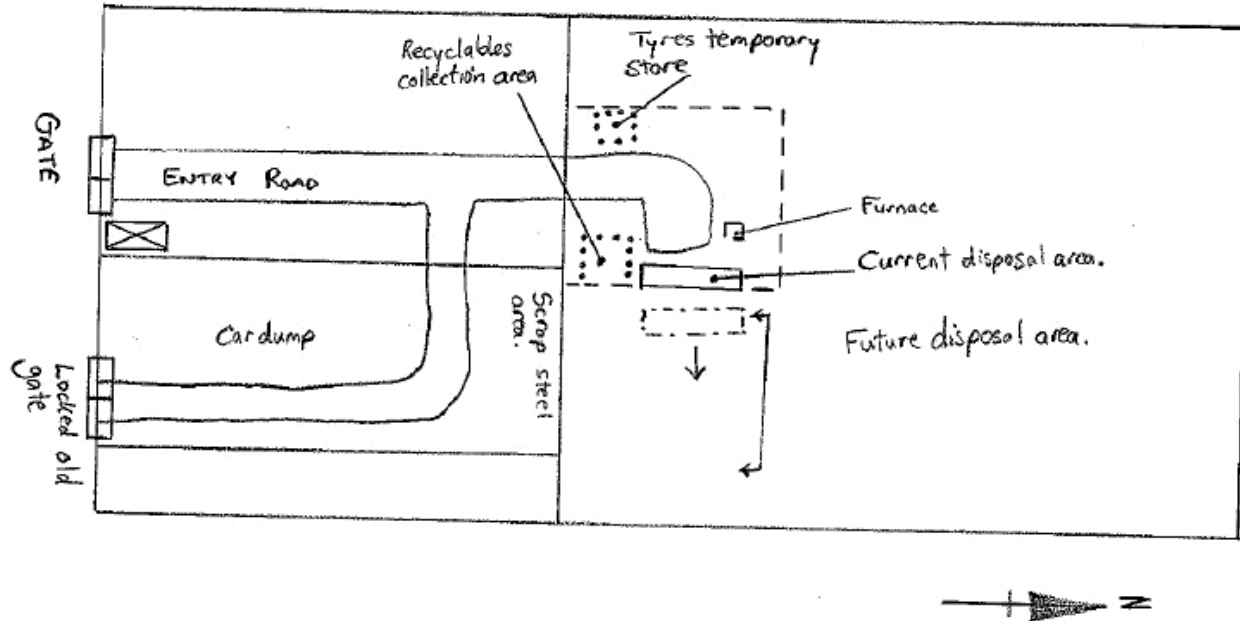
Simple things like separating car bodies, construction waste and bulky household items like fridges and furniture will extend the life of the landfill; using vegetation on your covered waste site will help prevent wind blown debris and reduce the need for additional fencing.

Other aspects of site management include improving the occupational health and safety of staff and the community, making sure you have the right equipment to manage the work required and restricting access to the site.

Included in this section:

- 4.01 Plant and Equipment
- 4.02 Security and fencing
- 4.03 Access to Tip Face
- 4.04 Signage
- 4.05 Separation of Materials
- 4.06 Emergency Management Plan

Key Performance Area: 4. ONGOING SITE MANAGEMENT



The design of your landfill site doesn't have to be too technical (see above), but it is important to have a plan or map of the area so that you can develop a good operational plan, monitor run off and plan for future development.

Notes:

[illegible]

Focus: 4.01 Plant and Equipment

Suitable equipment for compacting and covering wastes should at least be available to carry out operations for the site. Outstation communities with limited access to equipment should be assessed on a case by case basis to determine practicalities of removal of waste on a periodic basis.

Any equipment should be chosen for its ability to:

- Be fit-for-purpose, with the most appropriate functions for the needs of the community
- Give trouble-free service and be easily maintained onsite
- Run economically
- Be easily stored securely – you might consider smaller sized equipment that can be locked away in a work shed or shipping container
- Necessary licensing for operation – be careful of equipment which requires additional licensing as you might not have people in the community with necessary licences.

You may find that a variety of equipment can give adequate service but in general the larger the population served by the landfill, the more robust the equipment will have to be to enable the landfill to be operated efficiently and effectively.

Depending on supply of cover material you might need haul trucks, dozers, and loaders. At larger sites these may be permanent fixtures but at most sites they will have to be supplied on a periodic basis, by the councils or outside contractors.

Equipment for combating small fires, e.g. fire extinguishers, water tanks, pumps and hoses - should be available at larger sites, and in those areas of high fire risk. Sites with periodic or minimal supervision onsite might only need a water tank or a fire extinguisher. In such cases, the local fire authority may be able to provide equipment and fire fighting services.

It is useful to have vehicle washing areas to help prevent waste materials and soil being transported off site. Wash down facilities should be constructed so that they have:

- An impervious hardstand
- A suitable water supply
- An appropriate wastewater collection and disposal system.



Best Practice Statement: “Equipment onsite is well maintained and appropriate to the tasks and environment of the community. Equipment that is not used frequently is kept at a centralised depot and shared amongst communities within the council. At a minimum, have access to a back hoe and front end loader. Equipment is stored securely onsite and maintenance logs are updated.”



Unacceptable Scenario: There is no appropriate equipment in the community to undertake even simple tasks, like waste collection. Equipment was present but is in complete disrepair.



Manageable Scenario: Some basic plant and equipment exists onsite, but no maintenance records. Nearby communities are also assessing their equipment and options will exist for shared equipment in the future. Some storage in community, but it is not well secured. Some equipment is inappropriate to the community, in terms of tasks, size, function etc.



Better Practice Scenario: Plant and equipment are sufficient for community needs, and additional equipment is available as necessary from the council. Equipment is generally well maintained, but long distances and costs sometimes result in things being unusable for considerable periods of time. Storage is secure.

Steps for Achieving Best Practice

1. Work with your council asset manager to assess all existing plant and equipment for condition reports.
2. Update, or commence, maintenance registry, including condition reports.
3. Ensure equipment storage area is secure and sufficient for existing equipment.

4. ONGOING SITE MANAGEMENT



The type of plant and equipment to have in your community for ongoing site management will depend on your needs. A small front loader (above left) can be useful to push waste up, dig small trenches and generally maintain your landfill site. If you have recycling programs, a simple mobile compaction unit (above right) could be shared between communities.

Notes:

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Key Performance Area: 4 ONGOING SITE MANAGEMENT

Focus: 4.02 Security and fencing

Fencing at your site can help with the following:

- Control access to, and movement within, the site
- Reduce the dumping area to a minimal practical size
- Provide litter control
- Protect areas which are undergoing decommissioning and rehabilitation.

As well as external fencing to the landfill site, fencing within the site is necessary to help control a number of issues, e.g. 1.02 m high, three strand wire fencing may be adequate to protect areas being rehabilitated, while two or more panels consisting of 2 m high chicken wire mesh on a large steel frame would be appropriate for litter control. Moveable fences around the active landfill trench can be moved with the filling of the trench.

Recommended fencing for landfill perimeters (from NRETAS Guidelines) is between 1200 mm wire for small sites up to 1800 mm wire mesh security fencing for large, licensed landfill sites.

It is also important to remember the purpose of the fencing, i.e. to keep some things in and other things out. If you have feral animals in your area, they may damage your fence. If you have prevailing winds, you will need fencing to reduce windblown litter from the landfill site. Planting vegetation around the landfill helps improve the visual amenity of the site and provides wind barriers to help control dust and minimise blowing litter.



Best Practice Statement: "Site is open only during standard business hours, and is locked outside of these hours. Signage is present that indicates this. Around the site there is a permanent 1800 mm high feral-proof fence. Within the site there are a variety of smaller, movable fences to control litter, restrict access to dangerous areas and to guide users to the correct disposal sites."



Unacceptable Scenario: There is no fencing at all onsite. Litter blows around and into community; feral animals wander through site and scavenge at the tip face. There is no restriction of access or security onsite.



Manageable Scenario: External fencing is present, but not high or strong enough. There is no internal fencing, so there is still plenty of litter around.



Better Practice Scenario: External fencing is adequate height but may be damaged by feral animals. Some experimentation is being done to reduce feral animal impacts such as attaching tin cans to the fence or using solar powered electric fencing.

Steps for Achieving Best Practice

1. Work with community to determine external boundary of landfill site (refer to NRETAS Guidelines for more information).
2. Determine fencing needs for your site, as in height, material and distance.
3. Assess materials at landfill site to see if anything can be used for movable internal fencing.
4. Regularly inspect fencing for damage and repair as early as possible.

Key Performance Area: 4. ONGOING SITE MANAGEMENT



An appropriate perimeter fence (above left) will keep feral animals out of your landfill site and help to prevent inappropriate dumping of materials. It also acts as a wind break to reduce the amount of litter (above right) that blows around your landfill. You should also consider internal and movable fences within your site to further control litter and dumping of materials

Notes:

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Key Performance Area: 4 ONGOING SITE MANAGEMENT

Focus: 4.03 Access to Tip Face

The active 'tip face' is the part of your landfill or dumpsite that is open and actively being dumped at. If your tip face is very large, it is difficult to control litter, materials start to break down in the open air, vermin and feral animals have access to the waste and generally it becomes a bigger task to manage. By restricting the 'active' tip face, you reduce the amount of open and exposed waste that is at your site, and reduce a lot of the issues associated with that.

Using earth bunding around the tip face of unmanned sites is also important for the safe operation of vehicles, to prevent accidental reversing into trench or similar.



Best Practice Statement: "Public access to tip face is restricted to a strip of only 2 m along the trench, which is clearly indicated by appropriate signage. Access is restricted using some earth bunding, preventing vehicles from backing up to the site, and fencing. Council staff regularly inspect the site to ensure materials are not dumped outside the tip face, and that inappropriate items don't remain in the tip face."



Unacceptable Scenario: Tip face is completely open to anyone to dump anywhere. Trench is full to different levels, rarely covered over, often burnt, and all sorts of materials are dumped in there. No machinery can get into the tip face to compact or push it up.



Manageable Scenario: Tip face is open to anyone, although some ad hoc bunding restricts where materials are dumped. Trench is wide enough for machinery to get in there, but it is rarely compacted, pushed up or covered. Staff occasionally visit site and push up waste, although they often don't have adequate equipment to do this.



Better Practice Scenario: Tip face is restricted using some quite good bunding. Material is pushed up regularly, when equipment is available, but not really compacted. Inappropriate materials are often disposed of at the face, and staff try to remove them when possible.

Steps for Achieving Best Practice

1. Decide what part of the tip is best for access, a section of only about 2 m to 5 m.
2. Restrict open tip face area using internal fencing or bunding.
3. Using what machinery or equipment is available, compact or push wastes up to one end.
4. Cover waste regularly, and consider use of vegetation to assist in covering and dust suppression.
5. Ensure council staff monitor site to remove inappropriate items from tip.
6. As access area become full, open more of the tip face up along the trench site, being sure to restrict access to full area.

4. ONGOING SITE MANAGEMENT



Notes:

[illegible]

Focus: 4.04 Signage

One of the most simple things you can do to improve management of your landfill site is put signs up so that people know what goes where. Without signs, you can't expect people to put their materials in the right place. Signs don't have to be expensive, detailed or technical. Using pictures instead of words will help address issues of different languages. Simple arrows and directions signs can also help to guide people where to drive at the site.



Best Practice Statement: "Signs are locally and culturally appropriate, using graphics and local language to support the message. Where relevant they refer to appropriate legislation and possible penalties. Signs are durable, made of steel with weatherproof paint to Australian Standards. Different signs are used for different audiences and purposes. Signs refer to disposal processes, safety processes, opening hours, access to site, contact details."



Unacceptable Scenario: There is no signage anywhere on the site.



Manageable Scenario: Signs are present but are unclear or irrelevant. They are poorly made and not very durable. Written only in English and display no graphics.



Better Practice Scenario: Signage is present and generally well maintained, although doesn't indicate penalties or legislation for incorrect disposal. There is not enough detail in some of the signs (like safety practices, and emergency contact details).

Steps for Achieving Best Practice

1. Decide on the information that needs to be sign posted (good idea to do a 'walk through' of the site and think which things need to be pointed out).
2. Work with community and staff to ensure message is clear and culturally appropriate.
3. Gather materials from within the community (possibly from the landfill site) that could be re-used for signage.
4. Consider working with community centre or school to design signs. Maybe have a drawing or art competition?
5. Signs containing information for users of the landfill should be posted at the entrance and at appropriate points within the facility.
6. As a guide, the following information should be included in your signs:
 - Name of the facility (possibly the community name, or street name)
 - Owner and operator of the facility (i.e. council council, or community name), including contact details for reporting emergency situations, making inquiries, registering complaints etc.
 - Hours of operation of the site
 - Any arrangements or facilities for separation of materials, recycling and reuse of material
 - Wastes which should not be dumped at the landfill (and who to contact for advice on acceptable methods for disposal of such wastes)
 - Areas that are not open to the public, e.g. areas under rehabilitation or construction, or hazardous disposal points
 - Controls over scavenging, lighting or fires, littering and illegal dumping
 - Prohibited materials – see Section 1.04 for more information on prohibited wastes
 - Prohibited activities (e.g. litter on approach roads, burning waste or unauthorised disposal of waste) and the penalties for offences.

4. ONGOING SITE MANAGEMENT



Signage doesn't have to be highly technical or professional. It is better to have some kind of signage to give people direction for dumping materials, than to wait until you have enough money for more professional signs. You can even re-use scrap materials gathered from the landfill site as signs. It can help to educate people – for example, using a car door for a sign that points to car bodies, using a fridge door to point to whitegoods disposal.

Notes:

Key Performance Area: 4 ONGOING SITE MANAGEMENT

Focus: 4.05 Separation of Materials

Although recycling options are limited in small communities, the separation of materials at the landfill site will have major benefits to your waste management. Aside from the importance of separating dangerous goods (see Key Performance Area 1 - Hazard Reduction), other benefits include, but aren't limited to:

- Minimise reliance on plant and equipment because less damage when pushing up, and less need for compaction and pushing up
- Increase the longevity of your tip by not having bulky items disposed there
- Provide materials for reuse for community, such as wood for firewood, building materials, and furniture.

Some good examples of reusing of materials include tyres used for bunding and fencing at the landfill or in the community, washing machine bowls and other bulky items can be used as small garden beds or plant holders, building materials reused to create shade spaces or dog kennels in the community. The list is endless!



Best Practice Statement: "Only final residual waste is disposed of at the landfill. All bulky materials, paper, cardboard, containers and green waste are separated out. The site is well planned, easily accessed and clearly signposted. Materials separated include septage, hazardous wastes, construction materials, large bulky items, cars, whitegoods, carcasses, trees, recyclable materials."



Unacceptable Scenario: No separation at all, with everything going into the one trench.



Manageable Scenario: Some separation of bulky items such as cars and whitegoods, and some dangerous goods such as batteries and used oil, but there is no signage at the site. Separation of these materials is not enforced or managed by any staff.



Better Practice Scenario: Nearly all bulky and dangerous goods are separated out from the landfill, and some reuse projects are in place. Signage is present. Staff monitor the site, because a number of incorrect items still end up in the trench.

Steps for Achieving Best Practice

1. Set up drop off bays within the boundary of your landfill, away from the active tip face or trench.
2. Create "yes" signs for the various items to be separated, as well as "no" signs to stop items going in the wrong place.
3. Investigate ways these items could be reused in the community, and investigate collections for items that can't be reused (e.g. lead acid batteries).
4. Work with community to target specific items (such as batteries) around the community.
5. Arrange for separate household collection of bulky items, green waste and dangerous goods.

4. ONGOING SITE MANAGEMENT



Notes:

[illegible]

Key Performance Area: 4 ONGOING SITE MANAGEMENT

Focus: 4.06 Emergency Management Plan

Because of the nature of materials being disposed at landfill sites, you could have urgent or emergency situations that require a fast response. This could be things like uncontrolled fires onsite, flooding, chemical spills, damaged asbestos, contaminated food items or even a sudden influx of medical wastes.

The aim of an emergency management plan is to clarify management strategies and structures that are needed to coordinate events of that may be a declared or non declared emergency within the community. These events may be beyond the capacity of your community to effectively manage or control, however it is important that you have a clearly defined strategy to ensure the event is managed by the appropriate and capable authorities when necessary.

Developing a simple emergency management plan, and making sure all staff is aware of what to do in these situations can really reduce the risk of a bad situation getting much worse.



Best Practice Statement: “An Emergency Management Plan is in place and is reviewed regularly. Topics include floods, hazardous wastes, fire, high wind events, workplace injury, and storm conditions. Identify risky seasons and schedule preparedness measures. Identify equipment and processes to manage. The planning and location of facility should be to mitigate risks.



Unacceptable Scenario: Site has not ever been assessed for emergency procedures. No plan or preparation in place



Manageable Scenario: Some plans for emergencies exist, although they aren't all kept together and are very outdated. Emergency procedures are not known by staff or the community. Emergency equipment may be present, but it is not known.



Better Practice Scenario: An emergency management plan has been written, but not all staff has been trained or briefed in procedures. Much of the equipment needed for full emergency preparedness is not yet present onsite.

Steps for Achieving Best Practice

1. Contact LGANT for resources on emergency planning.
2. Conduct a 'walk through' of waste site to identify issues that may require emergency response.
3. Consider each issue and determine how you could address them in an emergency situation.

Key Performance Area:

4. ONGOING SITE MANAGEMENT



Some examples of simple fire fighting equipment



Notes:

[illegible]

Important Contact Details

Agency / Organisation	Most Relevant Position	Contact Details
Department of Natural Resources, Environment, The Arts and Sport (NRETAS)	Environmental Operations	Darwin – (08) 8924-4046; (08) 8924 4137 Alice Springs - (08) 8951-9201
Department of Health and Families (DHF)	Environmental Health Program Officers, including Environmental Health Officers	Greater Darwin Region - (08) 8922 7377 East Arnhem - (08) 8987 0440 / 8987 0441 Katherine – (08) 8973 9061 / 8973 9062 Barkly – (08) 8962 4302 Central Australia - (08) 8955 6122
Department of Local Government and Housing	Regional Managers	<u>Alice Springs Regional Manager</u> Leichhardt Building, 21 Gregory Tce, Alice Springs NT 0870 p...(08) 8951 5616 f...(08) 8951 5539 <u>Darwin Regional Manager</u> 1st Floor, RCG House, 83-85 Smith Street Darwin NT 0800 p... (08) 8999-8437 f... (08) 8999-8403 <u>Katherine Regional Manager</u> Government Centre, Ground Floor, First Street Katherine NT 0851 p...(08) 8973 8519 f... (08) 8973 8999 <u>Gove Regional Manager</u> Arnhem Shopping Village, Arnhem Road Nhulunbuy, NT 0881 p...(08) 8987 0528 f.. (08) 8987 0353 <u>Tennant Creek Regional Manager</u> First Floor Government Centre, Peko Road Tennant Creek NT 0861 p...(08) 8962 4387 f...(08) 8962 4430
The Centre for Appropriate Technology	Waste Management Research Officer	(08) 8951-4322
NT WorkSafe		Darwin – 1800 019 115, 08 8999 5141 Katherine – 08 8973 8416; 08 8973 8930 Alice Springs - (08) 8951 8682 (08) 8951 8618
Keep Australia Beautiful Council (NT)	CEO	(08) 8981-5535
Katherine West Health Board	Environmental Health Officer	(08) 8971-9315
Charles Darwin University	School of Australian Indigenous Knowledge Systems	(08) 8946-7749
Batchelor Institute of Indigenous Tertiary Education	Lecturer – Environmental Health	p... (08) 8939-7348 f... (08) 8939-7123
Cleanaway	Community Education Officer	p... (08) 8935 1110
Shire services managers	[to be inserted]	
Council Director of Infrastructure	[to be inserted]	
Council Asset & Works Manager	[to be inserted]	

Appendix B – Risk Matrix

An environmental risk assessment was undertaken for the Project during the EIS phase. The risk assessment identified the risk source (hazard and event), receptors and potential impact. The consequence and likelihood were determined using the descriptions identified in Table B1 and Table B2 respectively. The risk matrix is provided in Table B3.

Table B1 Consequence Description

Consequence	Insignificant	Minor environmental impact. Impacts are contained on-site and short term in nature. No detrimental effect on the environment.
	1	Minor repairable damage to common historic structures or sites. No disturbance of cultural heritage sites.
	Minor	Minor local habitat modification and / or lifecycle disruption for a listed species. No loss of individuals of listed species.
		Negligible soil impact. Chemical concentrations are above background but below EILs.
	2	No detectable change to background water quality. No exceedance of background and applicable Water Quality guidelines.
	Moderate	Moderate, unplanned localised environmental impact (may be of a temporary nature) or discharge contained on-site or with negligible off-site impact.
		Moderate but repairable damage to important historic structures or sites of cultural importance.
	3	Moderate local habitat modification and / or lifecycle disruption for a listed species. Minor local decrease in size of population(s) of listed species.
	Major	Localised soil impact. Low level <2 times exceedance of EILs.
		Local short-term minor exceedance of background and applicable Water Quality guidelines.
	Critical	Significant, unplanned environmental impact contained on-site or minor impact that is off-site.
		Considerable damage or infringement to sensitive historic structures or sites of cultural significance.
	4	Substantial local habitat modification and / or lifecycle disruption for a listed species. Moderate local decrease in size of population(s) of listed species.
		Localised long term or widespread short term soil impact. Chemical concentrations 2-5 times EILs.
	5	Local long-term or widespread short-term exceedance of background and applicable Water Quality guidelines.
		Major or widespread, unplanned environmental impact on or off-site. Could include substantial pollutant discharges. Significant resources required to respond and rehabilitate.
	Critical	Major damage or infringement to sensitive historic structures or sites of cultural significance.
		Moderate regional habitat modification and / or lifecycle disruption for a listed species. Substantial local decrease in size of population(s) of listed species.
	5	Widespread and / or long term impact to soils. Chemical concentrations 5-10 times EILs.
		Local, permanent or widespread, long-term exceedance of background and applicable Water Quality guidelines.
	Critical	Extensive long term environmental harm or harm that is very widespread. Could include extensive pollutant discharges. Impacts permanent or unlikely to be reversible within 10 years.
		Unsalvageable and permanent damage to sensitive historic structures or sites of cultural significance.
	5	Substantial regional habitat modification and / or lifecycle disruption for a listed species. Moderate or substantial regional decrease in size of population(s) of listed species.
		Irreversible and / or extensive impact to soils. Chemical concentrations >10 times the ecological investigation levels (EILs).
	5	Widespread, permanent exceedance of background and applicable Water Quality guidelines.
	5	
	5	

Table B2 Likelihood Description

Likelihood	Rare 1	Unlikely 2	Possible 3	Likely 4	Almost Certain 5
Description	The event may occur only in exceptional circumstances.	The event could occur at some time.	The event might occur at some time.	The event will probably occur in most circumstances.	The event is expected to occur in most circumstances.
Occurrence Intervals	>10 years	5 – 10 years	2 – 5 years	1 – 2 years	1 year

Table B3 Risk Matrix

			Severity of Consequence				
			Critical	Major	Significant	Moderate	Minor)
			5	4	3	2	1
Likelihood of Consequence	Almost Certain	5	Extreme	Extreme	High	High	Medium
	Likely	4	Extreme	High	High	Medium	Medium
	Possible	3	Extreme	High	Medium	Medium	Low
	Unlikely	2	High	Medium	Medium	Low	Very Low
	Rare	1	Medium	Medium	Low	Low	Very Low

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Appendix H – Water Management Plan

The background of the entire page is a photograph of a river or stream flowing through a wooded area. The water is calm, reflecting the surrounding trees and sky. The banks are covered with dense vegetation, including tall trees and shrubs. The overall scene is peaceful and natural.

TNG Limited
Mount Peake
Water Management Plan

December 2015

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1. Introduction

This Water Management Plan (WMP) has been prepared by GHD for the Mount Peake Project (Project).

Mining projects have the potential to have significant impacts on groundwater and surface water resources, and in order to safeguard these resources management plans are prepared to address site specific water issues.

This plan describes and justifies how TNG intends to manage water issues over the life of the mine. This is a dynamic document and will need to be revised as the Project is developed.

1.1 Project overview

The Mount Peak Project will comprise:

- The mining of a polymetallic ore body through an open-pit truck and shovel operation
- Processing of the ore to produce a magnetite concentrate
- Road haulage of the concentrate to a new railway siding and loadout facility on the Alice Springs to Darwin railway near Adnera
- Rail transport of the concentrate to TNG's proposed Darwin Refinery located at Middle Arm, Darwin.

A layout for the overall Project site and detail of the mine site layout are provided in Figure 1-1 and Figure 1-2 respectively.

Mining of ore will occur at a rate of up to 8.4 million tonnes per annum (Mtpa).

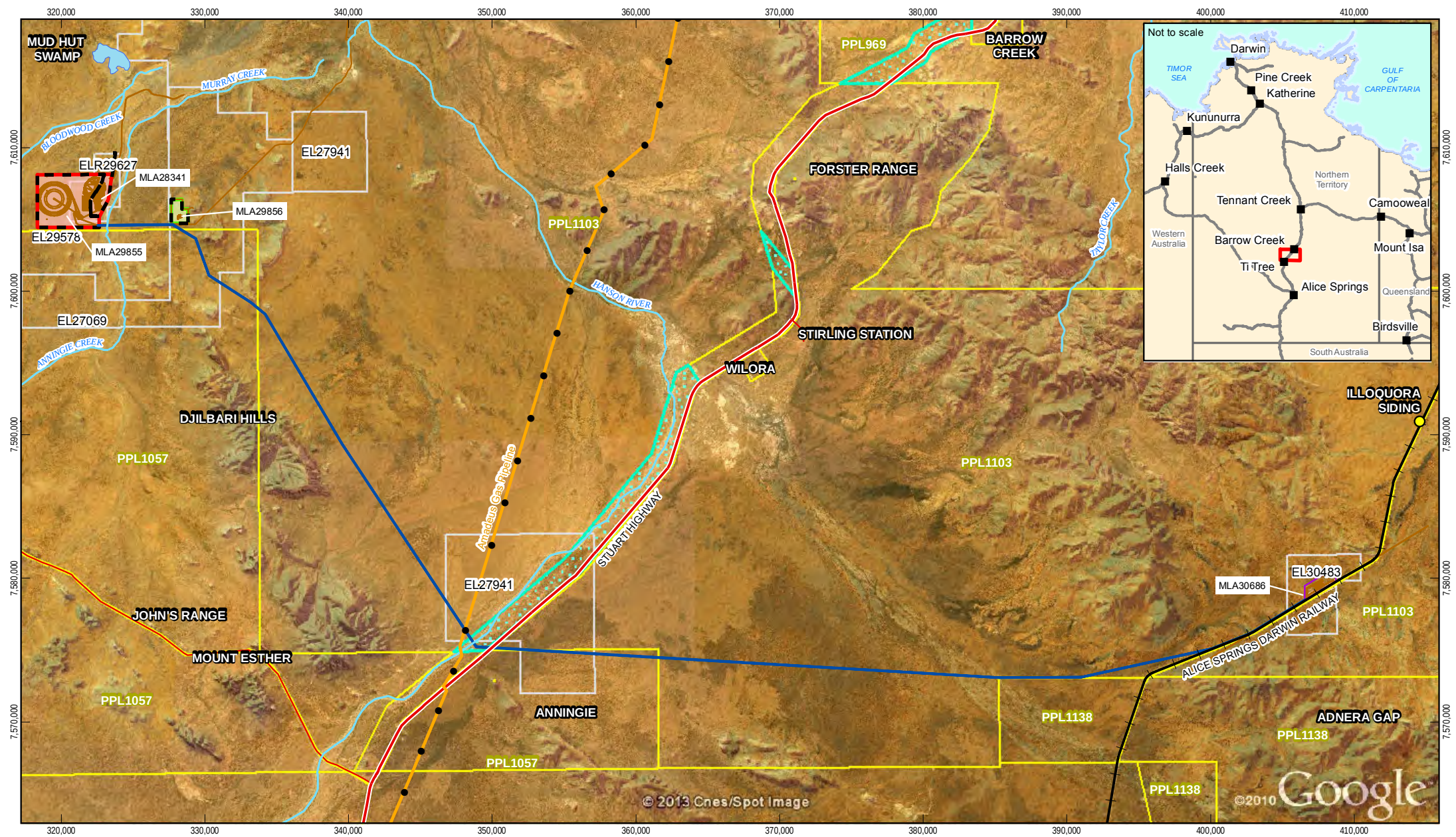
Ore processing involves crushing, grinding and magnetic separation to produce a magnetite concentrate. Plant throughput will be 3 Mtpa initially, doubling to 6 Mtpa in year 5. Up to 1.8 Mtpa of concentrate will be produced. The concentrate will have a moisture content of 10% w/w. This will be stockpiled in a concentrate storage area. The plant will produce up to 4.2 Mtpa of tailings.

The concentrate will be trucked via the access road to a new rail siding and loadout facility at Adnera. Trucks will side dump concentrate to a stockpile adjacent to the rail siding. The stockpile will have storage capacity of up to 150,000 tonnes.

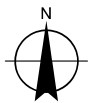
The Project will require approximately 2.6 Gigalitres per annum (GLpa) of water for mining, processing, dust suppression and potable use. A borefield will be established within the alluvial aquifer of the Hanson River. Around 12 supply and standby bores will be installed. A water supply pipeline will be constructed between the borefield and the site, a distance of approximately 49 km.

An accommodation village will be established to the east of the mine site. The construction and operation workforces are estimated to peak at 225 and 170 personnel respectively. The workforces will be largely fly-in fly-out due to low population numbers in the local area. Workers will fly to Ti Tree and will then be bussed to site.

The life of the Project is expected to be 19 years inclusive of construction (2 years) operations (15 years) and closure (2 years).



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Kilometres
Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 53



LEGEND

Illoquora Siding	Amadeus Gas Pipeline	Crown Land
Principal Road	Mine Site Facilities	Mount Peake Granted Tenements
Minor Road	Mud Hut Swamp	Mount Peake Mineral Leases
Major Watercourses	Rail Siding Loading Facility	Cadastral Boundaries
Railway	Mount Peake Mining Area	Access Road
	Camp Facilities	



TNG Ltd
Mount Peake EIS

Job Number 61-29057
Revision A
Date 23 Oct 2015

Project Location
Mount Peake Project Area

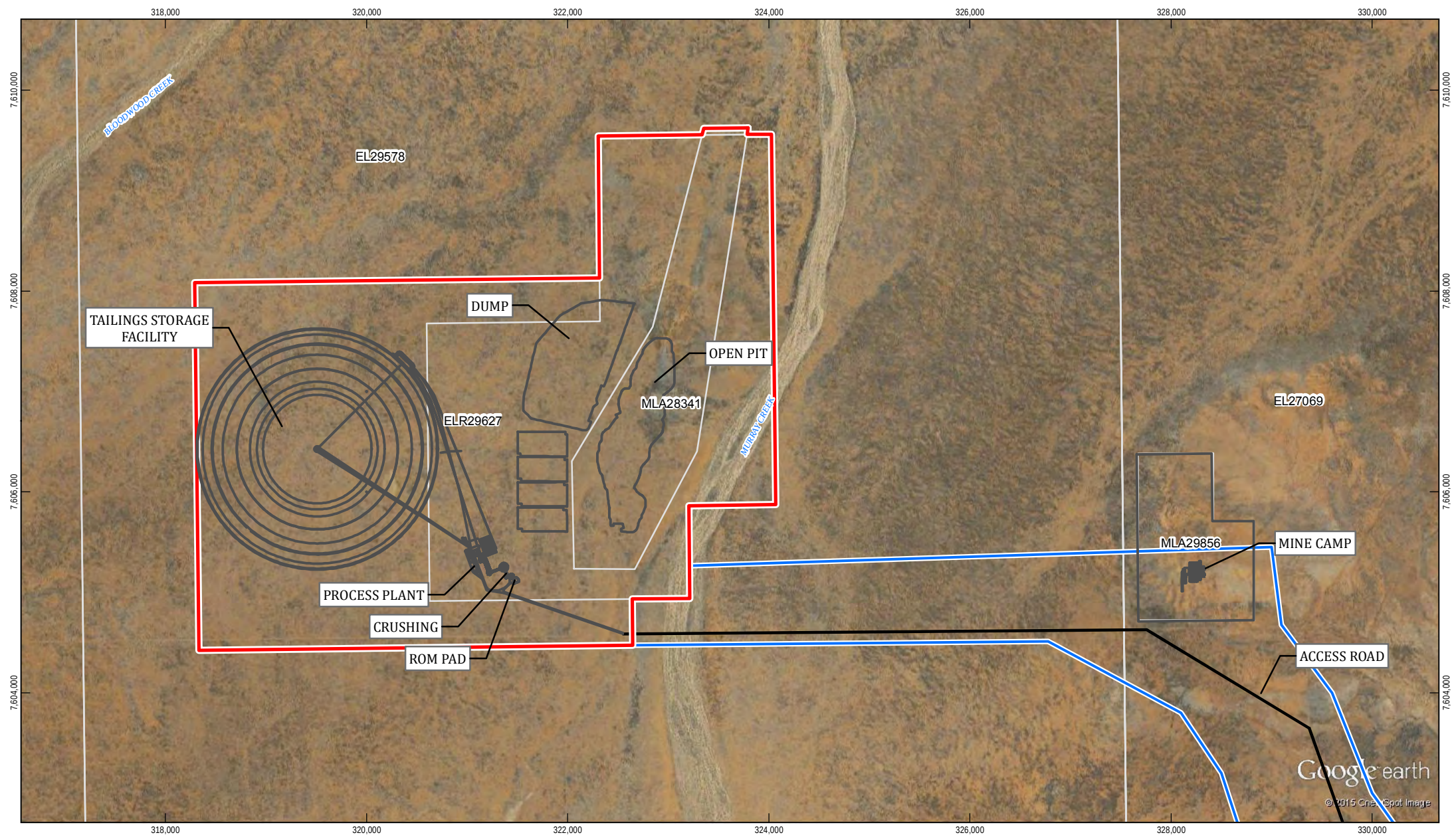
Figure 1-1

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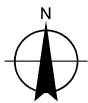
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Data source: TNG - Gas / Slurry Pipeline Study Corridor, Camp Facilities, Transport Study Corridor, Mount Peake Mining Area, Mount Peake Granted Tenements (2015). Geoscience Australia - Waterways, mainland, placename, road (2008). Google Earth Pro - Imagery (Date extracted: 13/02/2014). Created by: RB



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Kilometres
Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 53



LEGEND

- Mine Site Facilities
- Access Road
- Mount Peake Granted Tenements
- Transport Study Corridor
- Mount Peake Mining Area



TNG Ltd
Mount Peake EIS

Job Number 61-29057
Revision A
Date 26 Oct 2015

Mine Site Detail
Mount Peake Project Area

Figure 1-2

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Google: Imagery - 20150910; TNG Ltd: Mine site facilities, access road, mining area, Tenure - 20151021

The Project will consist of the following main features:

- One open pit
- One waste rock dump (WRD) with up to 70 Mt capacity
- One thickened tailings storage facility (TSF) with up to 63.4 Mt capacity
- Temporary ore stockpile facility – four stockpiles of up to 4 Mt each
- One beneficiation plant including a Run of Mine (ROM) pad, crushing and grinding plants, magnetic separation and product (concentrate) stockpiles
- One gas fired power station
- One main access road from the mine to the Stuart Highway and rail siding
- One rail siding
- Water supply bore field
- Ancillary infrastructure - accommodation village, access tracks, power lines, site roads etc.

1.2 Purpose

This WMP is a reference and guidance document that has been prepared to assist the operations in safeguarding the surface water and groundwater resources within and around the Project. The WMP has been designed to track the operations surface water and groundwater use and potential changes that may occur as a result of the operations.

This management plan is a 'living document' and it will be revised as the Project develops.

The Terms of Reference for the Project (NT EPA 2014) includes specific reference to the requirements for the WMP, including the following:

To mitigate likely impacts of the action on groundwater and surface water resources, the EIS should contain a detailed Water Management Plan that outlines clear and concise mitigation measures. The purpose of the plan is to maintain and protect both the quality and quantity of ground and surface water resources.

"All mitigation and monitoring measures in the Water Management Plan should be consistent with best practice advice from relevant Northern Territory and Australian Government advisory agencies. The Water Management Plan must include but not be limited to measures that:

- *avoid contamination of surface or groundwater resources;*
- *ensure the protection and resilience of water dependent ecosystems;*
- *protect and monitor water quality and levels for existing users of bores and/or surface waters;*
- *avoid the exposure of livestock to salt or other chemical substances which may be harmful; and*
- *treat and manage domestic wastewater and sewage."*

In addition to the above requirements, the Terms of Reference state that the WMP should outline details of the monitoring program that will be implemented throughout the life of the project. The monitoring program should:

- *identify clear thresholds and contingency measures should operational activities affect water quality on the site.*
- *describe programs monitoring for leaks /spills /escape of hazardous materials from pipelines, storage facilities (including TSF) and transport operations to ensure protection of local soils, aquifers, environments, workers and the public.*

This management plan addresses these conditions.

1.3 Objectives

The objectives of the WMP are to:

- Define management requirements to reduce potential water related risks associated with the project
- Establish surface water, mine affected water (water in storage onsite), groundwater, mitigation measures and sediment and biological sampling regimes and processes
- Provide a management process for surface and mine affected water across the Project to monitor potential impacts and inform management decisions.

2. Current conditions

2.1 Surface water

2.1.1 Catchments and key surface water features

Drainage tends to transition from annular water courses generally controlled by geology, to highly distributed channels associated with the formation of extensive alluvial fans. Groundwater recharge is likely in the vicinity of these fans. Water courses are typically sandy and highly braided. Surface water flow within the Project area is likely to spread laterally from channels across the extensive floodplain environment as low energy sheetflow. Sediment transport is most likely dependent on the magnitude of the event, with larger events responsible for sediment transport and channel formation.

Given the alluvial nature of terrain and the presence of ephemeral surface water drainage systems with floodout zones and palaeodrainage channels, there is potential for significant surface water - groundwater interactions within the vicinity of the creeks and rivers.

Watercourses generally flow north, with a number of smaller watercourses originating out of rocky outcrops into the surrounding plains. Key water courses in the vicinity of the Project site include Murray Creek, Bloodwood Creek, the Hanson River and Wood Duck Creek (Figure 2-1). Murray Creek and Bloodwood Creek are tributaries of the Hanson River, the main watercourse draining the western part of the Ti-Tree Basin. The proposed access road will cross Murray Creek, Wood Duck Creek and the Hanson River.

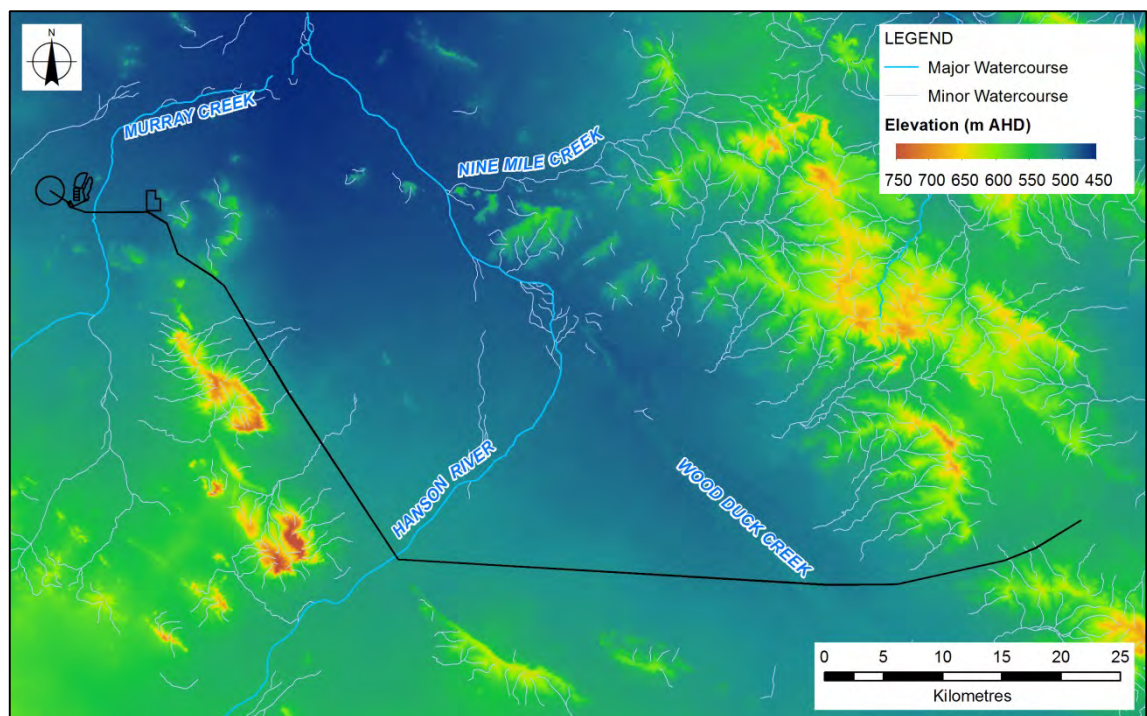


Figure 2-1 Locality plan depicting major waterways

The alluvial floodplains that separate the channels are referred to as floodouts, a term which has broad application and includes places where a drainage channel becomes subdivided, indistinct or disappears completely and water from the channel is dispersed across a plain or between dunes (Duguid *et al.* 2005). Several of the water courses are considered to be joined, with shared floodouts in large flood events.

A number of minor watercourses emanate from the Djilbari Hills in the vicinity of Mistake and Gingers Bores, flowing northwards before terminating a short distance later in the sandplain. Runoff is ephemeral and likely to be rapid in the foothills but slowing substantially on the plain.

Mud Hut Swamp, located in the floodout area of the Bloodwood Creek, and Stirling Swamp (Anmatyerr North Site), an interim floodout area for the Hanson River, are both listed as Sites of Conservation Significance (NRETAS 2009a, b). The channel of the Hanson River becomes ill defined, or braided, in the vicinity of Stirling Swamp, before becoming more defined again downstream.

The Hanson River rises in the Reynolds Range (also referred to as the Anmatijira Range) to the south west of the Project site, and flows north flooding out into the Tanami Desert, west of Tennant Creek. This floodout area is considered an important source for groundwater recharges (Duguid *et al.* 2005).

The Australian Natural Resources Atlas (ANRA) indicates that the Hanson River flows once in every 12 years on average (ANRA 2013). The Department of Infrastructure, Planning and Environment (2002) found that regional rivers located in the Ti Tree Groundwater Basin are only likely to flow when monthly rainfall exceeds 100 mm, with this threshold being achieved approximately once every two years on average.

2.1.2 Hydrological assessment

Floodway crossings are proposed at Murray Creek and the Hanson River. These crossings would not be expected to interrupt natural streamflow and geomorphological processes, but would require ongoing maintenance to ensure accessibility. There is no evidence of a single specific drainage line associated with Wood Duck Creek and surface flows in this vicinity are likely to present as sheet flow. Given the relatively long length of this crossing, regularly spaced and appropriately sized culverts are recommended.

An assessment of the hydraulics of the access road floodways was undertaken (GHD 2015). Peak discharges were estimated at the access road floodways across Murray Creek, Hanson River and Wood Duck Creek. Floodway flow depths were estimated and an assessment of the flow durations was undertaken for a range of storm event durations between 24 and 72 hours. The resulting flow depths and durations are summarised in Table 2-1.

Table 2-1 Key catchment flows durations and depths

Target catchment	Peak flow depths (m) by ARI		
	10-year	20-year	50-year
Murray Creek	0.42	0.76	0.99
Hanson River	1.44	1.81	2.15
Wood Duck Creek	0.37	0.51	0.71
Target catchment	Flow duration (hours) by ARI		
	10-year	20-year	50-year
Murray Creek	25-27	35-51	43-86
Hanson River	81-129	81-129	91-129
Wood Duck Creek	93-104	98-117	107-148

A mine site flood risk assessment was undertaken (GHD 2015). The resulting flooding extents along Murray Creek in the vicinity of the mine site indicate that the mine site is not expected to experience any significant flooding for events up to the 50-year ARI. However, a bench of lower lying topography in the vicinity of the proposed pit may be prone to flooding during more extreme events. Further investigation is required to establish the need for flood protection measures in this area.

Sheetflow processes occur along the access road within the alluvial plains to the east of Stuart Highway. No specific drainage lines have been defined and regularly spaced and appropriately sized culverts will be installed across the access road to prevent the creation of sheetflow shadow zones.

Sediment sampling was undertaken to characterise sediment quality as a proxy for water quality given the infrequent nature of flow events in the region. Samples revealed that particle size distribution ranges from sand and gravel to fines and sand. Sediment pH ranges from neutral to very strongly acid and sediment electrical conductivity was observed to be very low. Whilst metals were detected at concentrations above the Limit of Reporting (LOR) in the fluvial samples, none of the sediment samples exceeded the respective ANZECC sediment guideline for metals. No total recoverable hydrocarbon analytes exceeded their respective LOR.

2.2 Surface water quality

Due to the infrequent nature of surface water flow within the Project area, no sampling of surface water has yet been undertaken, however a single baseline sediment sampling exercise was undertaken as a proxy for surface water quality.

Sediment sampling locations were selected based on an initial desktop assessment considering the mine plan, transport corridor and environmental site characteristics. Locations were selected such that they are unlikely to be disturbed by mining activities and the monitoring points would remain active throughout the life of the mine. These sampling locations will be similar to those used during the ongoing monitoring program as further discussed in Section 5.

Sediment sampling locations include:

- **Murray Creek:** Upstream (SS-01) and downstream (SS-02) of the mine site
- **Bloodwood Creek:** At the discharge channel to Mud Hut Swamp (SS-03) and within Mud Hut Swamp (SS-08)
- **Hanson River:** At four locations, two along the highway (SS-06 and SS-07), one near the borefield (SS-04), and one downstream of the borefield (SS-05)
- **Unnamed creeks:** small creek near Gingers Bore that flows towards Hanson River (SS-09). Small creek that flows towards Stirling Swamp (SS-10).

Sampling results indicated the sediments were predominately sands, with fine sands and gravels. Laboratory analysis of the samples indicated the following:

- Sediment pH was found to range from neutral (pH 7.2, at Bloodwood Creek) to very strongly acid (pH 3.2, at the borefield location on Hanson River). The sediment pH of the majority of sediment samples is considered strongly acid to very strongly acid based on the interpretation of sediment pH (1:5 soil/water ratios)
- Electrical conductivity (EC), which is a measure of sediment salinity level was very low (3 uS/cm, SS-06) to slight (70 uS/cm, SS-10), with the water classified as non-saline and suitable for drinking and irrigation (Rhoades *et al.* 1992)

- Where metals were detected at concentrations above the laboratory reporting limits, the sediment concentrations were within the observed range of background levels reported for Australian soils (Hazelton and Murphy 2007). None of the sediment samples exceeded the respective ANZECC sediment guideline for metals where available. Concentrations of metal parameters were consistently reported highest at monitoring location SS-10, corresponding with the site with highest proportion of sediment fines
- Sediment total nitrogen concentrations ranged from <20 mg/kg (LOR, multiple sites) to 730 mg/kg (SS-10), with the majority of the total nitrogen concentration comprising total kjeldhal nitrogen (>90%)
- Sediment total phosphorus concentrations ranged from 9 mg/kg (SS-06) to 306 mg/kg (SS-10). Filterable reactive phosphorus concentrations ranged from <0.1 mg/kg (LOR, SS-01 and SS-02) and 1.6 mg/kg (SS-10)
- No total recoverable hydrocarbons were detected above the laboratory reporting limits.

2.3 Groundwater

In general the basement rocks of the region (Arunta and Georgina geological provinces) are not well studied in terms of their groundwater potential, largely a result of the regions remoteness. The deep basins may offer groundwater resources, but groundwater drilling investigations have generally focused on providing water for communities or for stock watering. As such only relatively minor yields have been required so drilling of production bores would tend to cease at relatively shallow depths once sufficient yield was obtained (Ride 2007).

Regional aquifer mapping by the Department of Land Resources Management (Tickell 2013) summarises that the general Project area contains two predominant aquifer types that are termed local scale aquifers only:

- Fractured and weathered rocks with minor groundwater resources
- Fractured and weathered rocks.

The fractured rock aquifers are likely to offer generally low groundwater yields. In addition to the two units that dominate the Project region, the Ti Tree basin is mapped as an aquifer of 'Unconsolidated sediments with intergranular porosity'. This unit is not mapped as continuing through the identified palaeovalley of the Hanson River (see further discussion below).

2.3.1 Cainozoic basins and palaeovalley systems

In addition to the broad fractured rock systems that are possibly present throughout the study area, a number of significant Cainozoic basins and palaeovalley systems have been identified within or adjacent to the Project area (Tickell 2013). The palaeovalley and sedimentary basins are relict drainage features that formed between 2 and 65 million years ago. Aquifer systems are present within the river sands and gravels that formed the channel systems within these relict drainage features.

These systems have been mapped and described in the publication "Water for Australia's arid zone – identifying and assessing Australia's palaeovalley groundwater resources" (English *et al.* 2012). A brief summary of these systems is provided in the following sections.

Ti Tree Basin

The Ti Tree Basin is the most studied and the most exploited groundwater resource in the region. The groundwater potential of the basin has been the focus of various government reports and policies since the early 1960s. The Basin is an intracratonic Cainozoic basin that is infilled with up to several hundred metres of alluvial and lacustrine sediments.

The basin is approximately 100 km wide from east to west and 75 km north to south. The basin sediments are known to be in excess of 300 m in depth, however the upper 100 m of sediments is most commonly targeted for groundwater abstraction. The primary use of the groundwater is for horticultural purposes. Data indicates that abstraction from the Ti Tree went through a period of increasing demand up to around 2005 when a maximum of around 4 GL/annum was abstracted. Demand has reduced since 2005 with the current demand being less than 2 GL/annum.

Groundwater within the basin generally flows from south to north, with discharge known to occur towards the Hanson River and Stirling Swamp. The Stirling Swamp area may be an expression of discharge from the Ti Tree aquifer where evapotranspiration could be a major component of the water balance for the aquifer.

Hanson River palaeovalley

The extent of the palaeovalley was determined through assessment of spatial data, including existing geological mapping, satellite imagery and available drilling data. It is recognised that within the Hanson River area, drilling data is relatively limited; therefore the mapped extent of the palaeovalley could be highly speculative (Tickell 2013).

The Hanson River palaeovalley is mapped as continuing from the northern discharge of the Ti Tree Basin, passing through Stirling Swamp and connecting with the existing Hanson River Channel. The channel then passes through the Project area before continuing north for approximately 200 km before it merges with the Palparti palaeovalley. The Hanson River palaeovalley is generally around 4 km wide, but as narrow as 2 km and as wide as 10 km.

With the exception of work undertaken by TNG, there has been no known groundwater investigative drilling undertaken in the area of the Hanson River palaeovalley. Drilling within the identified extents of the system has been limited to stock bores. Stock bores are generally successful in terms of yield, and in some instances may have not fully intersected the aquifer.

Utilisation of the Hanson River palaeovalley is currently limited to the stock bores. The majority of bores being equipped with solar powered low volume shaft driven pumps, which are used to fill water tanks that keep cattle troughs filled.

2.4 Water Control Districts

The Department of Land Resource Management declares Water Control Districts in areas that need close management of water resources. Managing of the water resource will avoid stressing groundwater reserves, river flows or wetlands.

The Project area lies within the Western Davenport Water Control District, which covers an area of almost 25,000 km² (Figure 2-2). From the west it includes the Hanson River and the proposed location of the borefield, and extends east to cover most of Murray Downs Station. The Stuart Highway bisects the District passing through Barrow Creek, Wycliffe Well and Wauchope.

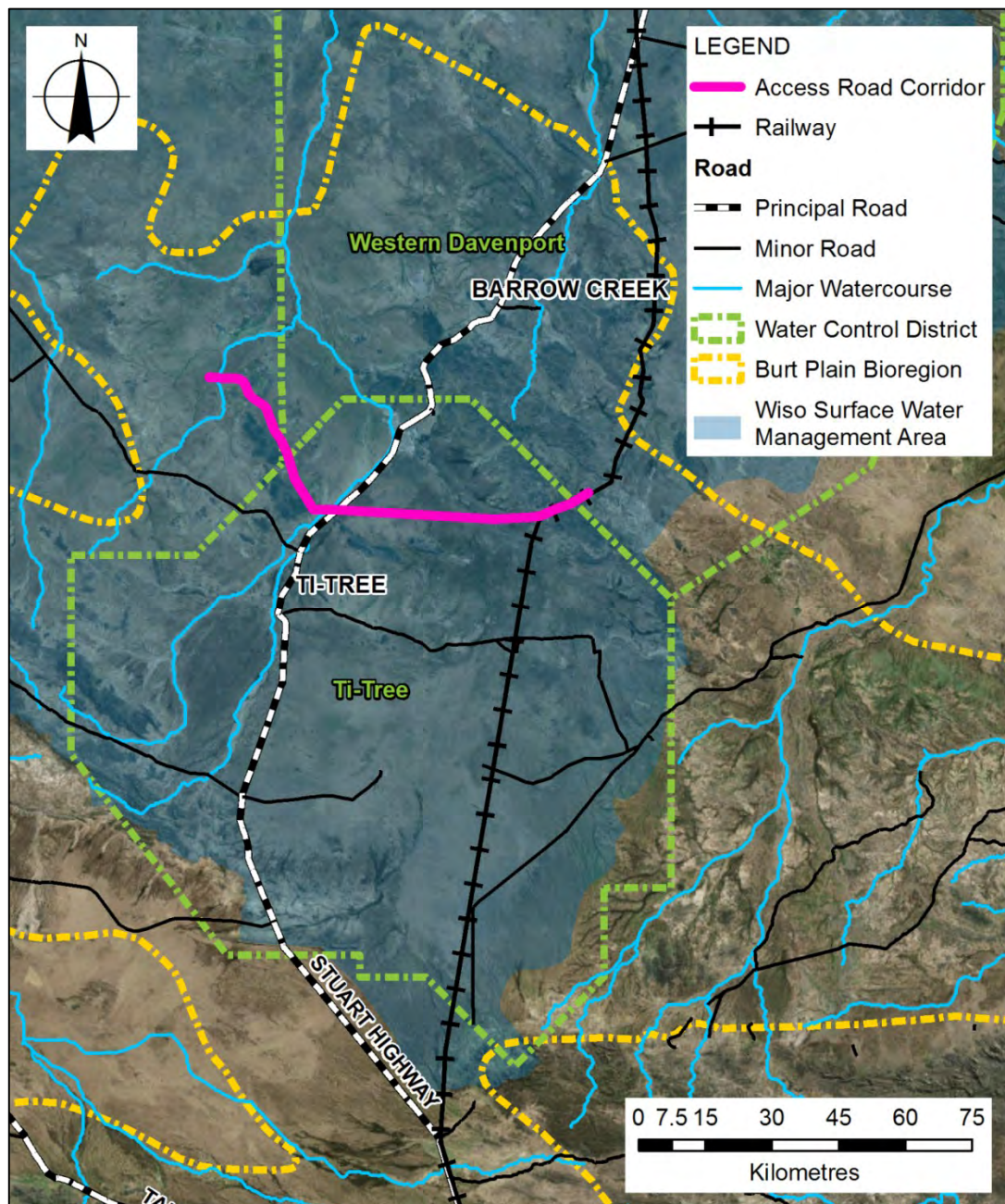


Figure 2-2 Water Management Area and Control Districts

The allocation plan (Department of Natural Resources 2009) recognises that there are currently no known or significant surface water extraction activities and the total of t current licensed and unlicensed groundwater extraction per annum is estimated to be less than 0.004% of estimated storage. The allocation plan also notes that further scientific work needs to be undertaken to improve the knowledge about the areas water resources and estimation of their characteristics.

The technical assessment for the Western Davenport Water Control District estimates that groundwater storage in the Cainozoic or upper level aquifers in the larger regional scale aquifer is in the order of 12,800 GL and storage in the deeper fractured rock aquifers is in the order of 16,000 GL. The allocation plan identifies that current licensed groundwater abstraction is limited, with the main uses for horticulture and community supply. An additional unlicensed volume is attributed to stock bores, which based on an estimation of bore numbers and stock is estimated to be in the region of 350 ML/year.

The Water Control District is separated into five management zones based on a consideration of topography, underlying geology, hydrogeochemistry and stratigraphy. The Territory Government has followed the principle that in the absence of adequate scientific information, total extraction of groundwater over a century should not exceed 80% of the estimated total aquifer storage. The Project area overlaps with part of the Southern Ranges management zone. A summary of this zone is provided below as Table 2-2.

Table 2-2 Southern Ranges management zones summary

Area	Estimated storage	Estimated annualised recharge	Available allocation
8498 km ²	147 GL	8.5 GL	6.8 GL/annum

2.5 Existing groundwater use

There are relatively few existing users of groundwater within the Project area. However, an understanding of these existing groundwater users is required in order to identify them and protect them from potential adverse impacts. The following sections summarise the key known groundwater users within the Project area.

2.5.1 Stock bores

The pastoral lease of Stirling Station covers most of the Project area, with Anningie Station being immediately to the south of the Project area. The access road corridor follows the boundary of the two stations lying on the Stirling Station side of the boundary.

Both pastoral stations use stock bores and wells for year-round water supplies. In general, stock bores are relatively evenly distributed around the Project area with typical distance between stock bores of around 10 km. The majority of the bores within the Project area are located along existing creek and drainage lines. For example, there are a series of stock bores along the western bank of the Hanson River Channel, with bores located at 10 km intervals between Hansons Bore on Stuart Highway to Prosperity Bore, some 90 km north down-stream.

The majority of stock bore and well locations are historic having been established early in the pastoral stations development. As such, some locations have since been re-drilled, or bores installed to replace old wells which were traditionally hand dug and relatively shallow. Due to the relatively low volumes of groundwater required at each location, bores tend to be relatively shallow and generally less than 40 m deep. Due to the widespread nature of these bores, they tend to target different units but are predominately targeting the fresher shallow groundwater associated with recent alluvial sediments.

Due to the relatively shallow nature of stock bores, they have the potential to be impacted by any reduction in groundwater levels, and consideration of impact on these bores will be a key factor when assessing drawdown impacts from the mine site and from the operational borefield.

2.5.2 Community and domestic supply

Within the Project area, there are a number of groundwater abstraction bores that are used for public water supply. These include supply for Stirling Station homestead, Barrow Creek and the Wilora community. All these locations have dedicated bores that provide a permanent water supply. The Wilora community is supplied with groundwater with an existing licence for 40 ML/year (issued to the Power and Water Corporation). Barrow Creek service station is licensed for 1 ML/year. No current licence data is available for Stirling Station homestead.

2.5.3 Groundwater dependant ecosystems

Stirling Swamp, located north of the access road, comprises a large network of claypans, lignum swamp, semi-saline samphire and temporary open water, and the adjacent Hanson River. Stirling Swamp is thought to be connected to groundwater through a topographic low forming a 'window' to the relatively shallow Ti Tree aquifer water table. This area is therefore considered a discharge zone of the Ti Tree aquifer.

Mud Hut Swamp is located approximately 8 km north of the mine site. It is formed from a flood-out of the Bloodwood Creek and, based on its location as an outflow of the creek, it is unlikely that the swamp is maintained by groundwater.

There are no known permanent or semi-permanent water holes along the Hanson River, with any pools formed through surface water flow. These are relatively short lived as they are subject to evaporation and drain to the underlying aquifer.

2.6 Groundwater quality

Limited groundwater quality information is available with current water quality data obtained during development of a number of new test production bores constructed within the target aquifer. In addition to this testing, a number stock bores located within the project area have also been sampled for water quality assessment.

The data indicates that the groundwater quality is quite variable within the project area. The shallow stock bores tend to be the least brackish with a TDS in the range of 2000-4000 mg/L. High salinities (>5000 mg/L) were found at two of the test drilling sites located to the north and south of the proposed borefield. The site south of the borefield had a TDS of 27,000 mg/L, significantly greater than the other tested bores (next highest TDS, of 13,000 mg/L).

Detailed laboratory analysis was undertaken on the proposed abstraction bore in the borefield to assist in determining the treatment requirements of borefield water. The data for this site (WB05) indicated that according to the Australian Drinking Water Guidelines (2011), the groundwater at this site contains elevated levels of Turbidity, Iron, Manganese and Ammonia. It should be noted that some of these results may be due to insufficient bore development and concentrations could improve over time with continued pumping.

Additional groundwater quality sampling and assessment will be required following development of the borefield. This will include scheduled sampling events, as further discussed in Section 5.

3. Mine plan and water

The following section provides a brief summary of water related infrastructure and water demand proposed for the Project.

3.1 Groundwater supply and distribution

A water supply is required to meet the various needs of the Project, in particular for ore processing, dust suppression and camp supply purposes. Following a 2015 drilling and testing program, the Hanson River alluvial aquifer was identified as a potential groundwater resource that could meet the supply requirements of the Project.

A conceptual design of the water supply system was developed based on the preliminary water balance (GHD 2015). The water balance dictated the water demands for the two stages of mine operation, with Stage 1 operational for years 1 to 4 processing 3 Mtpa of ore, and processing increasing in Stage 2 (years 5 to 15) to 6 Mtpa of ore.

The raw water requirements for the two stages have been estimated as follows:

- Stage 1: 178 m³/h
- Stage 2: 300 m³/h.

This demand will need to be supplied from the borefield.

3.1.1 Borefield

The borefield is to be located along the western bank of the Hanson River and will eventually include up to 10 production and two standby bores. The borefield will be developed in two stages in parallel to the mine plan. The borefield operational summary is presented Table 3-1.

Table 3-1 Summary of proposed borefield

Item	Stage 1	Stage 2	Comment
Overall water demand	1.6 GL per annum (51 L per second)	2.6 GL per annum (82 L per second)	Total water demand based on water balance.
Minimum number of active production bores required	6	10	Two bores from Stage 2 to augment supply during any reduction in supply from Stage 1 bores (maintenance/failure)
Proposed standby bores	2	2	
Proposed spacing of bores	1800 m		Aligned on track parallel to river channel.
Proposed continuous pumping rate	8.5 L/s		Based on limited pumping and modelling data.

Bores will be powered by stand-alone diesel generators with 4,670 L diesel storage tanks. The presence of the generators and diesel storage tanks provides a potential risk of contamination to groundwater resource from hydrocarbon spills. Risk of contamination is highest during flooding and both surface and groundwater contamination may occur depending on whether the river system is under gaining or losing conditions.

The design of production bore infrastructure will consider the geomorphology of the alluvial bed within the Hanson River flood-out zone to minimise risk of inundation. The design will consider the ARI wet season rainfall event appropriate to the hazard category, and the geomorphology of the alluvial bed of the Hanson River flood-out zone to ensure the footings and structures can withstand moderate to high flow events that may result in morphological change.

Elevated drill pads be constructed to ensure the well casings, headworks, generators and fuel tanks remain above the 100-year ARI level. Edges of the pads should be constructed at a slope that ensures stability under saturated conditions and should be protected against erosion. Generators and fuel tanks should be located within lined and bunded structures constructed on top of the drill pad. The bunded storage should be sufficient to accommodate simultaneously an appropriate ARI wet season rainfall event and failure of a full fuel tank.

In addition to the production bores, development of an appropriate groundwater monitoring network is an integral part of borefield development. This is discussed in Section 5.

3.1.2 Road construction bores

In addition to the borefield identified above, temporary water supply bores are required for access road construction.

A water demand during construction of 56,000 m³ is expected. A minimum spacing for water supply points of 20 km is required equating to a minimum of 4 water supply locations. Based on the construction schedule of 9 months, each water supply point would need a continuous supply of around 1 L/s. It is proposed that at each location a turkey's nest will be established at a suitable capacity, with a skid mounted pump to fill water carts.

For the access road west of Stuart Highway, a number of water supply options are being considered. For the western most area of the road, water can be sourced from an offtake from the proposed water supply pipeline. This assumes that the borefield and pipeline have been developed by the time road construction starts in this area.

Stock bore 'Gingers' offers a relatively good yield. It is located 4.5 km from the access road and water could be reticulated over this distance. Gingers could be redrilled if it is unsuitable for an appropriate pump. This would be looked upon favourably by the Station.

A new bore is proposed to be constructed on the northern side of the Hanson River. The alluvial aquifer in this area is likely to offer supply in excess of the requirements. Consideration of potential impacts to the stock bore (Bullocky Bore on Anningie station) on the southern side of the river will be needed.

East of the Stuart Highway there is a significant length of the access road which passes through areas without existing supply. A new bore is recommended in this area. A supply could be met by the known shallow, mostly calcrete aquifer present in this area. Two stock bores, Crocodile and Tinfish, could potentially be used to supplement supply, with the water reticulated to the road alignment. An additional bore is also recommended in the area of the proposed siding.

3.2 Pit inflow

3.2.1 Groundwater inflow

Air-lifting testing of exploration holes within the pit area demonstrated that the pit area will not be subject to significant groundwater inflow, and as such, there is no indication the pit will require substantial dewatering infrastructure.

Numerical groundwater modelling predicted groundwater inflow would peak at the end of the mining period at just over 100 m³/d and reduce to around 70 m³/d over the next 80 years.

Groundwater inflow to the pit will be removed through use of in-pit sumps. Water will be reticulated to the Raw Water Dam for use within the Project water circuit. The dewatering volumes have not been included in the overall water balance due to their uncertainty.

3.2.2 Surface water inflow

In addition to groundwater inflow, the pit will be subject to surface water inflow through direct runoff of rainfall. Drainage around the pit will be designed to ensure that flood protection measures are incorporated to prevent surface flows entering the pit. This is likely to be in the form of a dedicated ring drain sized to take into account flows from significant rainfall events (i.e. 100-year ARI event).

Murray Creek is around 450 m from the pit edge, therefore the drainage design around the pit will also need to consider flood protection from Murray Creek overflow. This would likely be in the form of a bund and additional drainage on the eastern side of the pit.

Where surface water inflow does make it into the pit, for example by direct rainfall within the pit area, the surface water will accumulate in the pit base. This water will mix with the groundwater inflow and be removed from the pit through sump pumps, directing the water to the Raw Water Dam for use within the Project water circuit.

3.3 Tailing Storage Facility

Tailings will be produced during the magnetic separation of the crushed and screened ore and will consist of non-magnetic silts and sands. Tailings disposal in the form of a slurry using the Central Thickened Discharge (CTD) method will be used, which is estimated to return approximately 74% of the tailings water.

The circular TSF is designed to hold 63 Mt and be 2,134 m in diameter and 35 m in height. It will occupy an operational area of 357 ha. Given that the tailings do not contain contaminants, the TSF design did not include floor lining.

Excess water from the deposited tailings will be collected in a recovery water pond located at the north of the TSF. The expected initial settlement of the 65% solid content of the slurry to 75% solid content at the beach will result in the release of about 70 m³ of water per hour. This water will be collected via an underdrainage system which will discharge to the recovery water pond. This pond will also collect rainfall runoff within the TSF. From the pond, water will be returned to the processing plant.

The recovery water pond will be lined with capacity of about 20,000 m³ and will be equipped with return water pumps and pipeline. To prevent siltation of the pond, the collected water will be discharged through a rockfill bund that would act as a filter for the suspended solids.

To monitor behaviour of the TSF and its influence on the environment, a seepage monitoring system will be installed. The monitoring system comprises 14 monitoring bores designed primarily to monitor groundwater level and allow for sampling to carry out water quality checks. If needed, these bores will be used as water recovery wells with water pumped back to the TSF and / or to the water recovery pond.

3.4 Waste rock dump and ore stockpiles

The waste rock material and ore stockpiles are unlikely to contain significant volumes of water. However, the waste rock dump (WRD) and ore stockpile areas will need to have a managed drainage system to control surface water runoff. The drainage system will collect surface water runoff and seepage and direct it to storage.

The drainage system around the WRD and stockpiles will need to be sized to take into account flows from significant rainfall events (i.e. 100-year ARI event). Inclusion of sediment control will be required in order to prevent the build-up of fines within the drainage system.

3.4.1 Potential for Acid Mine Drainage

The rock types that will contribute to the waste dumps exhibit oxidising conditions so are expected to have low sulphide content as follows:

- Surface overburden (pre-strip) comprises desert sand aeolian and colluvial/alluvial sediment, which is weathered material that formed at the surface under strongly oxidising conditions and will not contain sulphides
- A small amount of overburden will be gabbro hanging wall (which is either weathered or fresh) containing some magnetite thereby indicating oxidising conditions and is likely to have low sulphide content
- Some waste adjacent to the orebody material comprises granite which may have a small sulphide component (up to 2%).

The material to be stockpiled in the WRD is likely to have a sulphide content well below 1 wt% sulphide content, while the gabbro ore has a lower sulphide content (less than 0.5 wt% sulphide). This sulphide content will not generate a significant Acid Mine Drainage (AMD) issue. Therefore, the WRD should not pose any discernible risk to the identified receptors and endpoints.

As with the ore stockpiles, it is recommended that periodic testing of the WRD be conducted to confirm the benign nature of this material. Further characterisation of the waste materials should be conducted to determine the salinity profiles of the waste materials

It is not anticipated that Acid Mine Drainage will be generated by the WRD. Regular monitoring of seepage water will be required to assess the contamination potential of WRD seepage and its potential impact on the water system.

3.5 General operational areas

An assessment of the potential for contamination (GHD 2015) identified various areas where potential sources of contamination may be present. Within the operational area of the mine, including the Adnera Loadout Facility, there will be various potential sources including fuel storage areas.

Such areas will include bunding to ensure that any spills are contained and cannot impact water resources.

All water from wash-down, workshop and refuelling areas will be intercepted and channelled to oil/water separators and containment storage.

3.6 Water treatment plant

Water treatment is required to provide water that is suitable for human consumption, amenity irrigation and the slurry pump glands. Some of the water from the Raw Water Dam will be treated to bring it up to potable water standard. The water treatment process will comprise:

- Filtration using multi-media filters
- Desalination using brackish water reverse osmosis
- Disinfection using sodium hypochlorite or similar.

The filtration system is expected to have a recovery (ratio of treated water to raw water) of about 95% depending on the concentration of suspended solids in the raw water. Depending on the concentration of sparingly soluble salts in the raw water, the desalination process is expected to have a recovery of around 70%.

There is no chloride limit for the water entering the Processing Plant. To this end, the waste water streams from the multi-media filters and brackish water reverse osmosis will be discharged to the Process Water Dam for reuse in the Processing Plant.

3.7 Water storage

Various water storage systems will be used on site, which have been sized based on the water balance. Enclosed storage tanks, such as those used for potable water supply are not included here.

3.7.1 Raw Water Dam

The preliminary sizing of the Raw Water Dam has been based on the requirements for both emergency storage and for buffering of the daily consumptive fluctuations. The Raw Water Dam would need to store a total of 12.3 ML and 20.7 ML for Stages 1 and 2 respectively.

Given the need for staging, two storage cells are to be constructed one of 12.3 ML and the other of 8.4 ML. Each cell would utilise a common embankment wall. Typical dimensions of square turkeys nest dams comprising excavated centres enclosed within an embankment wall are provided in Table 3-2.

Table 3-2 Indicative raw water dam dimensions

Dimension	Stage 1	Stage 2
Volume water (ML)	12.3	8.4
Length of inside base of pond (m)	34	25
Length of top of pond embankment (m)	70	67
Length of pond embankment at ground level (m)	91	82

3.7.2 Process Water Dam

The Process Water Dam has also been sized based on the requirements for emergency storage and for buffering of the daily consumptive fluctuations. The storage requirements based on the water balance indicate that the Process Water Dam would need to store a total of 3.6 ML and 7.2 ML for Stages 1 and 2 respectively.

Given the need for staging, two cells are to be constructed, of 3.6 ML each utilising a common embankment. Typical dimensions of square turkeys nest dams comprising excavated centres enclosed with embankment walls are provided in Table 3-3.

Table 3-3 Indicative Process Water Dam dimensions

Dimension	Stage 1 and 2
Volume water (ML)	3.6
Length of inside base of pond (m)	11
Length of top of pond embankment (m)	47
Length of pond embankment at ground level (m)	68

3.8 Water discharge

3.8.1 Mine water discharge

The mine water balance has been developed to return all process water to the water circuit. This includes decant water from the TSF and brine effluent from the Water Treatment Plant.

There will be no uncontrolled discharges of untreated process water from the Mount Peake Project area.

3.8.2 Treated Waste Water

A sewage treatment plant will be required for the Project for sewage arising from the administration and camp facilities. It is expected that the sewage treatment plant will be located at the mine camp.

Once the solids are removed from the treated waste (and disposed of off-site at a licensed facility), the treated waste water effluent will be used for irrigation of grassed areas around the camp. The water will be applied at a rate to ensure that there is no runoff that could impact surface waters.

4. Risks and management actions

The following have been identified as the key groundwater and surface water risks. As additional key risk areas are identified, they will be added.

Through identifying the key risks, management of water resources can be better addressed. This includes the specific monitoring requirements that are tailored to address the risks outlined in the following section. The monitoring requirements are presented as Section 5.

4.1 Groundwater risks

4.1.1 Borefield cannot meet supply demand

Water supply for the Project is to be met from the borefield. Initial modelling and aquifer assessment indicates that the palaeovalley alluvial aquifer will have the required volume to meet the supply demands. However, this will need to be validated following borefield development.

If drilling and testing of the borefield identifies that the required demand cannot be met by the aquifer, for example if the relatively high yielding sands and gravels are not as extensive as predicted, then alternative sources of groundwater will need to be sought. This may include expanding the borefield further along the Hanson River palaeovalley, or utilising alternative palaeovalley supplies such as the Willowra Basin. The same may apply if the borefield is established and its performance in terms of yield deteriorates significantly with time.

Appropriate management actions

- Assessment of lithology and aquifer parameters against expectations during borefield development.
- Monitoring of borefield performance throughout its operation.
- Contingency will be required for the development of an additional water supply. For example, extending the borefield to the north, or developing an additional borefield in the Willowra Basin, west of the mine site.

4.1.2 Borefield drawdown impacts

Maximum predicted groundwater drawdown is modelled as being up to 12 m below current groundwater levels (which are 10 – 12 m below ground level) at the operating bores in the centre of the borefield. The 1 m drawdown contour extends to around 6 km south of the borefield (GHD 2015).

A drawdown of 12 m below current groundwater levels could result in the following:

- Decline in availability of water to ecosystems including riparian vegetation
- Shorter hydroperiod in waterbodies.

Groundwater modelling has predicted that drawdown at the borefield will cause relatively localised impacts to existing stock bores. Several existing stock bores are predicted to be impacted by up drawdown of up to 3 m.

Predictions indicate that drawdown will not reach Stirling Swamp.

Following development of the borefield, the groundwater model will need to be revised to take into the account the new lithological data and more detailed aquifer properties. Following the re-running of the groundwater model, predicted drawdown impacts will need to be calibrated against actual drawdown to test the validity of the model.

More extensive drawdown than predicted could result in groundwater level decline in a greater number of stock bores.

Appropriate management actions

- Monitoring of groundwater levels and response to abstraction.
- Comparison of monitored groundwater levels to model predicted water levels.
- Anticipation of groundwater level decline at identified receptors, such as stock bores. This will assist in preventing drawdown causing supply impacts to existing groundwater users.

4.1.3 Mine pit drawdown impacts

Groundwater modelling has predicted that drawdown around the mine pit will occur as a result of the pit excavation and proposed in-pit dewatering. The extent of drawdown is relatively localised to within around 2 km of the pit after completion of mining.

The limited extent of drawdown is reflective of the lack of groundwater expected within the basement geology. If water bearing fractures or significant weathering zones are encountered, then water ingress to the pit, and potential extents of drawdown may increase.

Appropriate management actions

- Monitoring of groundwater levels around the pit and their response to pit dewatering.
- Comparison of monitored groundwater levels to model predicted water levels.
- Update of groundwater model if significant structural features are encountered within the pit area that may increase groundwater volumes and flow.

4.1.4 Borefield water quality change

Borefield water quality has been assessed based on laboratory analysis of the existing production bore (WB05). It is known that the groundwater salinity increases in the area to the south of the borefield therefore there is a risk that this saline water could be drawn towards the borefield as result of continued abstraction.

Some of the borefield water will be treated at the mine site, for example to provide a potable supply. Specifications for water treatment have been based on the existing water quality results, therefore if water quality changes with time/abstraction then the treatment process will need to be able to cope with this change.

Appropriate management actions

- Assessment of water quality during borefield development.
- Monitoring of borefield groundwater quality at regular intervals.
- Consideration of changes in water quality when specifying water treatment options.

4.1.5 Contamination of borefield aquifer from site activities

As identified in Section 3.1.1, site activities have the potential to contaminate the groundwater resource through actions such as spills, equipment failure or accidents. For the borefield, this would relate to those activities and potential contamination sources within the extent of the palaeovalley aquifer system.

If a potential contamination incident were to occur, appropriate emergency actions would be undertaken.

Appropriate management actions

- Have appropriate emergency response plans for potential spills within the Project area.
- Determination of design criteria for elevated drill pads for protection of well casings, headworks, generators and fuel tanks, which are stable under saturated conditions and protected against likely flooding and erosion.

4.2 Surface water

4.2.1 Contamination of surface water from Acid Mine Drainage

Current data indicates that the ore and waste material to be excavated is to have a very low sulphide content and will not cause a significant Acid Mine Drainage (AMD) issue.

However, the current assessment is based on a fairly limited sampling ratio of waste material and potential AMD indicators; therefore there is a risk that some of the waste material may have different chemical properties than the tested material. If AMD material are found to be present and not addressed, contamination of the surface water features could occur.

Appropriate management actions

- Periodic and targeted testing of the material entering the WRD is conducted to confirm the benign nature of this material.
- Have contingency measures in place to deal with any potential AMD material, for example a separated contaminated cell with appropriate drainage control.

4.2.2 Contamination of surface water from site activities

Site activities have the potential to contaminate local surface waters resource through such actions as spills, equipment failure or accidents. For the surface water features proximate to the operational areas, this would relate to those activities and potential contamination sources close to existing creek lines.

If a potential contamination incident were to occur, appropriate emergency actions would be invoked.

Appropriate management actions

- Have appropriate emergency response plans for potential spills within the Project area.

4.2.3 Change of flow regime from creek modification

Development of the mine site access road and the borefield access road will require development of a number of crossing points of existing drainage lines and overland flow areas. The crossing points have the potential to alter the flow regime of the creek.

Appropriate management actions

- Design crossing points to maintain flow.
- Prepare a Drainage, Erosion and Sediment Control Plan to provide a framework for managing the risk of erosion and release of sediments to the receiving environment.

5. Monitoring

Groundwater and surface water monitoring will form an essential component of the ongoing environmental management programme for the operations. The main purpose of a monitoring programme is to provide relevant information that can be used by site planners and managers as a basis for informed decision making. The monitoring regime needs to be closely aligned to the identified Project risks.

Establishment of robust baseline (pre-mining) conditions, monitoring during the construction phase, mining phase, and post mining phase will be required in order to assess any potential change to groundwater levels and groundwater quality. Site specific trigger values will be developed following an assessment of baseline conditions.

In addition to dedicated and targeted groundwater and surface water monitoring, water monitoring will also be required from a number of locations relating to site water infrastructure, including water storages, drainage and process waters.

The following sections highlight existing and proposed monitoring locations and a proposed program to meet the water management requirements for the site.

5.1 Groundwater monitoring

Targeted groundwater monitoring will be undertaken in and around mine operational areas. In general, the monitoring can be separated into three areas, as summarised below.

5.1.1 Borefield

An effective monitoring network ensures that aquifer performance can be measured and adapted where necessary. This is essential to safeguard the water supply for the life of the mine whilst ensuring that impacts are minimised.

The monitoring network will need to be consistent with borefield design, therefore until the borefield is developed the monitoring network presented is conceptual only. The network will include monitoring wells located at the indicative locations summarised in Table 5-1 and shown in Figure 5-1. Groundwater monitoring wells in the area of the mine site are shown in more detail in Figure 5-2. In total, a monitoring network of 20 monitoring wells is recommended.

Table 5-1 Proposed borefield monitoring wells

Location	Number of monitoring wells	Comment
Next to production bores	Stage 1: 8 Stage 2: +4	A monitoring well will be located at each production bore. These will be the investigation holes for each site (production bores then constructed where investigation drilling is favourable). The monitoring well will be used to determine aquifer properties from the pump testing and ongoing performance of the aquifer immediately adjacent to the production bore site. One monitoring well has already been established at production bore WB05 (monitoring well WB01).
Between select production bores	Stage 1: 3 Stage 2: +1	Locating monitoring wells between the production bores will determine the aquifer response to pumping and the cumulative impacts from bores.

Location	Number of monitoring wells	Comment
At northern and southern extent of borefield	Stage 1: 1 Stage 2: +1	Monitoring bores to the north and south of the borefield will assist in determining the impacts up and down gradient of the borefield. This is important as it will show impacts on station wells located close the borefield (for example Browns Bore), and to monitoring for potential saline ingress to the borefield from the known high salinity area in the south.
Regional locations	Stage 1: 2 Stage 2: +0	The use of existing bores in regional locations outside the modelled extent of drawdown will be used as control bores. These bores are already in place (WB02 & WB03).

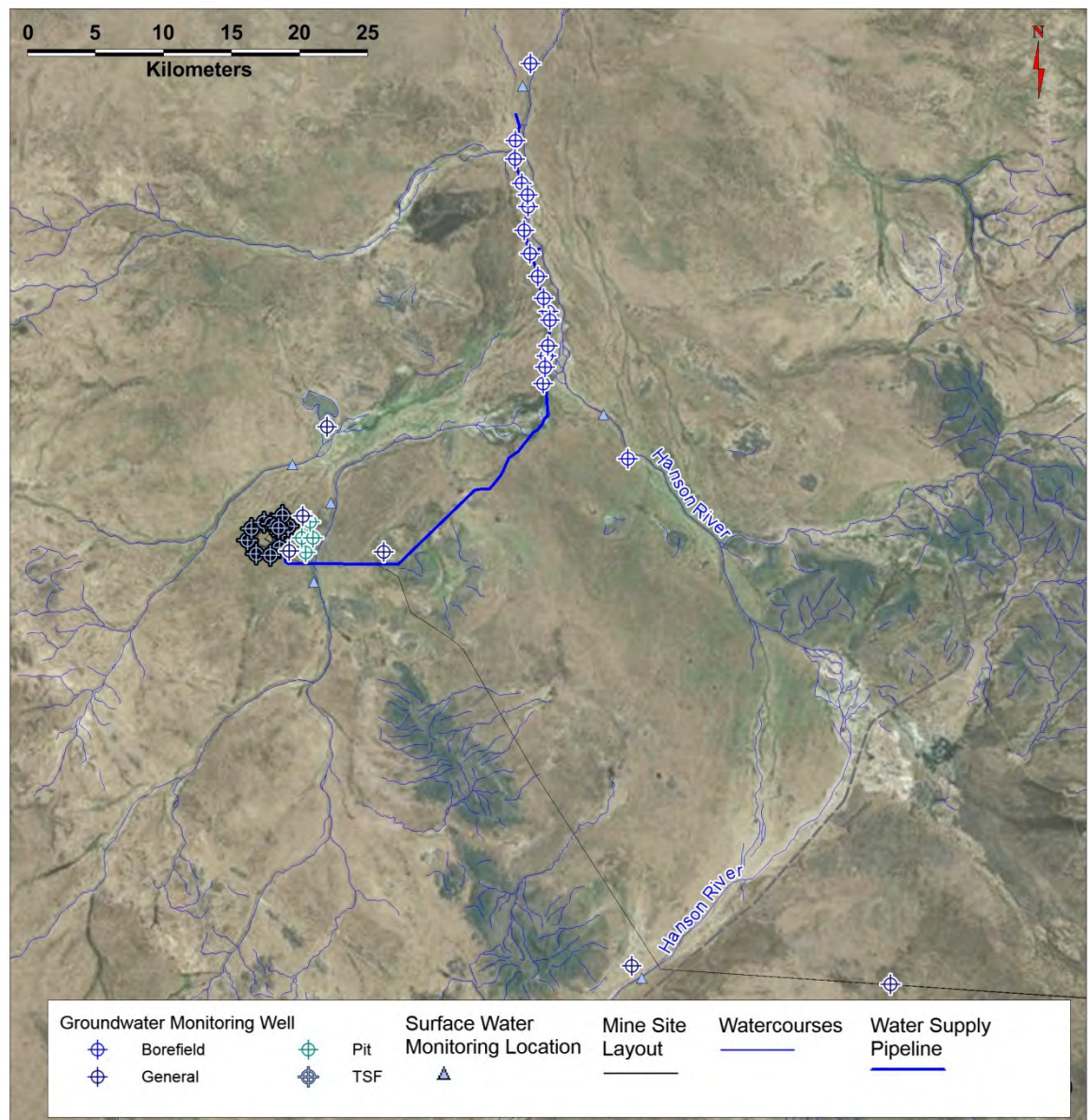


Figure 5-1 Groundwater monitoring locations

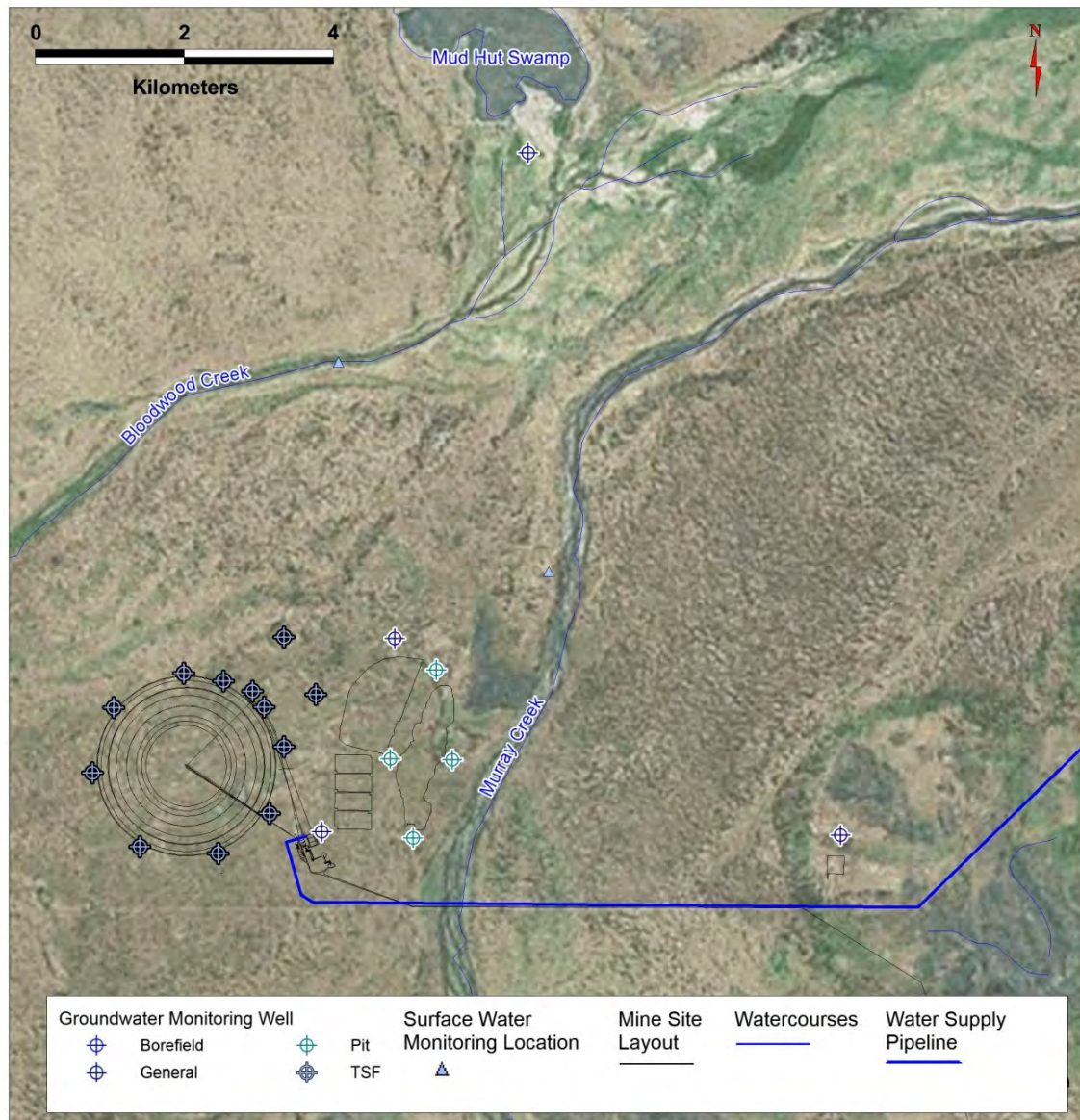


Figure 5-2 Groundwater monitoring locations within mine site area

5.1.2 Mine site

Monitoring wells should be located in areas where the groundwater model predicts drawdown effects around the pit. The wells will assist in validating the model and assessing whether drawdown is in-line with the predicted values.

Wells should be located at varying distances (and depths) from the pit in order to monitor the change in drawdown with distance from the pit.

Installation of seven monitoring wells around the pit and mine area are recommended (Figure 5-1). Locations are also recommended in key operational areas to allow monitoring of potential operations impacts. These would include locations at the Waste Rock Dump, ore stockpiles and water storage areas.

5.1.3 TSF

To monitor behaviour of the TSF and its influence on the environment, a seepage monitoring system will be installed. The system will comprise 12 monitoring bores designed primarily to monitor groundwater level and allow for sampling to carry out water quality checks (Figure 5-1).

The proposed monitoring wells would be installed to the base of the alluvials, expected to be around 25 m in depth. The monitoring wells would be constructed with 100 mm casing. This will allow the wells to be used as recovery wells if significant seepage is detected. If used as a recovery wells, the recovery system would reticulate the water back to the TSF and / or to the water recovery pond.

5.1.4 Regional locations

Regional / background locations, i.e. monitoring sites in areas where no groundwater drawdown from mine operations are predicted, are recommended to provide appropriate baseline data.

As noted in Section 5.1.1, this should include locations within the palaeochannel, but beyond the predicted extent of drawdown. Locations both upstream (towards Stirling Swamp) and downstream should be considered.

Use of existing pastoral wells could also be used for regional monitoring.

5.2 Surface water

Due to the nature of the proposed operation, surface water impacts appear likely to be confined to those areas within and immediately downstream of the mine operations and corridors.

Potential surface water monitoring locations were selected based on a desktop assessment followed by a site visit. The assessment considered the current mine plan and corridors, as well as available environmental site characteristics including surface water drainage channels, creeks, catchment areas, topography, site geomorphology, desirable cross-section characteristics for flow monitoring, accessibility and health and safety considerations.

As a reflection of the ephemeral nature of the creeks within the Project area, proposed monitoring locations will be from key areas where opportunistic sampling can be undertaken during flow events. In addition, sediment sampling will be undertaken following flow events as a proxy for water quality given the infrequent nature of flow events within the region. The accumulation of elements in the sediment will provide an indicator of sediment quality, as well as an indicator of surface water quality and any contaminant progression within the vicinity of the Project site, and at upstream and downstream locations.

Ideally, the pre-development monitoring network should be located so that it will not be disturbed by mining activities and the monitoring points remain active throughout the life of the mine to provide continuous data sets. Additional infill water resources monitoring may be required as the mine is developed and infrastructure is constructed.

An assessment of the proposed monitoring sites is provided in the following sections.

Proposed surface water monitoring locations are summarised in Table 5-2. The locations are presented on Figure 5-3.

Table 5-2 Surface water monitoring locations

Location name	Easting (MGA53)	Northing (MGA53)	Description
Murray Creek - Upstream	323,147	7,603,228	Immediately adjacent to the mine site. Generally a wide channel (100-150m) with multiple low flow channels and poorly defined banks.
Murray Creek - Downstream	324,335	7,609,077	Locations required both up and down stream of the site to determine any changes the mine site may have on surface water.
Bloodwood Creek	321,486	7,611,849	Bloodwood Creek upstream of the Project site and in the neighbouring minor catchment. Downstream of the Project site it becomes a

			large ill-defined floodout area. There are a number of small well defined channels feeding into Mud Hut Swamp. Locations will demonstrate surface water quality and flow in a neighbouring catchment (i.e. background site).
Hanson River - Borefield	344,312	7,615,744	The Hanson River channel has various forms within the Project area, from a main channel adjacent the borefield and the Stuart Highway, to a braided system west of Stirling Swamp. Locations required at Stuart Highway, upstream of the proposed crossing point (to represent flows into the mine catchment), upstream of the confluence of Hanson River and Murray Creek and downstream of the borefield.
Hanson River - Highway	347,524	7,574,562	
Hanson River - Downstream	321,486	7,611,849	

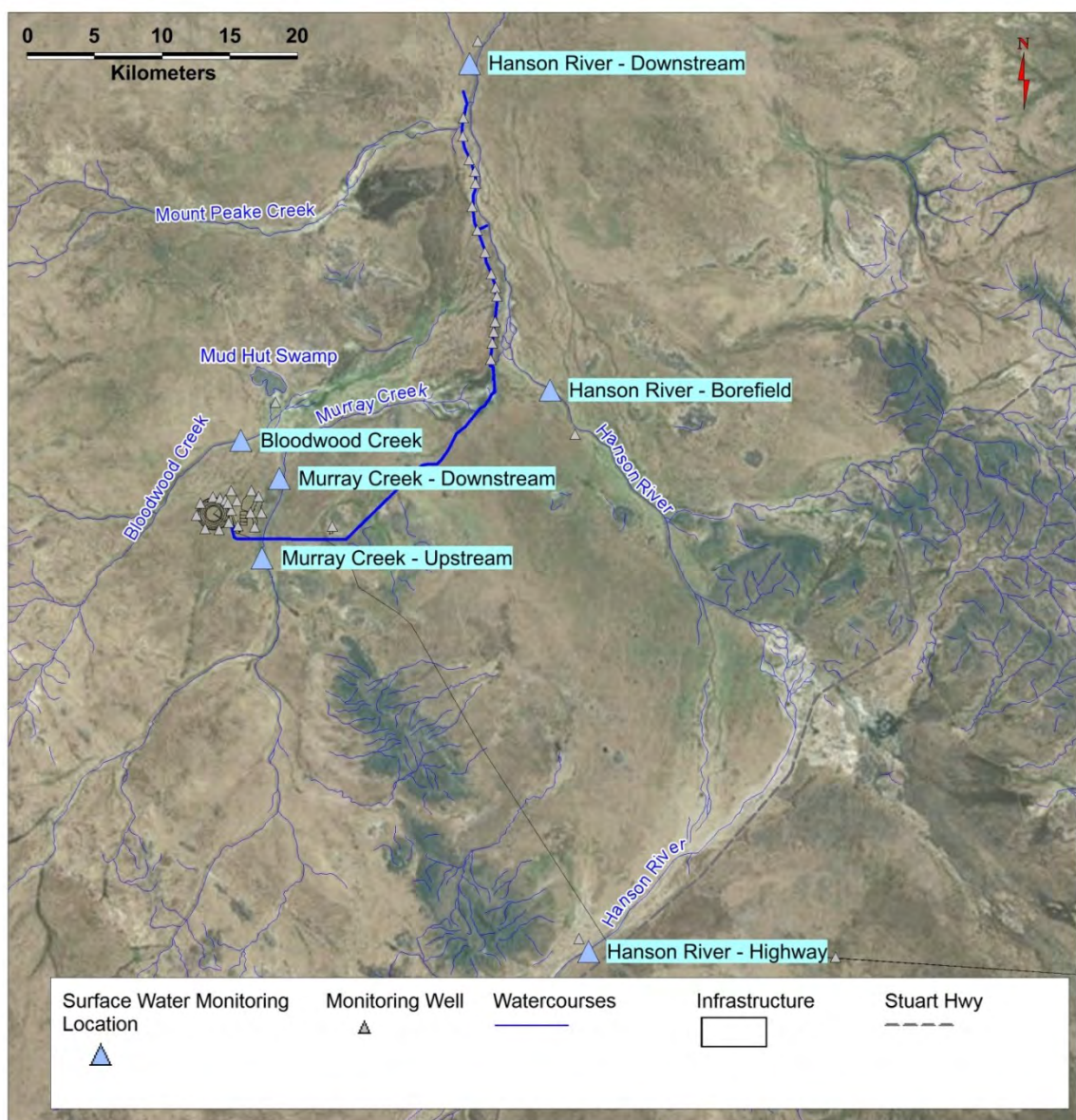


Figure 5-3 Surface water monitoring locations

In addition to the surface water monitoring locations summarised in Table 5-2, an automatic weather station and rain gauge is recommended for installation at an appropriate site adjacent to the proposed mine. The following climatic parameters are recommended for monitoring on a continuous basis:

- Rainfall
- Solar radiation
- Wind speed and direction
- Temperature
- Relative humidity.

5.3 Assessment criteria

The following sections present the preliminary assessment criteria for groundwater and surface water. The proposed sampling suites and adopted criteria will need to be modified once baseline conditions (pre mining and abstraction) are determined. The baseline conditions will allow for site specific assessment criteria to be developed including trigger and action levels for key parameters.

Although Australian and New Zealand Environment and Conservation Council (ANZECC 2000) freshwater criteria are an important benchmark assessment level for water quality in Australia, baseline groundwater quality at the site may be naturally degraded and may not meet the ANZECC criteria as a result of salinity impacts, and/or metal impacts from mineralised geology.

On this basis, trigger values for specific contaminants should be set based on annual mean background concentrations. However fluctuation in background concentrations over time will occur naturally and often are driven by seasonal effects (climate, groundwater levels, surface water flooding etc). The criterion for a specific parameter, for example salinity, is thus best described by a range of values as well as a straight mean.

Given that the main goal of environmental management at mine sites is to ensure that no degradation in water quality relative to baseline conditions occurs, then it is appropriate to consider using background water quality data for parameters that are found in concentrations lower than the ANZECC criteria.

Baseline data should be collected over a period of at least a year in order to detect any natural seasonal variations.

Table 5-3 provides a summary of the parameters required for assessment and the relevant assessment criteria. Given the ephemeral nature of the surface water systems, assessment criteria based on water use are presented, to reflect that the surface water is likely to recharge the groundwater system.

It should be noted that an additional suite will be required for the water supply bores – this should be developed to meet the requirements of the water treatment plant.

Table 5-3 Groundwater and surface water assessment criteria

Parameter	Guideline value	Reference / comment
<i>Physiochemical characteristics</i>		
pH	6.0 – 8.0	Reference only – assess baseline
Electrical Conductivity	5000 µs/cm	Reference only – assess baseline
Total Suspended Solids	4000 mg/L	ANZECC 2000 Stock Watering
Turbidity	TBC	Reference only – assess baseline
<i>Major ions</i>		
Calcium	1000 mg/L	ANZECC 2000 Stock Watering
Magnesium	TBC	Reference only – assess baseline
Sodium	180 mg/L	ADWG 2011 Aesthetic
Potassium	TBC	Reference only – assess baseline
Chloride	250 mg/L	ADWG 2011 Aesthetic
Sulphur	333 mg/L	ANZECC 2000 Stock Watering (as Sulphate S)
Carbonate	TBC	Reference only – assess baseline
Silica	80 mg/L	ADWG 2011 Aesthetic
<i>Nutrients</i>		
Nitrogen	5 mg/L	ANZECC 2000 Irrigation - long-term Trigger Value
Phosphorous	0.05 mg/L	ANZECC 2000 Irrigation - long-term Trigger Value
<i>Metals</i>		
Aluminium	5 mg/L	ANZECC 2000 Stock Watering
Arsenic	0.5 mg/L	ANZECC 2000 Stock Watering
Boron	0.5 mg/L	ANZECC 2000 Stock Watering
Cadmium	0.01 mg/L	ANZECC 2000 Stock Watering
Copper	0.5 mg/L	ANZECC 2000 Stock Watering
Mercury	0.002 mg/L	ANZECC 2000 Stock Watering
Lead	0.1 mg/L	ANZECC 2000 Stock Watering
Nickel	1.0 mg/L	ANZECC 2000 Stock Watering
Selenium	0.02 mg/L	ANZECC 2000 Stock Watering

Parameter	Guideline value	Reference / comment
Zinc	20 mg/L	ANZECC 2000 Stock Watering
Hydrocarbons		
Total Recoverable Hydrocarbons	TBC	Reference only – assess baseline
BTEX	TBC	Reference only – assess baseline

5.4 Monitoring schedule

Once the network of monitoring wells and surface water monitoring stations are established, a site monitoring schedule can be developed. This will draw on interpretations of the data from the baseline conditions and consideration of the mine schedule.

The monitoring schedule will detail exactly which monitoring locations get sampled at what frequency, and what analysis is undertaken on each sample. As detailed above, the schedule will need to be updated if particular trends are identified.

A preliminary monitoring schedule is detailed below as Table 5-4.

Table 5-4 Preliminary monitoring schedule

Monitoring parameter	Frequency	Comment
Pre-mining baseline (for a period of up to two years)		
Groundwater levels	Quarterly	For all existing bores and select pastoral bores/wells
Groundwater field water quality parameters	Quarterly	For all existing bores and select pastoral bores/wells
Groundwater laboratory water quality parameters	Bi-annually	For all existing bores and select pastoral bores/wells
Surface water flow / levels	Opportunistically during flow events	At nominated locations if a flow event occurs
Surface water field quality parameters	Opportunistically during flow events	At nominated locations if a flow event occurs
Surface water and sediment laboratory water quality parameters	Opportunistically during flow events and post event for sediment sampling.	At nominated locations if a flow event occurs
During operation		
Groundwater abstraction volume	Continuous and monthly summaries	For all active abstraction bores
Groundwater levels	Monthly	For all existing bores and select pastoral bores/wells
Groundwater field water quality parameters	Monthly	For all existing bores and select pastoral bores/wells

Monitoring parameter	Frequency	Comment
Groundwater laboratory water quality parameters	Quarterly	All active bores and select monitoring wells
Surface water flow / levels	Opportunistically during flow events	At nominated locations if a flow event occurs
Surface water field quality parameters	Opportunistically during flow events	At nominated locations if a flow event occurs
Surface water and sediment laboratory water quality parameters	Opportunistically during flow events and post event for sediment sampling.	At nominated locations if a flow event occurs
Post mining (period to be determined)		
Groundwater levels	Quarterly	For all inactive abstraction bores and select monitoring wells and pastoral bores/wells
Groundwater field water quality parameters	Quarterly	At select inactive abstraction bores and select monitoring wells and pastoral bores/wells
Groundwater laboratory water quality parameters	Bi-annually	At select inactive abstraction bores and select monitoring wells and pastoral bores/wells
Surface water field quality parameters	Opportunistically during flow events	At nominated locations if a flow event occurs
Surface water and sediment laboratory water quality parameters	Opportunistically during flow events and post event for sediment sampling.	At nominated locations if a flow event occurs

5.5 Process water monitoring

In addition to the groundwater and surface water sampling, periodic sampling will be required from a number of locations within the operations. This monitoring is required in order to track changes within the water circuit and inform management decisions regarding use of the process water.

The monitoring locations are summarised below as Table 5-5.

Table 5-5 Process water monitoring

Location	Description
Raw water dam	Water quality and water levels within the raw water dam will require ongoing monitoring to determine any changes in water quality and available volumes. It is advisable that automated continuous monitoring of levels and salinity is established. This will allow near immediate responses to any significant changes. Additional periodic comprehensive water quality sampling would be undertaken, nominally on a quarterly basis.
Process water dam	Water quality within the process water dam will require ongoing monitoring to determine any changes in water quality. It is advisable that automated continuous monitoring of salinity is established. Additional periodic comprehensive water quality sampling would be undertaken, nominally on a quarterly basis.
Water treatment plant outflow	Assessment of treated water will required periodic sampling in accordance with the parameters specified in the Australian Drinking Water standards. In accordance with the Standard, sampling and analysis are required most frequently for microbial constituents, and less often for organic and inorganic compounds. Due to the relatively small population of water users and remoteness of the area (i.e. less than 1000 people, and difficulty in sending off laboratory samples), a sampling frequency for E.coli is recommended on a monthly basis.
Trailing's seepage/decant	In addition to monitoring the water level and quality at bores surrounding the TSF, periodic sampling of water volumes and water quality of tailings seepage from the decant system will be required. It is recommended that the volume is gauged with an automated system and water quality samples taken, including weekly field parameters (EC and pH) and quarterly comprehensive laboratory analysis.
Rock dump drainage	Material entering the rock dump will effectively be dry due to the lack of groundwater expected within waste rock. However, the rock dump will have dedicated drainage to collect any minor seepages and control surface water runoff. Monitoring of this runoff will be required to confirm that the material is inert and does not pose an AMD risk. It is recommended that the volume of drainage is assessed, and monitored for key water quality parameters during surface water runoff events.

6. Emergency and contingency planning

6.1 Emergency Response Plan

The identification and development of action plans for predictable emergency scenarios enables the site to prepare and allocate both resources and infrastructure to respond to potential emergencies.

TNG has developed an Emergency Response Plan (ERP). The purpose of this plan is to provide a framework for effective management of emergency situations and to minimise any harm to people, property, the environment, reputation or loss to the business.

6.2 Risk Register

Typical emergency situations that could arise and impact the ability of the Project to manage the water systems include:

- Flooding
- Exceedance of design events
- Failure of a containment structure
- Loss of power supply
- Inability to obtain critical equipment or spares.

6.3 Preparation and response

6.3.1 Flooding

A Flood Risk Management Standard should be developed for the Project. The Management Standard should define the minimum requirements for managing surface flooding and to ensure that TNG has systems in place to minimise, to an acceptable level, the major risks (loss of life or damage to property or the environment) associated with surface flood events.

The standard should address the risks associated with excessive and unplanned surface flooding of mine infrastructure as a result of extreme storm events or containment failure (e.g. dam or pipe failure). It should consider only the previously mentioned surface controls which can be used to reduce the likelihood and/or the consequence of such an event.

A Flood Risk Management Plan should be prepared for all operations following a systematic process to identify areas within the operation which could be affected by flooding, including:

- Surface infrastructure
- Key roads, bridges and streams / river crossings, power supply networks
- Open pit
- Environmentally sensitive land
- Employees and residential areas.

6.3.2 Exceedance of Design Events

Management of the water inventory in the various storages within the mine water system will be in accordance with the system design. The System Design Plan will provide for:

- Wet season containment - Design Storage Allowance (DSA) for a 1:20 AEP event required at the first of November each year
- Storm event containment - Mandatory Reporting Level (MRL) for a 1:10 AEP 72 hour duration event at any time.

Contingency measures include:

- Provision of DSAs
- Real-time monitoring of water storages and transfers and predictions of rate of change during extreme events
- Mobilisation of temporary pumping equipment for emergency transfers
- Follow procedures regarding reporting once Regulated Dams achieve a MRL.

6.3.3 Failure of containment structures

Containment structures are designed and constructed according to appropriate design standards. Contingency and prevention measures include:

- Routine inspections by appropriately qualified professionals
- Inspections during extreme events, particularly during discharge.

6.3.4 Power supply

An inventory of diesel powered mobile pumping equipment should be maintained on site for dewatering and water supply purposes and which can be redeployed for emergency pumping of mine affected water.

6.3.5 Critical equipment and spares

An inventory of spares and equipment should be maintained on site.

6.4 Awareness and training

TNG will ensure that all staff are trained appropriately in emergency response procedures. Further, details of such procedures should be displayed on all noticeboards and crib rooms. Relevant training for the identified emergency situations includes:

- Flood preparedness and response procedures
- Mine water system operating procedures
- Use of spill kits and emergency response procedures.

6.5 Management Actions

- A Flood Risk Management Plan is to be developed
- The response plan to prevent non-compliant discharges of mine water will be reviewed annually prior to the wet season and will include an appropriate inventory of mobile pumping equipment
- A review of staff awareness of, and training for, emergency responses will be undertaken.

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Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0	A.Osbaldeston	I. McCardle				27/11/2015

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Appendix I – Weed Management Plan



TNG Limited

Mount Peake Weed Management Plan

December 2015

Document Status

Version	Author	Reviewer	Approved by	Date	Status
Rev. 0	A. Koscielski	I. McCardle			

Amendments

Section	Details
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Appendix B – Monthly Weed Surveying Form
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1. Introduction

1.1 Purpose

The Mount Peake Project involves several key activities during the construction and operations phase which will disturb soils and potentially facilitate the transfer of weeds across the Project. The Weed Management Plan (WMP) will be implemented to reduce the risk of proliferation of existing weeds and introduction of new weed species. The purpose of the WMP is to:

- Address weed management requirements described in the Project EIS guidelines
- Summarise weeds present at the Project and within the Bioregion
- Provide an appraisal of weed status including current legislative status in the NT
- Identify measures to control and eradicate noxious weeds, environmental weeds, Weeds of National Significance (WONS) and unlisted common weeds before, during and after construction
- Identify key responsibilities for construction and operational personnel.

1.2 Objective

The objective of this management plan is to:

- Educate site personnel and provide management measures for known weeds
- Prevent the spread of Class A, B and C weeds and/or Weeds of National Significance
- Prevent the introduction of new classified weed species across the Project.

1.3 Legislation and Guidelines

A summary of the legislation and guidelines associated with the identified and/or management of weeds is provided below:

- Environment Protection and Biodiversity Conservation Act
- Territory Parks and Wildlife Conservation Act
- Weed Management Act
- Australian Weeds Committee – Weeds of National Significance 2012
- Australian Weeds Committee – The Australian Weeds Strategy
- Northern Territory Government – Northern Territory Weed Management Handbook 2012
- Department of Natural Resources, Environment, The Arts and Sport – Guidelines for Weed Data Collection in the Northern Territory
- Department of Land Resource Management – Buffel Grass Management Guide for Central Australia.

1.4 Weeds

A weed can be defined as an exotic species (foreign/introduced species) or a native species that colonises and persists in an ecosystem in which it did not previously exist and is unwanted in that environment.

Weeds are able to successfully establish and spread due to the absence of natural predators and diseases which gives them a competitive edge over other species thereby changing the

natural diversity and balance of ecological communities. An induced disturbance to the natural environment (such as clearing) and movement of machinery, vehicles and equipment create ideal conditions for weed growth and contribute to weed spread.

1.4.1 Categories

Weeds can be categorised according to the areas they colonise and the types of threat they pose. Several different categories of weeds (noxious weeds, environmental weeds, WONS, unlisted common weeds) are recognised at a national, state and local level. The levels and a description of significance is provided

Table 1-1 Weed Categories

Category	Description
Northern Territory	
Class A	To be eradicated These plants either do not occur in Northern Territory but pose a significant threat if they invade, or are present and pose a serious threat. Under the WMA reasonable effort must be made to eradicate these weeds.
Class B	Growth and spread to be controlled These weeds often occur widely in the Northern Territory. They are capable of spreading further and should be prevented from doing so. To prevent their spread, continuing control measures are required. Under NT legislation reasonable attempts must be made to contain the growth and prevent the movement of these plants.
Class C	Introduction into the Territory is to be prevented This category includes plants that pose an unacceptable risk of spreading in this State or to other parts of Australia if they were to be sold or traded in the Northern Territory and are a serious threat to another State or Territory of Australia. All schedule Class A and B weeds are considered to be Class C weeds.
National Significance	
Weeds of National Significance	To be eradicated Weeds of national significance are recognised as having potential to significantly impact on natural values including: threats to human health and safety; threats to pastoral and agricultural industries; threats to water quality and supply; threats to indigenous flora; and threats to biodiversity and cultural values.
Non-indigenous	
Environmental Weed	Weeds are defined as non-indigenous plant species that have invaded (or have the potential to invade) natural ecosystems and threaten (or have the potential to threaten) environmental and/or conservation assets. They can also be Australian native species that are not local (indigenous) to an area but have potential to damage the local plant community.

1.4.2 Environmental Weeds

Environmental weeds are defined as non-indigenous plant species that have invaded (or have the potential to invade) natural ecosystems and threaten (or have the potential to threaten) environmental and/or conservation assets (NRETA 2008). Invasions of environmental weeds often reduce plant diversity and result in loss of habitat for native animals (Smith 2002). Environmental weeds can also be declared noxious weeds, e.g. *Pennisetum polystachion* (Mission Grass); however, a number of serious environmental weeds are not included in the Schedules of the Weed Management Act 2001. Environmental weeds can also be Australian native species that are not local (indigenous) to an area but have potential to damage the local plant community, e.g. *Acacia dunnii* (Elephant Ear Wattle).

For the purpose of this report, environmental weeds are defined as species that are considered to pose a significant threat to the natural environment as determined by the Weeds Cooperative Research Centre.

2. Existing Conditions

2.1 Surveys

A flora and vegetation survey has been undertaken at the Project as part of the EIS process. A summary of the report is provided in Table 2-1.

Table 2-1 Summary of Flora and Vegetation Survey(s)

Report Title	Date		Summary
	Report	Survey(s)	
Mount Peake Flora and Vegetation Survey	Nov-15	Apr-13	The assessment was undertaken in April 2013 as part of the EIS process (GHD 2015). The survey targeted the Mine Site, Mine Camp, 1 km corridor along the proposed Access Road and Adnera Loadout Facility. Flora survey techniques used were consistent with the <i>Northern Territory Guidelines and Field Methodology for Vegetation Survey and Mapping</i> (Brocklehurst <i>et al.</i> 2007) and included: • 45 quadrats • 24 check sites • Aerial surveys • Opportunistic collections • Vegetation mapping. The survey mapped eight vegetation communities within the Project area including: • Mulga shrubland on sandy red earths • Riparian woodland along watercourses and drainage channels • Triodia grassland on sandy plains • Floodplains dominated by <i>Eucalyptus victrix</i> • Open Corymbia woodland on loamy alluvial plains • Low Acacia shrubland on rocky slopes • Tall Acacia shrubland on stony quartz • Low open Eucalyptus woodland on limestone. The majority of the vegetation to be cleared for the project would be from two vegetation communities Mulga shrubland on sandy red earths and Triodia grassland on sandy plains. Both of these communities are well represented at the local and regional scale. The NT Government flora records for the study area (plus a 20 km buffer) contain 1,392 records of 494 species. These records include one threatened flora species (<i>Eleocharis papillosa</i>) listed as vulnerable under both the <i>Territory Parks and Wildlife Conservation Act 2006</i> (TPWC Act) and the <i>Environment Protection and Biodiversity Conservation Act 1999</i> (EPBC Act). Database records for the locality included 7 near threatened species, 6 endemic species and 14 species recorded as being data deficient. A total of 16 exotic species have also been recorded within the locality. The 2013 survey identified 238 flora species (233 native and five introduced) within the study area. No threatened flora species were recorded during the survey, although there is potential habitat for the threatened species the Dwarf Desert Spike Rush (<i>Eleocharis papillosa</i>) within the study area. This species is listed as vulnerable under both the TPWC Act and the EPBC Act. The report is available as part of the EIS documentation on the NT EPA website (http://www.ntepa.nt.gov.au/environmental-assessments).

2.2 Bioregion

The Project is located with the Burt Plain Bioregion which is characterised by plains and low rocky ranges with extensive areas of mulga and other acacia woodlands. The bioregion covers an area of 73,605 square kilometres which represents approximately 5% of the Northern Territory (NRETAS 2005). The extents of the bioregion and Project location are provided in Figure 2-1.

2.3 Weed Status

2.3.1 Regional

In addition to those weeds identified during the 2013 survey, the Department of Natural Resources, Environment and the Arts Biodiversity Conversation group (now Department of Land Resource Management) assessed the Burt Plain Bioregion (Neave *et al.* 2006). The assessment indicated a total of 15 weeds have been identified in the Bioregion (approximately 73,605 km²). Two species are listed Weeds of National Significance: *Prosopis pallida* (Mesquite, Algaroba) and *Parkinsonia aculeata* (Parkinsonia).

2.3.2 Onsite

As detailed Table 2-1, a flora and vegetation onsite survey was undertaken in 2013. A summary of survey locations are provided in Figure 2-2. The survey identified four environmental weeds and one *NT Weeds Management Act* Class B/C weed (*Tribulus terrestris* – Caltrop).

A summary of regional and onsite weeds is provided in Table 2-2.

2.4 Identified Weeds

2.4.1 Buffel Grass

Buffel Grass is a deep rooted perennial grass native to northern Africa, the Middle East and India. It has been planted extensively in central Australia and elsewhere for cattle fodder and to help control erosion. During the EIS survey its cover density has been identified as follows:

- 5 – 25% along creeks and major drainage lines
- 0 – 5% within all vegetation communities.

Impacts

Buffel Grass is recognised to have a significant capability to alter species composition, structure and function of plant communities (Franks 2002) due to:

- Ability to form dense swards and reducing the heterogeneity and floristic diversity of native plant communities
- High volume of plant matter can accumulate during dry period increasing the intensity of fires which can lead to mortality of overstorey tree species and a reduction in post-fire re-establishment of native species
- Ability to rapidly re-sprout after fire and can accumulate enough biomass to burn again in a short period of time compared with native species (Neave *et al.* 2006)
- Preference and domination of riparian vegetation communities due to the lighter texture soils (sandy loams) and relatively high phosphate levels.

2.4.2 Bitter Melon

During the EIS survey it was identified along creeks and major drainage lines. Bitter melon is an introduced flora species which has the ability dominate over native species.

Table 2-2 Summary of Weeds

Name		Classification					Presence	
Common	Scientific	WONS	Class A	Class B	Class C	Env	Bioregion ^A	Project ^B
Athel Pine	<i>Tamarix aphylla</i>			✓	✓		✓	
Bathurst Burr	<i>Xanthium spinosum</i>			✓	✓		✓	
Buffel Grass	<i>Cenchrus ciliaris</i>					✓		✓
Bitter Melon	<i>Citrullus lanatus</i>					✓		✓
Caltrop	<i>Tribulus terrestris</i>			✓	✓		✓	✓
Castor Oil Plant	<i>Ricinus communis</i>			✓	✓		✓	
Coffee Senna	<i>Senna occidentalis</i>			✓	✓		✓	
Elastic Grass	<i>Eragrostis tenuifolia</i>					✓		✓
Khaki Weed	<i>Alternanthera pungens</i>			✓	✓		✓	
Mesquite, Algaroba	<i>Prosopis pallida</i>	✓	✓		✓		✓	
Mimosa Bush	<i>Vachellia farnesiana</i>					✓		✓
Mossman River Grass	<i>Cenchrus echinatus</i>			✓	✓		✓	
Noogoora Burr	<i>Xanthium strumarium</i>			✓	✓		✓	
Parkinsonia	<i>Parkinsonia aculeata</i>	✓		✓	✓		✓	
Patterson's Curse	<i>Echium plantagineum</i>		✓		✓		✓	
Prickly Pears – Devil's Rope Pear	<i>Opuntia</i> spp. – <i>Opuntia imbricata</i>			✓	✓		✓	
Rubber Bush	<i>Calotropis procera</i>			✓	✓		✓	
Saffron Thistle	<i>Carthamus lanatus</i>			✓	✓		✓	
Thornapples – Native Thornapple	<i>Datura</i> spp – <i>Datura leichhardtii</i>			✓	✓		✓	
Total		2	2	13	15	3	15	5

Notes: ^A Sourced from Neave et al 2006.
^B Sourced from GHD April 2013 survey data.

2.4.3 Caltrop

Caltrop has seeds which can remain dormant in the soil profile for several years. The seeds generally germinate following periods of rainfall. Plants are known to grow rapidly, flowering and forming new burrs within three to five weeks.

Impacts

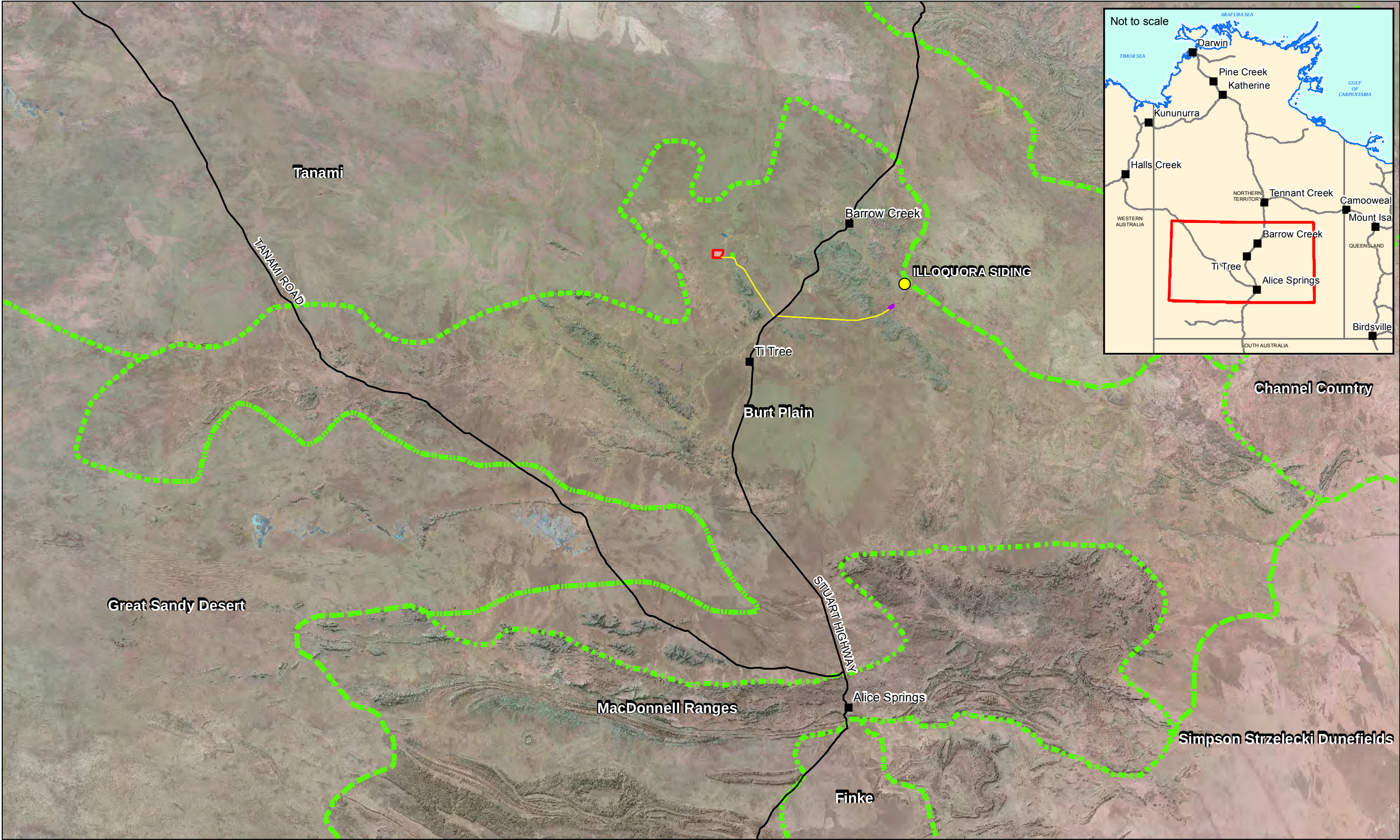
Caltrop is considered a nuisance due to its potential to poison animals and its sharp spiny burrs impacting animals and/or humans.

2.4.4 Elastic Grass

During the EIS survey it was identified along creeks and major drainage lines. Elastic grass can overtake waterways and out-compete native vegetation.

2.4.5 Mimosa Bush

During the EIS survey it was identified along creeks and major drainage lines. Mimosa Bush can overtake waterways and out-compete native vegetation.



1:1750,000 @ A3

0 20 40 60 80

Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 53

N

LEGEND

- Towns
- Illoquora Siding
- Roads
- Bioregions
- Rail Siding Loading Facility
- Mount Peake Mining Area
- Camp Facilities
- Access Road Corridor

TNG Limited
Mount Peake EIS

Job Number 61-29057
Revision 0
Date 22 Oct 2015

Bioregions

Figure 2-1



3. Control Measures

3.1 Weed Control Techniques

Different weed control techniques possess specific advantages and disadvantages, with the optimum method of control dependent on the type of weed, level of infestation and where it is located (e.g. disturbed areas verses remnant native vegetation). For instance, while chemical spraying may be very effective in eliminating a specific weed, it may also destroy surrounding indigenous vegetation. Alternatively, hand pulling of weeds in-between indigenous vegetation creates a low impact on the native flora; however, the method may be economically unviable and cause soil disturbance that in turn may act as a possible site for weed establishment.

Management of weed species at the Project area is likely to require the employment of a number of different control methods. Treatment methods available include Physical, Land Management, Chemical or Biological as detail in Table 3-1.

Table 3-1 Weed Control Techniques

Type	Description
Physical	
Hand Pulling	Labour intensive method that should be carried out systematically before seed set to ensure effectiveness of the treatment. It is important to ensure that all root material is removed and plants or plant parts are not left on the ground to re-shoot or release seed. It is most effective for isolated small outbreaks and is particularly suitable for easy to remove shallow-rooted grasses and herbaceous plants (Smith 2002).
Grubbing	This treatment uses implements such as shovels, spades and mattocks to manually remove weeds. This means of control is best suited to the removal of deep-rooted woody species (Smith 2002).
Slashing	This mechanism of control involves the use of machinery to slash weeds before they are able to set seed. The advantage of this form of control is that it maintains some ground cover to prevent erosion and re-colonisation of weeds, it is relatively inexpensive and can be used for relatively large infestations. It is not usually effective for controlling perennial weeds but may eradicate some annuals if carried out before seed is mature. A disadvantage is that some plants may regrow close to the ground and set seed out of reach of machinery (Smith 2002).
Cultivation	Cultivation of weeds aims to expose the roots and bury the plant to a depth where it cannot re-grow. This is a very effective method of controlling annual or herbaceous plants and seedlings. Deep cultivation or ripping is technique that can be utilised for perennial species (Smith 2002). This method of control is relatively cheap and can be used for controlling large weed infestations.
Mowing	This provides a similar effect to slashing but is usually used on smaller infestations. It is recommended that mowing or slashing occurs from the outside an patch of weeds inwards as this has been shown to be more effective in containing an outbreak (Smith 2002).
Mulching	Mulching around plants can be effective for small areas. This control technique prevents weeds from germinating by removing the light and increasing the temperature of the soil's surface. Materials that can be utilised include cardboard, sawdust, rocks, black plastic, straw, woodchip, etc. Mulching also has the additional benefit of helping reduce erosion and conserving soil moisture (Smith 2002).
Land Management	
Revegetation	Revegetation may help to control weed infestations by encouraging the growth of native species, which are then able to out-compete and reduce the numbers of exotics. In cleared or disturbed areas revegetation can be utilised to prevent weeds from colonising. As a component of long-term weed management, revegetation can follow other control methods to prevent weeds from re-establishing. It is recommended that indigenous species are planted (i.e. plant of local provenance) as these species are more likely to be better adapted to the local soil and climatic conditions (Smith 2002).
Quarantine	Isolating infestations can be an effective way of preventing dispersal or disturbance factors and therefore prevent a weed from spread further. This technique is most effective for eradicating small outbreaks or may be used to help reduce the proliferation or spread of larger infestations (Smith 2002).

Fire	In some instances burning areas can work to eliminate weeds from an area. This means of weed control is particularly effective for woody weeds and fire-sensitive species. However, one disadvantage in using fire to control weeds is that it can have the reverse effect and encourage some weed species. As fire may trigger the germination of some weed seeds it is recommended that some form of follow-up control such as cultivation or spraying is undertaken (Smith 2002).
Chemical	
Foliar Spray	Using a chemical based foliar spray may be a suitable method for the control of herbaceous weeds or young re-growth (Smith 2002). Disadvantages with this kind of control are the potential for damage to surrounding native flora species or other non-target plants. The use of chemical sprays is best suited to large infestations of herbaceous weeds that are some distance from areas of remnant native vegetation.
Soil Application	This method of weed control involves application of a granular, pellet or liquid herbicide directly onto the soil around a weed or infestation. The herbicide is absorbed through the plant roots (Smith 2002). The disadvantage of this technique is that rain is required for the treatment to be effective and this may not occur within the desired time for best treatment.
Biological	
Biological	Biological control is an attempt to restore balance to systems that go out of kilter when exotic species invade or take over. It is rarely an attempt at eradication. The most common strategy is to import host-specific natural enemies of the invader from its native home, and to encourage them to establish and multiply in their new home. Once established, the populations are self-sustaining and a long-term balance is reached with the target pest. A number of biological control projects have involved Northern Territory weeds: Noogoora Burr, Salvinia, Parkinsonia, Spinyhead Sida, Mimosa and Bellyache Bush have all been targeted. Biological control is often the only relatively inexpensive, specific, permanent and environmentally safe option for the management of introduced weeds. There have been over 1000 releases of insects or diseases worldwide. Stringent testing in quarantine has generally prevented significant damage to non-target plants. Although only about one-third of the projects result in successful control, economic benefits far outweigh all the costs, and benefits continue to accrue each year. None of the weeds present within the project has a reliable biological control that can be used for management. This method of treatment is not considered a viable option for weed management at the site.

3.2 Personnel, Vehicle and Equipment Hygiene

The implementation of personnel, vehicle and equipment hygiene procedures is critical to minimising the spread and/or introduction of noxious weeds, environmental weeds, WONS and unlisted common weeds. Weed hygiene measures to be implemented at the Project include:

- Established vehicle access points across the Project
- Washdown bays established at vehicle access points where vehicles and equipment are to be cleaned of mud, dirt and organic matter from underneath vehicle, in the cabin and/or load trays, followed by removal of excess material by high pressure air or water spray jets
- All personnel will follow an entry cleaning procedure that includes an inspection of clothing, removal of attached seeds if present, and washing down or changing of footwear (especially if mud/dirt is attached to the sole and/or seeds are stuck to the shoelaces)
- The movement of vehicles, equipment and personnel between disturbed areas will be minimised as much as possible, to reduce the risk of spreading/introducing weeds.

3.3 Ground Disturbance Permit

All ground disturbance will be undertaken through a permitting system with sign-off required prior to ground disturbance occurring. If the area contains weeds they will be removed prior to vegetation clearance so that vegetative material would be clean and able to be mulched and reused directly on site.

The Ground Disturbance Permit (GDP) will have photo graphic evidence of before and after impacts. The area of disturbance will be kept to a minimum and no protected areas or buffer zones will be disturbed. The GDP will include:

- Disturbance Requirements (contractor, dates, works and dimensions)
- Area Assessment (restricted work areas, EIS approved area, within lease boundary, services, weeds controlled)
- Clearing Details (surveyed and demarked by flagging, supervisor of clearing, post clearing survey data).

The GDP will be issued by the Environmental Manger.

4. Weed Management

Weed management refers to weeds which are known to be present or have potential to be present across the Project Section 2. Management of weeds is structured below as follows:

- **Key Activities, Risks and Impacts:** A summary of the key activities being undertaken during the management period. The potential environmental impacts and residual risk levels are identified for each environmental aspect
- **Objective:** The guiding environmental management objective(s) and activities that apply to the element
- **Mitigation Measures:** The procedures to be employed to ensure that the relevant objectives are met
- **Responsibility:** Nominates the responsible position for implementing actions and monitoring
- **Trigger, Action, Response Plan (TARP):** The actions to be implemented in the case of non-compliance. This includes strategies of remediation and the person(s) responsible for the actions.

4.1 Key Activities, Risks and Impacts

The key activities and potential environmental impact have been identified for weed management are listed in Table 4-1. The risk matrix is provided in Appendix D.

Table 4-1 Key Activities, Risks and Impacts

Activity	Potential Environmental Impact	Residual Risk Level		
		Consequence	Likelihood	Risk
Construction activities requiring the clearance of approximately 1,038 ha of native vegetation.	Increased likelihood of weed establishment in cleared areas.	3	2	M
Road construction through Anmatyerr North Site of Conservation Significance (SOCS).	Introduction or spread of weeds within Anmatyerr North SOCS.	3	2	M
Transport of materials, vehicle movements and inappropriate waste management allowing introduction of new weeds and spread of existing weeds during construction and operation phases.	Modify or inhibit ecological processes.	3	1	L
	Reduce the diversity or modify the composition of plant species.	3	1	L
	Fragment or damage habitat important for the conservation of biological diversity.	3	1	L
	Cause a long term reduction in rare, endemic or unique plant populations or species.	3	1	L
	Fragment, isolate or substantially damage habitat for rare, endemic or unique plant species.	3	1	L

4.2 Objective

The weed management objectives have been established and are detailed in Table 4-2.

Table 4-2 Weed Management Plan Objectives

Objective	Target	Indicator
Prevent the spread of Class A, B and C weeds, WoNS and environmental weeds.	Zero occurrences of classified weeds outside of areas surveyed/identified in 2013.	Number and density of classified weeds outside of survey/identified areas in 2013.
Prevent the introduction of new classified weed species across the Project.	Zero occurrences of new weeds.	Number of new weed species and density.
Undertake weed management across the Project.	Chemical control of weeds undertaken monthly.	Number of chemical control events occurring across the year.
	Annual survey and control.	Number of weed survey and control undertaken.
Monthly and annual weed survey and control.	Effective weed management survey and chemical control yearly.	Number of weed survey and control undertaken.

4.3 Mitigation Measures

Mitigation measures have been developed to minimise potential impacts associated to weed. The mitigation measures, timing and responsibilities are provided in Table 4-3.

Table 4-3 Mitigation Measures

ID	Mitigation Measure	Timing	Responsibility
Site Induction			
WD01	Site inductions will include the following components for weed management: - Summary of known weed infestations at the site - Requirement to enter and exit site through recognised vehicle access points - Requirement to jet wash vehicles/equipment entering and exiting the Project - Weed removal required prior to vegetation clearing - Areas to be cleared are to be flagged and approved through a Ground Disturbance Permit Procedure - All onsite personnel are to utilise existing/approved roads and tracks only.	Site Induction	All personnel
General			
WD02	Imported fill will be certified weed-free prior to being utilised at the Project.	Construction and operation	Construction and Site Manager
WD03	All vehicles entering and exiting the Project area are to be jet washed to remove potential seeds.	On site entry.	All personnel
WD04	Monthly survey and control of weeds across the Project. The survey is to determine if weed controls have been effective and if additional measures are required.	Monthly	Environmental Manager
WD05	If works are being undertaken in an area known to contain classified weeds, plant/equipment and vehicles are to be washed prior to vacating the areas.	At all times.	Construction and Site Manager
Vegetation Clearing			
WD06	Prior to clearing a Ground Disturbance Permit is required to be issued by the Environmental Manager.	At all times	Environmental Manager
WD07	Minimise ground disturbance at all location and specifically at riparian zones and within the Anmatyerr North Site of Conservation Significance (SOCS).		
WD08	Weed removal prior to vegetation clearing so that vegetative material would be clean and able to be mulched and reused directly on site.		
WD09	Areas to be cleared outside of existing disturbance will be flagged to prevent over clearing.		
WD10	Vegetation stockpiled from clearing activities will be monitored and chemical control undertaken should weeds be identified.		

ID	Mitigation Measure	Timing	Responsibility
Inspection and Monitoring			
WD11	Daily assessment of compliance with Ground Disturbance Permits.	Daily	Environmental Manager
WD12	Monthly weed infestation monitoring and application of chemical control. Monitoring and applications will be recorded in the Weed Register (Appendix C).	Monthly	Environmental Manager
WD13	Annual weed survey and control by an appropriately experienced and qualified botanist. The annual weed survey will include the Mine Site, Access Road, Adnera Loadout Facility and exploration areas. The annual weed survey will establish potential requirements for additional measures such as planting of native species.	Annual	Environmental Manager and Contractor
Management Plan Review			
WD14	Annual Weed Management Plan performance review (Section 5).	Annual	Environmental Manager

4.4 Trigger, Action and Response Plan

The Trigger, Action and Response Plan (TARP) outlines remedial actions and responses to the situation. The levels of incidents and TARP are provided in Table 4-4.

Table 4-4 Trigger, Action and Response Plan

Responsibility	Situation Standard	Level 1	Level 2
	No introduction of weeds at the Project or spread of weeds from current locations.	Trigger: Spread of environmental weeds to areas previous weed free.	Trigger: Introduction of Class A, B and C weeds and WoNS to areas previous weed free or within SOCS.
Site Personnel	Comply with: • Site Induction requirements • Personnel, Vehicle and Equipment Hygiene Procedures • Ground Disturbance Permit Procedures.		
Environmental Manager	Ensure all employees and contractors are aware of all required procedures and systems to erosion and sediment management and are provided with all required resources to implement the requirements effectively. Daily assessment of compliance with Ground Disturbance Permits. Monthly weed infestation monitoring and application of chemical control. Ensure all employees and contractors are provided with appropriate clearance approvals and on-ground guidance prior to giving any ground disturbance instructions. Commission an annual weed survey and control by an appropriately experienced and qualified botanist following Wet Season rains.	Undertake additional chemical control and increase frequency to weekly. Record monitoring and application of chemical control in the Weed Register.	Undertake additional chemical control and increase frequency to weekly. Record monitoring and application of chemical control in the Weed Register. Commission an appropriately experienced and qualified botanist to undertake a weed survey and control across the Project. The subcontractor is to establish additional weed mitigation measures required. Provide summary of weed survey within Monthly Report and recommend additional mitigation measures. Revise the Environmental Management Plan and Weed Management Plan following Site Manager approval of additional mitigation measures.

Responsibility	Situation		
	Standard	Level 1	Level 2
Subcontractor	Annual weed survey and control by an appropriately experienced and qualified botanist. Weed surveyor to provide assessment report summarising controls, spread and additional management measures (if any).		Undertake weed survey and assessment of Project activities and exiting weed mitigation measures. Determine additional mitigation measures and provide a summary report.
Site Manger	Ensure that the Weed Management Plan is implemented by all Site Personnel.		Assess and implement Monthly Report mitigation measures. Facilitate the revision of the Environmental Management Plan and Weed Management Plan.
	Clearing undertaken in accordance with Ground Disturbance Permit.	Trigger: Clearing undertaken outside of established Ground Disturbance Permit approval but outside of sensitive areas (i.e. restricted works areas).	Trigger: Clearing undertaken outside of established Ground Disturbance Permit approval and within sensitive areas (i.e. restricted works areas).
Environmental Manager	Daily assessment of compliance with Ground Disturbance Permits.	Commence investigation into the clearing works to determine root cause of over clearing. Establish the significance of over clearing and determine rehabilitation measures. Produce summary report within 1 week of the incident occurring.	Commence investigation into the clearing works to determine root cause of over clearing. Establish the level/area of impact within the sensitive area. Produce summary report within 24 hours of the incident occurring.
Site Manager	Ensure that the Weed Management Plan is implemented by all Site Personnel.	Review summary report and establish undertake debriefing with site personnel.	Review summary report and inform relevant stakeholder regarding over clearance. Review contractor / personnel performance and implement management measures.

5. Previous Period Performance

No data from the previous period is available for review.

6. References

Brocklehurst, P., Lewis, D., Napier, D., and Lynch, D. (2007). Northern Territory Guidelines and Field Methodology for Vegetation Survey and Mapping. Technical Report. Northern Territory Department of Natural Resources, Environment and the Arts.

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NRETAS (2005), *Northern Territory Parks and Conservation Masterplan – Northern Territory Bioregions Assessment of Key Biodiversity Values and Threats*, Department of Natural Resources, Environment, the Arts and Sport, Darwin, NT.

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Appendices

Appendix A – Northern Territory Weed Management Handbook – Control Options for Caltrop

Identified Weeds

Caltrop was the only declared weed species identified during the surveys. The Northern Territory Weed Management Handbook provides recommended control options which are provided below.

Caltrop – *Tribulus cistoides* and *Tribulus terrestris* (Class B and Class C)

OPTIMUM TREATMENT TIMES

darkener colour indicates preferred treatment times

JAN	FEB	MAR	APR	MAY	JUN
JUL	AUG	SEP	OCT	NOV	DEC



Chemical and concentration	Rate	Weed growth stage, method and comments
2, 4-D amine 625 g/L Various trade names	320 mL / 100 L or 1.1-2.4 L / ha (boom)	Seedling or adult (individuals or infestation): Foliar spray – apply when actively growing
Glyphosate 360 g/L Various trade names and formulations	10 mL / 1L	Seedling or adult (individuals or infestation): Foliar spray – apply when actively growing
Metsulfuron-methyl 600 g/kg Various trade names	10 g / 100 L	Seedling or adult (individuals or infestation): Foliar spray – apply when actively growing, wetting agent required

Non-chemical applications: Grub plants out by hand and burn.

Appendix B – Monthly Weed Surveying Form

Monthly Weed Survey Form

Assessor		Date	
Site Location(s)		Purpose of Visit	
Weed Control Equipment		Weather	

[illegible]

Appendix C – Weed Register

[illegible]

Appendix D – Risk Matrix

An environmental risk assessment was undertaken for the Project during the EIS phase. The risk assessment identified the risk source (hazard and event), receptors and potential impact. The consequence and likelihood were determined using the descriptions identified in Table D1 and Table D2 respectively. The risk matrix is provided in Table D3.

Table D1 Consequence Description

Consequence	Insignificant	Minor environmental impact. Impacts are contained on-site and short term in nature. No detrimental effect on the environment.
	1	Minor repairable damage to common historic structures or sites. No disturbance of cultural heritage sites. Minor local habitat modification and / or lifecycle disruption for a listed species. No loss of individuals of listed species. Negligible soil impact. Chemical concentrations are above background but below EILs. No detectable change to background water quality. No exceedance of background and applicable Water Quality guidelines.
	Minor	Moderate, unplanned localised environmental impact (may be of a temporary nature) or discharge contained on-site or with negligible off-site impact.
	2	Moderate but repairable damage to important historic structures or sites of cultural importance. Moderate local habitat modification and / or lifecycle disruption for a listed species. Minor local decrease in size of population(s) of listed species. Localised soil impact. Low level <2 times exceedance of EILs. Local short-term minor exceedance of background and applicable Water Quality guidelines.
	Moderate	Significant, unplanned environmental impact contained on-site or minor impact that is off-site.
	3	Considerable damage or infringement to sensitive historic structures or sites of cultural significance. Substantial local habitat modification and / or lifecycle disruption for a listed species. Moderate local decrease in size of population(s) of listed species. Localised long term or widespread short term soil impact. Chemical concentrations 2-5 times EILs. Local long-term or widespread short-term exceedance of background and applicable Water Quality guidelines.
	Major	Major or widespread, unplanned environmental impact on or off-site. Could include substantial pollutant discharges. Significant resources required to respond and rehabilitate.
	4	Major damage or infringement to sensitive historic structures or sites of cultural significance. Moderate regional habitat modification and / or lifecycle disruption for a listed species. Substantial local decrease in size of population(s) of listed species. Widespread and / or long term impact to soils. Chemical concentrations 5-10 times EILs. Local, permanent or widespread, long-term exceedance of background and applicable Water Quality guidelines.
	Critical	Extensive long term environmental harm or harm that is very widespread. Could include extensive pollutant discharges. Impacts permanent or unlikely to be reversible within 10 years.
	5	Unsalvageable and permanent damage to sensitive historic structures or sites of cultural significance. Substantial regional habitat modification and / or lifecycle disruption for a listed species. Moderate or substantial regional decrease in size of population(s) of listed species. Irreversible and / or extensive impact to soils. Chemical concentrations >10 times the ecological investigation levels (EILs). Widespread, permanent exceedance of background and applicable Water Quality guidelines.

Table D2 Likelihood Description

Likelihood	Rare 1	Unlikely 2	Possible 3	Likely 4	Almost Certain 5
Description	The event may occur only in exceptional circumstances.	The event could occur at some time.	The event might occur at some time.	The event will probably occur in most circumstances.	The event is expected to occur in most circumstances.
Occurrence Intervals	>10 years	5 – 10 years	2 – 5 years	1 – 2 years	1 year

Table D3 Risk Matrix

			Severity of Consequence				
			Critical	Major	Significant	Moderate	Minor)
			5	4	3	2	1
Likelihood of Consequence	Almost Certain	5	Extreme	Extreme	High	High	Medium
	Likely	4	Extreme	High	High	Medium	Medium
	Possible	3	Extreme	High	Medium	Medium	Low
	Unlikely	2	High	Medium	Medium	Low	Very Low
	Rare	1	Medium	Medium	Low	Low	Very Low

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Appendix J – Emergency Response Plan



TNG Limited

Mount Peake Emergency Response Plan

December 2015

Document Status

Version	Author	Reviewer	Approved by	Date	Status
Rev. 0	A. Koscielski	I. McCardle			

Amendments

Section	Details
n/a	

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Appendix A – NT EPA Section 14 Incident Report Form

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Appendix C – NT WorkSafe Sections 35 to 39 Incident Notification Form

1. Introduction

1.1 Purpose

The Emergency Response Plan (ERP) has been prepared to provide a response framework to specific emergencies at the Mount Peake Project. It is accepted that should control measures installed at the site fail, TNG will operate in accordance with this ERP, notifying relevant stakeholders and regulators as detailed.

The ERP forms part of the Environmental Management Plan (EMP). However, the document has been developed as a standalone plan to facilitate responses to emergencies. It covers the construction and operation phases and its purpose is to:

- Provide a process for identifying, assessing and managing emergencies to minimise impact to human health and surrounding environment
- Provide internal and external reporting requirements for emergencies
- Review and assess historical and/or industry specific incidents to inform future management of emergencies (subsequent ERP revisions through the Mining Management Plan process).

1.2 Objective

The ERP sets to outline *standardised responses* to ensure emergency situations are captured sufficiently. The main objectives of the ERP are:

- Outline potential emergency situations
- Identify initial responses (emergency response)
- Provide communication requirements
- Establish requirements for site representatives
- Provide statutory reporting requirements
- Provide investigation framework (where applicable).

1.3 Emergency Situations

The most likely emergency situations pertaining to the Project have been established through the EIS process. A summary of the emergency situations covered by this plan are provided in Table 1-1.

Table 1-1 Emergency Situations

Situation	Page No.
Fire – Building, Machinery or Explosion	9
Human Health – Injured Person	10
Human Health – Fatality	11
Sacred Site / RWA Interference	12
Structural Failure	13
Hazardous Substances Spill	14
Vehicle Incident	15

2. Project Details

2.1 Overview

TNG Limited will operate the Mount Peake Project. The Mount Peak Project comprises two main areas: the Mine Site which is connected to the Adnera Loadout Facility by a private access road. The Project is situated approximately 235 km north-northwest of Alice Springs. The closest community is Wilora, situated approximately 47 km east of the Mine Site and 43 km west of the loadout facility. The location and general arrangement of the Mount Peake Project is provided in Figure 2-1.

Table 2-1 Operator Details

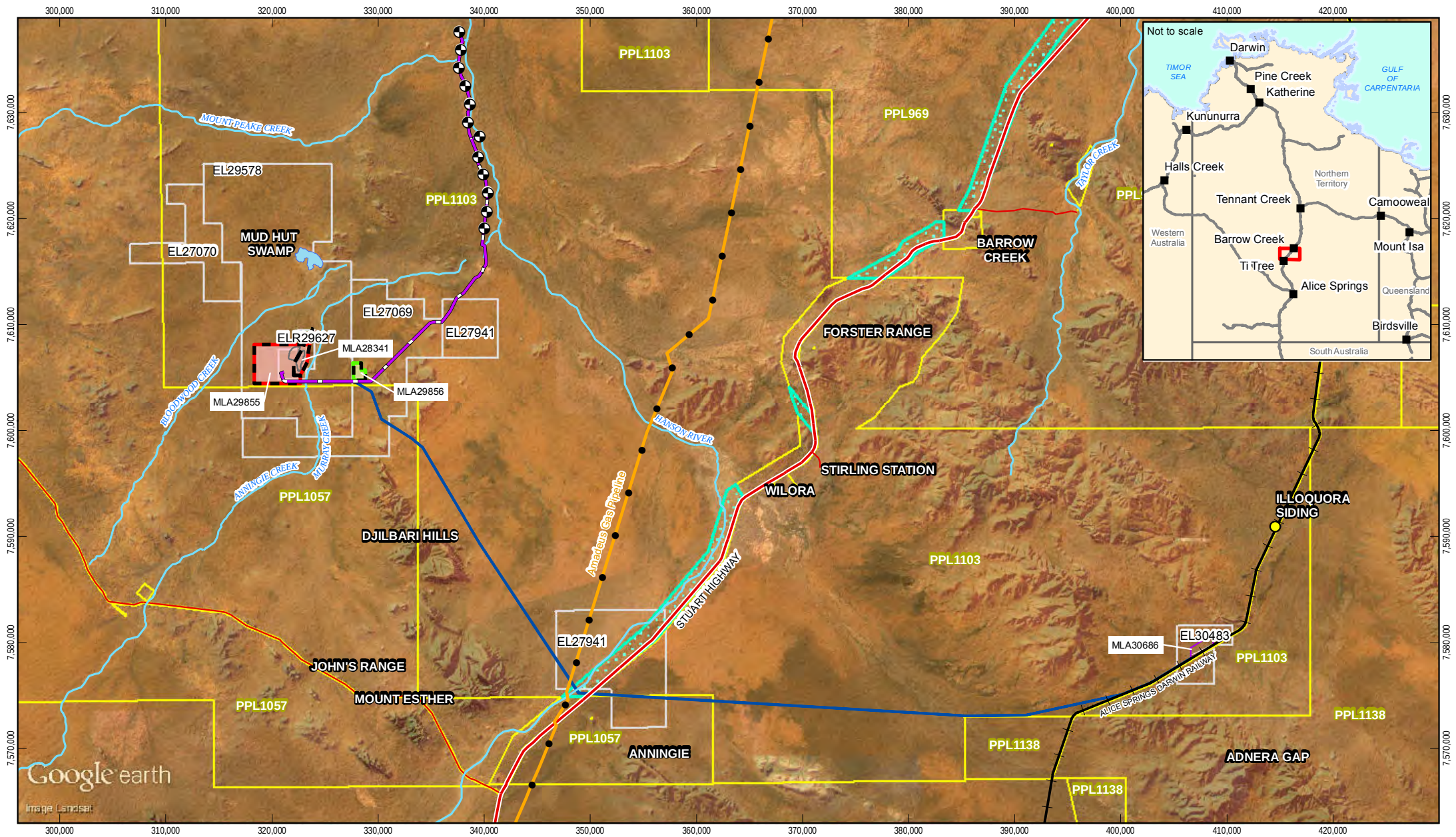
Company	TNG Limited
Contact	Paul Burton Managing Director
Street address	Level 1, 282 Rokeby Road, Subiaco, WA 6008
Postal address	PO Box 1126, Subiaco, WA 6904
Phone	+61 8 9327 0900
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Email	peb@tngltd.com.au
ABN	12 000 817 023
ASX code	TNG
Web	www.tngltd.com.au

2.2 Emergency Communications

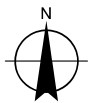
The Project is located within a remote area of Central Australia where mobile phone coverage is generally not available. In general, communication at the site will be undertaken via Ultra High Frequency (UHF) radio (with booster relays were required). A summary of emergency contacts is provided in Table 2-2.

Table 2-2 Summary of Emergency Contacts

Contact	Number	Assistance
Internal		
Construction Teams	UHF 10	Emergency Field Team Member
Open Pit	UHF 01	Emergency Field Team Member
Waste Rock Dump	UHF 02	Emergency Field Team Member
Processing Plant and TSF	UHF 03	Emergency Field Team Member
Mine Camp	UHF 04	Emergency Field Team Member
Haul Road	UHF 05	Emergency Field Team Member
Adnera Loadout Facility	UHF 06	Emergency Field Team Member
Emergency Channel	UHF 12	Emergency Operations Officer
External		
Fire / Police / Ambulance	000 / 112	Priority response to emergencies
Ti Tree Remote Health Centre	08 8956 9736	Nearest medical centre
Ti Tree Police Station	08 8956 9733	Nearest priority response
Ti Tree Volunteer Fire Brigade	08 8956 9733	Nearest fire response
Care flight / Royal Flying Doctor Service	000 / 112	Medical Retrieval Service
Aboriginal Areas Protection Authority	08 8999 5511	-



Paper Size A4
0 2.5 5 7.5 10 12.5 15
Kilometres
Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 53



LEGEND

Illoquora Siding	Major Watercourses	Rail Siding Loading Facility	Cadastral Boundaries
Potential Borefield	Railway	Mount Peake Mining Area	Access Road
Borefield Delivery Pipeline	Amadeus Gas Pipeline	Crown Land	Camp Facilities
Principal Road	Mine Site Facilities	Mount Peake Granted Tenements	
Minor Road	Mud Hut Swamp	Mount Peake Mineral Leases	



TNG Ltd
Mount Peake EIS

Project Location
Mount Peake Project Area

Job Number	61-29057
Revision	A
Date	29 Oct 2015

Figure 2-1

G:\61\29057\11 GIS\Maps\MXD\EIS_MDS\6129057_001_ProjectLocation.mxd

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Data source: TNG - Gas / Slurry Pipeline Study Corridor, Camp Facilities, Borefield Infrastructure, Transport Study Corridor, Mount Peake Mining Area, Mount Peake Granted Tenements (2015). Geoscience Australia - Waterways, mainland, placename, road (2008). Google Earth Pro - Imagery (Date extracted: 13/02/2014). Created by: RB

2.3 Muster Points

During emergencies and emergency training exercises it is common the personnel from a department, specific work area or accommodation area will be required to evacuate to a place of safety.

Designated areas have been established across the site based on being the least hazardous in the event of an identified emergency.

In an evacuation, all personnel will cease work immediately, leave all equipment in a safe condition before walking calmly and quickly toward the nearest muster point, upwind of the incident if possible.

2.4 Emergency Team Structure and Responsibility

In order to effectively manage emergency a designated Emergency Team (ET) has been established. A summary of the roles and responsibilities are provided in Table 2-3.

Table 2-3 Emergency Team Responsibilities

Emergency Team Position	Responsibilities			
Emergency Response Coordinator	The Emergency Response Coordinator (ERC) is responsible for the implementation of the ERP and Emergency Team (ET). The ERC will: • Ensure sufficiently trained resources are available onsite to deal with potential and actual emergency situations • Review and approve modifications to the ERP annually and/or after an emergency situation • Undertake and/or authorise reporting to statutory bodies (DME, NT EPA and NT WorkSafe) relating to incidents within statutory timeframes.			
	Primary	Site Manager	Secondary	Deputy Site Manager
Emergency Operations Officer	The Emergency Operations Officer (EOO) responsibilities include: • Monitor site radio communications for emergency situations; • Communicating with Emergency Field Team Members (EFTM) and/or Field Team Member • Implement the ERP and capture all information relating to the situation • Provide the 'All Clear' over UHF and to Muster Points • Undertake and/or manage investigations into emergency situations or remedial works • Maintaining up to date Emergency Team members for roosters and associated contact details • Provide training to EFTM • Provide summary of incidents, actions and responses to the ERC • Produce a 'Safety Moment' to onsite personnel within 1 week of incident occurring; • Provide tool-box talks that summarise emergency responses and detail any historical and/or industry specific incidents which have occurred and management measures used • Annually revise the ERP based on historical and/or industry specific incidents to inform future management of emergencies (subsequent ERP revisions through the Mining Management Plan process).			
	Primary	HSE Manager	Secondary	Deputy HSE Manager
Emergency Field Team Member	The EFTM will often be the first response for the majority of emergency situations. The EFTM responsibilities include: • First response coordinator to capture emergency and/or commence response • Communicating with EOO • Provision of first aid to injured site personnel • Safety of all site personnel (including employees, subcontractors and visitors) within their areas • Undertaking a roll call at Muster Points • Provide accurate and updates to all site personnel.			
	Primary	Area Supervisor	Secondary	-
Medical Services Provider	The Medical Services Provider (MSP) will provide immediate first aid as required and establish additional measures required (i.e. external emergency response). The MSP will train all member of the ET with basic first aid routinely and provide tool-box talks on topical issues as required.			

Emergency Team Position	Responsibilities		
Field Team Member	All site personnel including employees, subcontractors and visitors are responsible for: • Complying with Site Induction requirements and Emergency Team instructions; • Ceasing activities and leaving work areas in a safe condition as required; and • Reporting to local Muster Points and returning to work when the 'all clear' instruction is provided.		
	Primary	All site personnel	Secondary -

2.5 Emergency Procedures

2.5.1 Alarm

A manually activated alarm will be installed at the Processing Plant to facilitate the management of emergencies. At all remaining areas the notification of an incident will be conveyed over the UHF radio and teams will be directed toward Muster Points.

2.5.2 All Clear

The Emergency Operations Officer is responsible for closing out incidents and providing the 'All Clear' radio call to all site personnel and Muster Points effected.

All works which were being undertaken through a permit system (i.e. Hot Works) will require the initial permit to be closed out and a new permit commenced.

2.5.3 Re-entry

Once the all clear signal has been given, personnel may return to their work areas. In most situations a debrief will be held following the incident.

2.5.4 Debrief

The Emergency Operations Officer will schedule and undertake a debrief meeting following the incident. The meeting will include Emergency Response Coordinator, Emergency Field Team Member, Medical Services Provider and site personnel directly involved with the incident. The debrief meeting will be undertaken to:

- Establish the root cause of the incident
- Assess response times and effectiveness
- Undertake a step-by-step assessment of individuals actions and appropriateness
- Identify additional management measures and/or responses for future incidents.

The Emergency Operations Officer is to update the ERP and provide briefing to all onsite personnel.

2.6 Education and Training

2.6.1 Site Induction

All site personnel will be inducted to the Project during construction and operation phases. The site induction will include:

- Summary of potential emergency situations
- Site personnel requirements
- Detail of Muster Points.

2.6.2 Safety Moments

Following an incident at the Project (including near misses) a safety moment will be produced by the Emergency Operations Officer. The Safety Moment will include a picture of the incident (where relevant), summary of events leading up to the incident, root cause and future management measures or recommendations.

2.6.3 Tool-box Talks

The Emergency Operations Officer will provide monthly tool-box talks to each construction or operational area. The tool-box talks will summarise emergency responses and detail any historical and/or industry specific incidents which have occurred and management measures used.

2.7 Statutory Notification Procedures

Incidents which occur and are considered to form part of the ERP will be captured, assessed and reviewed through the ERP and MMP processes. In addition, regulatory reporting requirements for incidents and triggers are provided in Table 2-4. All external communication of incidents will be signed and approved by the Emergency Response Coordinator (Mine Manager).

Table 2-4 Regulatory Body Reporting Requirements

Entity	Trigger	Timeframe and Contact Details	Incident Reporting Details
Northern Territory Environment Protection Authority (NT EPA)	Incident which causes, or is threatening or may threaten to cause pollution resulting in material environmental harm or serious harm.	< 24 h post incident ntepa@nt.gov.au pollution@nt.gov.au	The Section 14 Incident Report Form requires the following details: • Incident causing or threatening to cause pollution • Location occurred and area impacted; • Date and time • How the pollution has occurred, is occurring or may occur • Attempts made to prevent, reduce, control, rectify, investigation and/or clean up the pollution or resultant environmental harm caused or threatening to be caused by the incident • Operator details. The form is to be signed by the Emergency Response Coordinator (Mine Manager) for submission. A blank form is provided in Appendix A.
Department of Mines and Energy (DME)	Incident which causes minor environmental impact with some minor actual or potential harm to the environment.	As soon as practicable. Mineral.Info@nt.gov.au	The Section 28 Notification of Environmental Incident Form requires the following details: • Site and operator details • Location occurred and area impacted (GPS coordinates) • Date and time • Description of incident • Emergency and remedial actions taken • Nature of impact and severity • Current situation • Details of sampling undertaken • Notification status internally and externally. The form is to be signed by the Emergency Response Coordinator (Mine Manager) for submission. A blank form is provided in Appendix B.

Entity	Trigger	Timeframe and Contact Details	Incident Reporting Details
NT WorkSafe	Incident which results in either: • Death of a person • Serious injury or illness or • Dangerous incident.	Immediate verbal communication via 1800 019 115 Written notification < 48 h post incident. ntworksafe@nt.gov.au	The NT WorkSafe Incident Notification Form requires the following details: • Person submitting details • Incident details including date, time and human injury details • Work activity being undertake at the time of incident • Witness(es) details • Details of injured / deceased persons • Summary of injury or illness • Future remedial actions. The form is to be signed by the Emergency Response Coordinator (Mine Manager) for submission. A blank form is provided in Appendix C.
Department of the Environment (DotE)	Impact (injury or death) involving matters of national environmental significance.	As soon as practicable. 02 6274 1372 compliance@environment.gov.au	n/a
Heritage Branch	Exposure and/or interference with unidentified natural, cultural or indigenous heritage.	As soon as practicable. Tel: 08 8951 9247 heritage@nt.gov.au	No standard notification form is available. However, the following should be provided within the initial notification: • Type of natural, cultural or indigenous heritage • Location of the site (grid reference) • Type and method of interference (exposed and/or damaged) • Name and organisation of discoverer • Photograph of site.
Central Land Council	Entrance and/or damage of sacred site or restricted works area.	As soon as practicable. Tel: 08 8951 6338 jstoll@clc.org.au	No standard notification form is available. However, the following should be provided within the initial notification: • Location of the site (grid reference) • AAPA certificate pertaining to the site • Summary of damage • Name and organisation of discoverer; • Type and method of interference (exposed and/or damaged) • Photograph of damage.
Aboriginal Areas Protection Authority (AAPA)	Entrance and/or damage of sacred site or restricted works area.	As soon as practicable. Tel: 08 8999 5511 enquiries.aapa@nt.gov.au	No standard notification form is available. However, the following should be provided within the initial notification: • Location of the site (grid reference) • AAPA certificate pertaining to the site • Summary of damage • Name and organisation of discoverer; • Type and method of interference (exposed and/or damaged) • Photograph of damage.

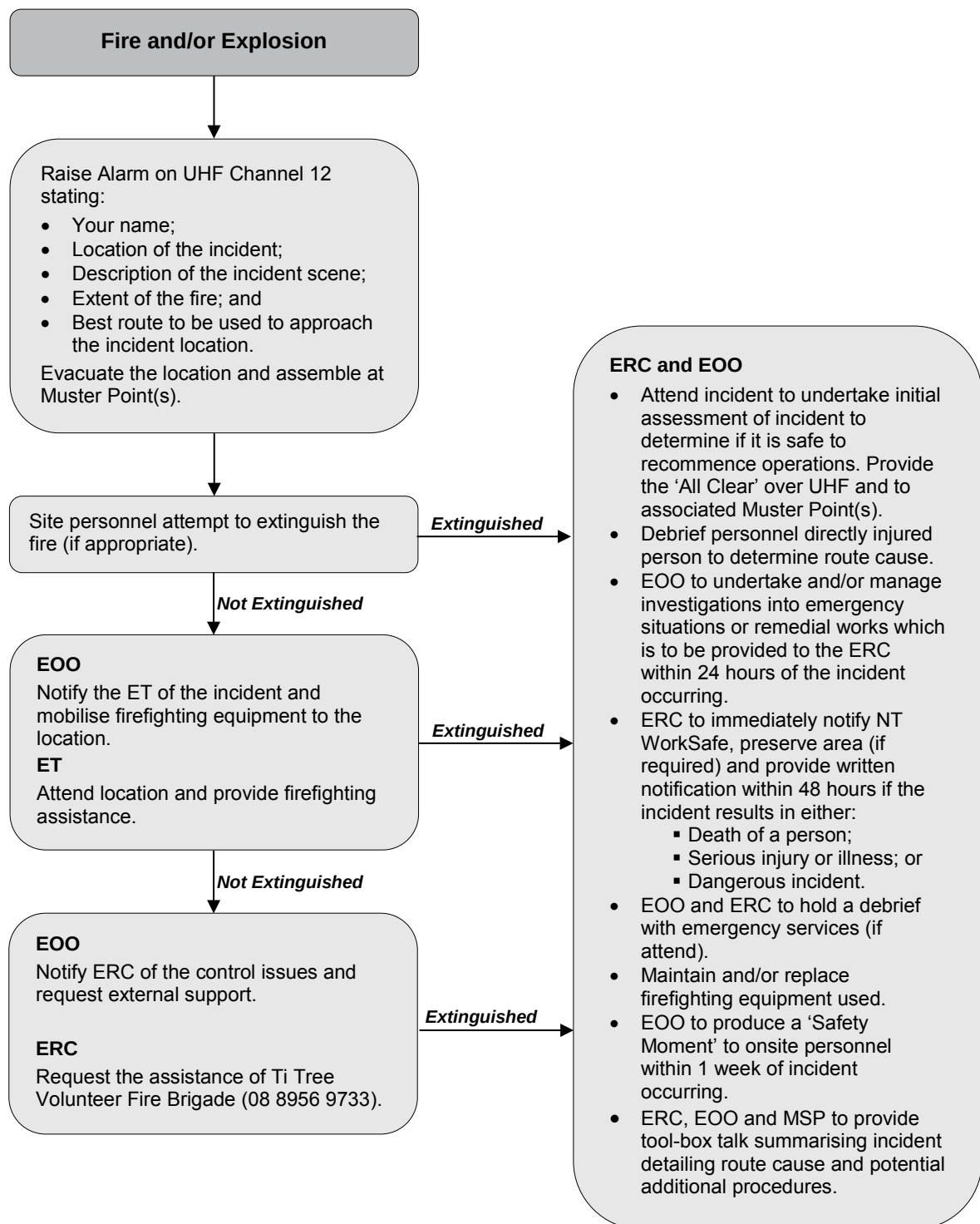
3. Emergency Response Actions

Emergency response actions have been predetermined to facilitate the management of incidents at the Project. Incidents may include one or more response plans and they should be used in unison as required. The responses covered include:

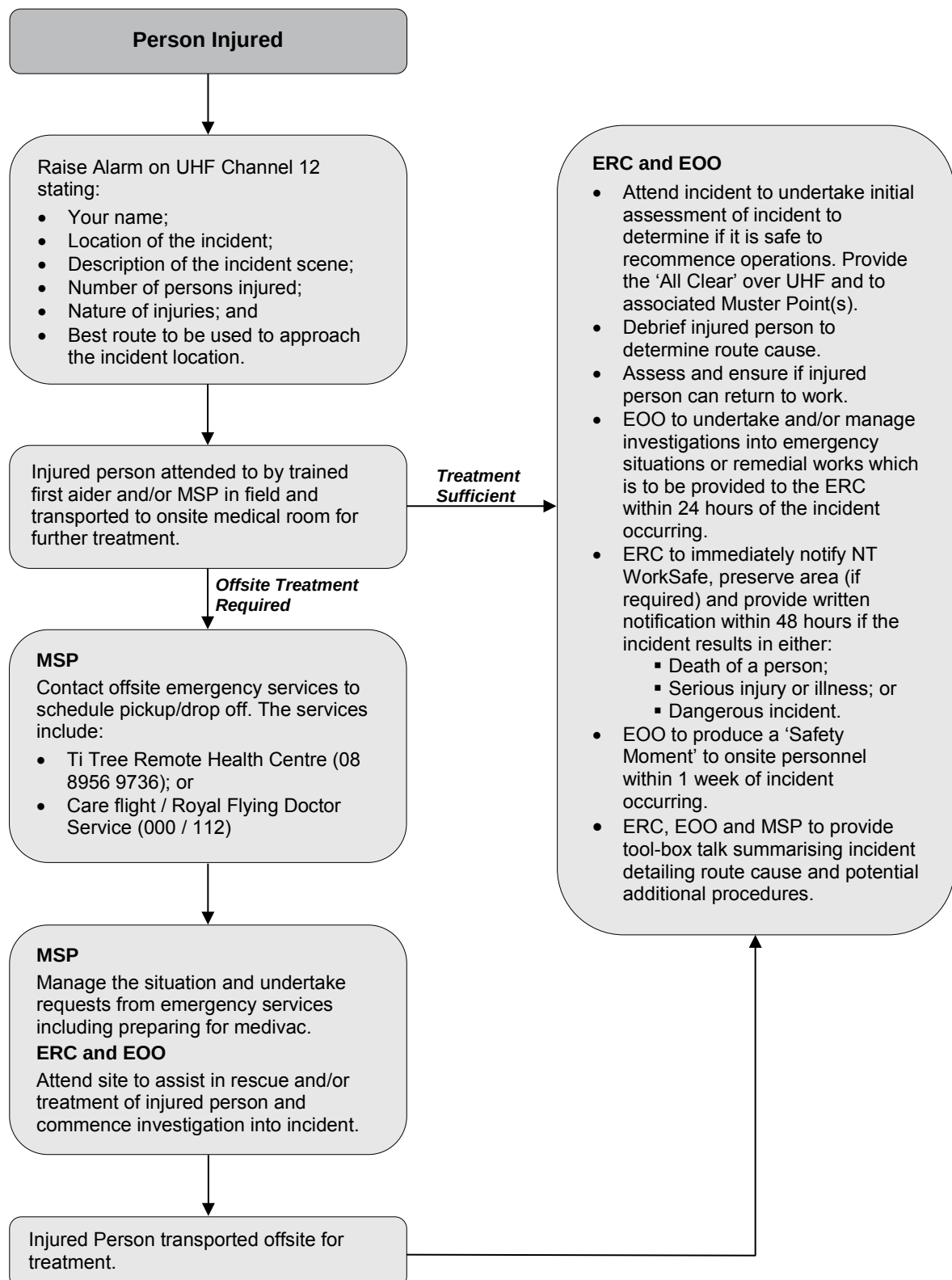
- Fire – Building, Machinery or Explosion
- Human Health – Injured Person
- Human Health – Fatality
- Sacred Site / RWA Interference
- Structural Failure
- Hazardous Substances Spill
- Vehicle Incident.

The emergency response actions are provided below.

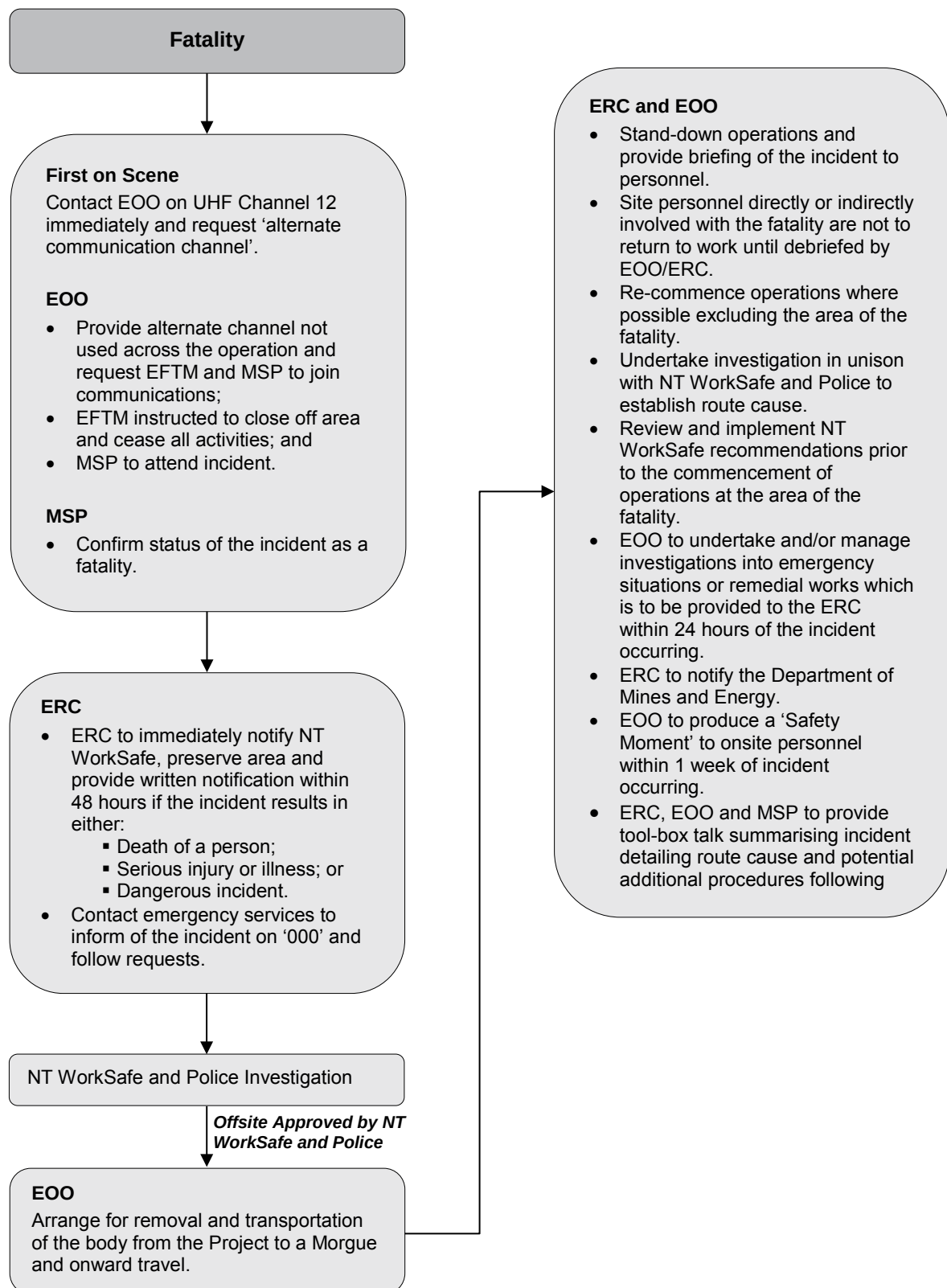
3.1 Fire – Building, Machinery or Explosion



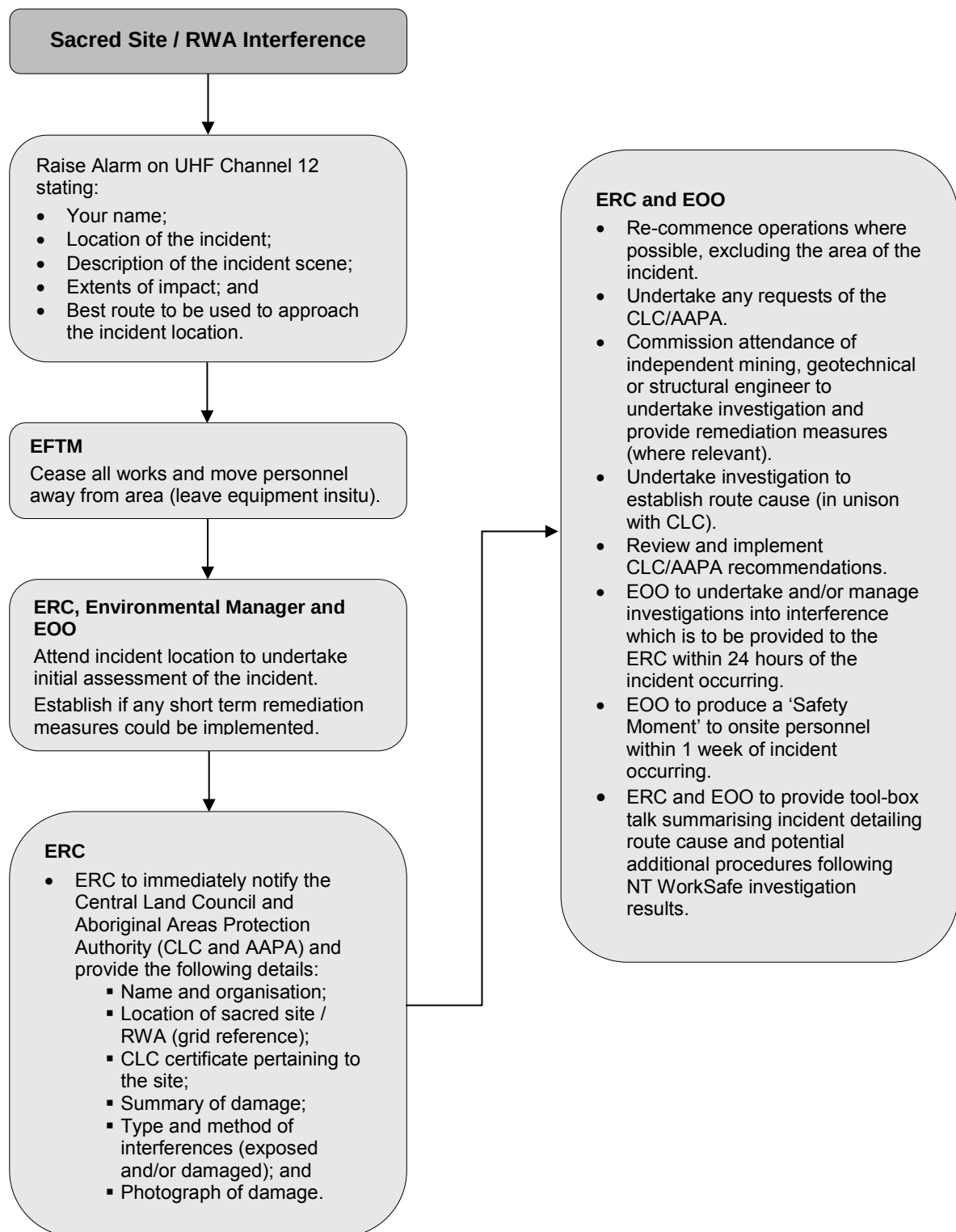
3.2 Human Health – Injured Person



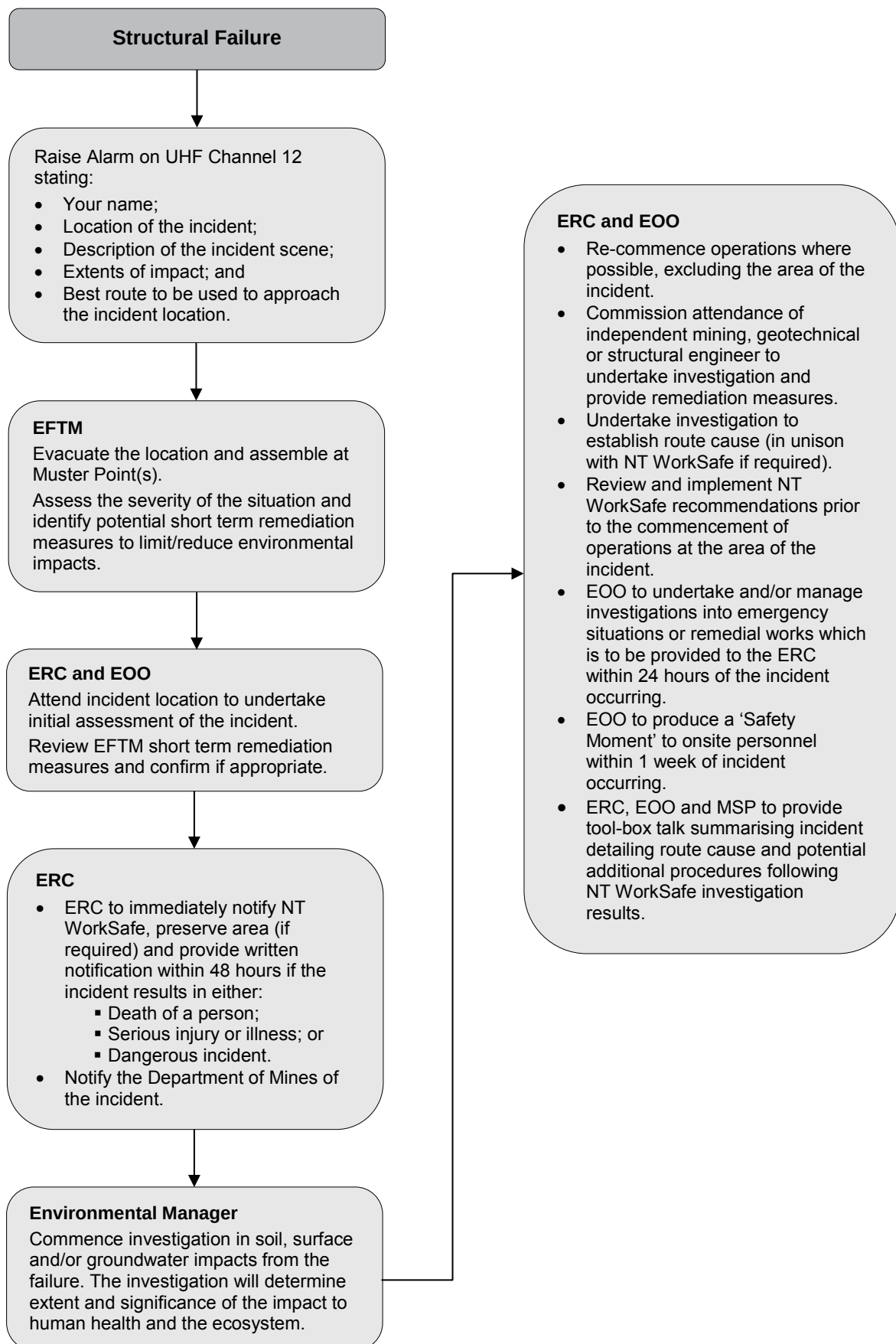
3.3 Human Health – Fatality



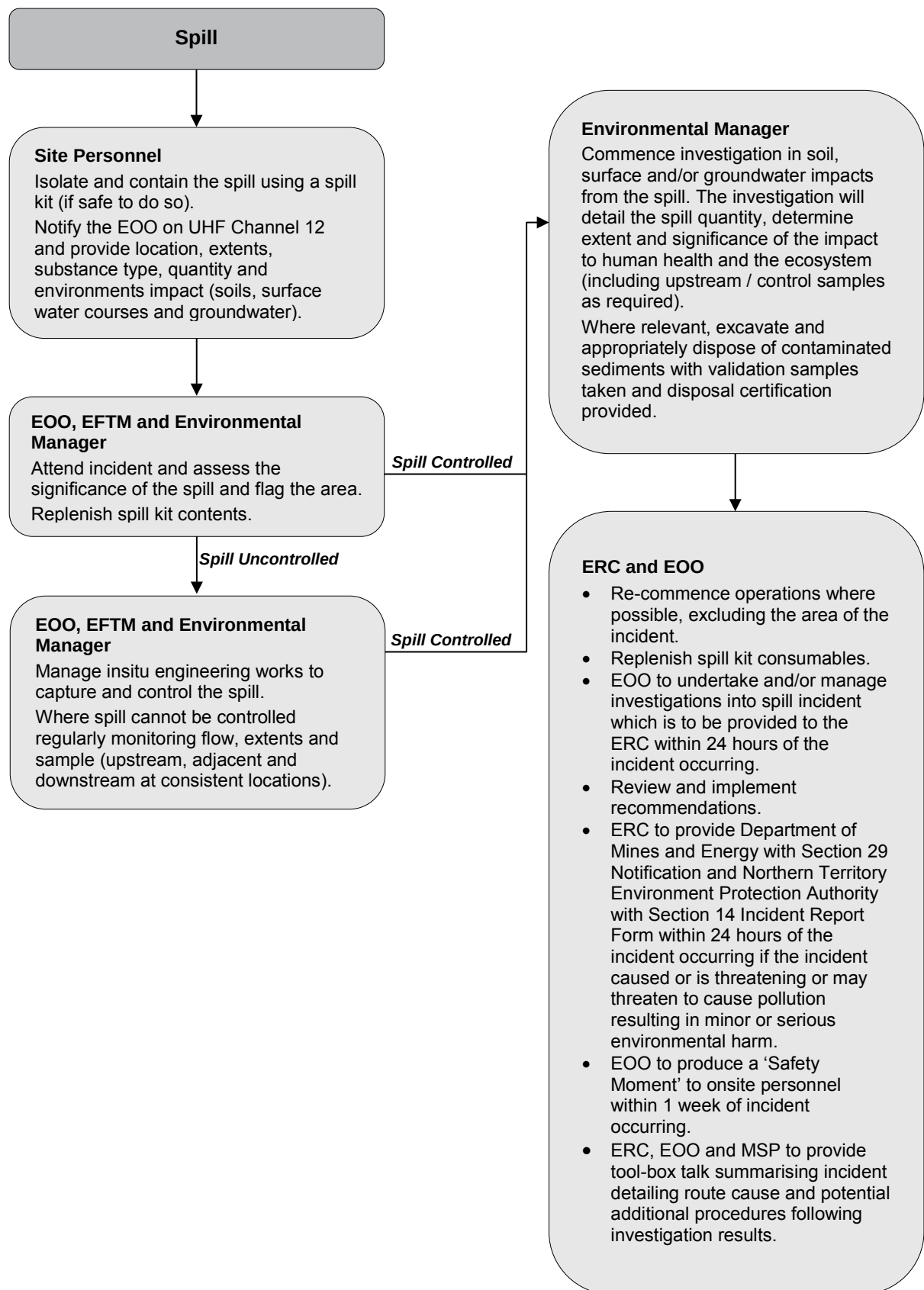
3.4 Sacred Site / RWA Interference



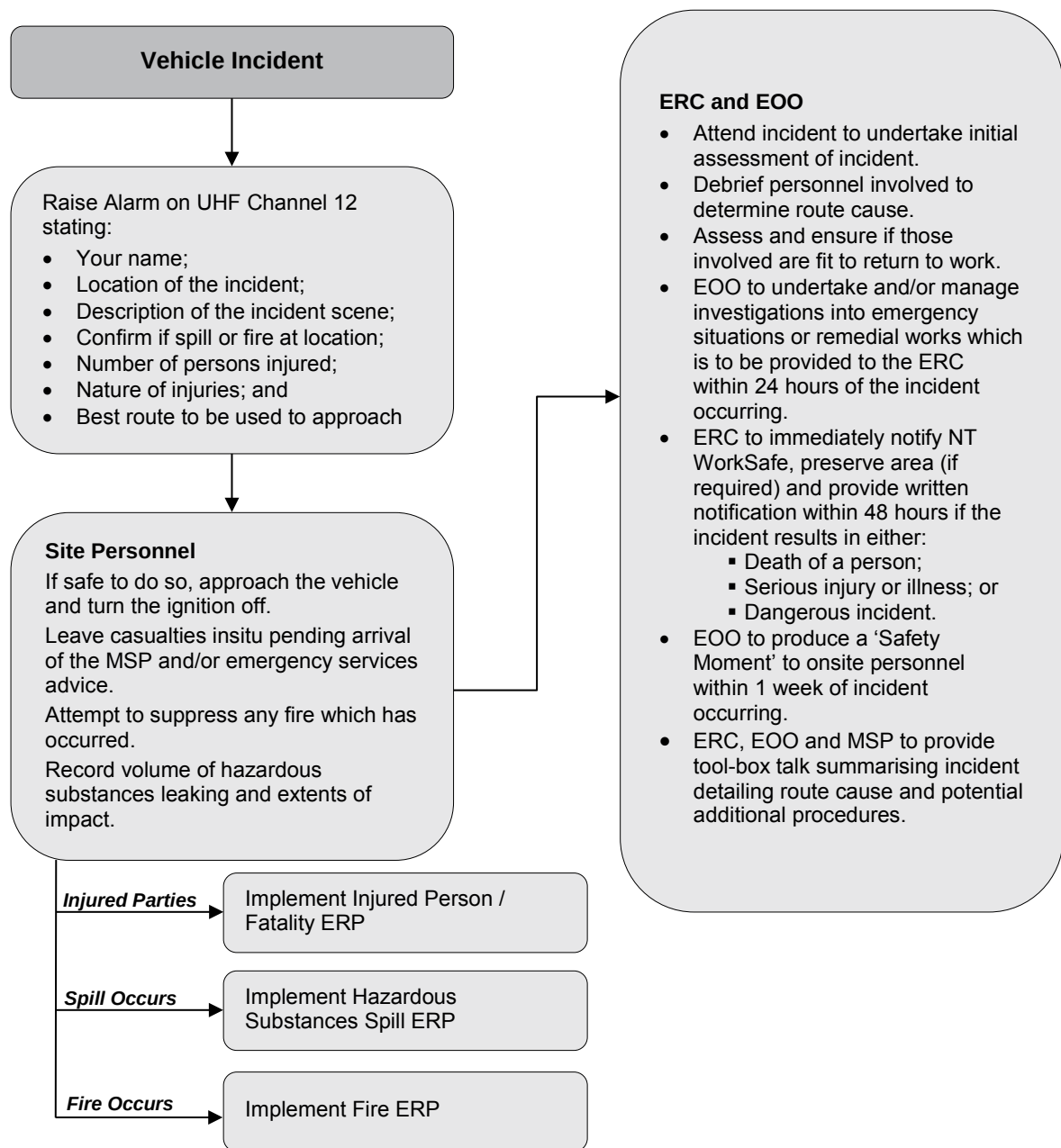
3.5 Structural Failure



3.6 Hazardous Substances Spill



3.7 Vehicle Incident



4. Previous Period Performance

No emergency situations occurred during the previous reporting period.

Appendices

Appendix A – NT EPA Section 14 Incident Report Form

SECTION 14 INCIDENT REPORT (*Waste Management and Pollution Control Act*)

Date and Time of Notification:	
Person / Company:	
Incident:	

(a) the incident causing or threatening to cause pollution	
(b) the place where the incident occurred	
(c) the date and time of the incident	
(d) how the pollution has occurred, is occurring or may occur	
(e) the attempts made to prevent, reduce, control, rectify or clean up the pollution or resultant environmental harm caused or threatening to be caused by the incident	
(f) the identity of the person notifying the NT EPA	

Appendix B – DME Section 28 Notification of Environmental Incident

Notification of an Environmental Incident

Section 29 of the Mining Management Act

Forward completed form to: Mining Compliance Division,
Department of Mines and Energy

Email: mineral.info@nt.gov.au (preferred) or Fax: (08) 89996527

PLEASE TYPE OR PRINT CLEARLY

Please ensure that you have read the [Draft Guideline - Environmental incident reporting under Section 29 of the Mining Management Act \(July 2012\) \[167kb\]](#)

NAME OF MINING SITE	
NAME OF OPERATOR	
DATE & TIME OF INCIDENT	
NAME OF PERSON NOTIFYING	
POSITION/TITLE	
CONTACT PERSON	
CONTACT DETAILS	Business: Mobile
	Fax: E-mail:
INCIDENT LOCATION (use GPS co-ordinates, attach map, etc as appropriate)	
DESCRIPTION OF INCIDENT	
EMERGENCY & REMEDIAL ACTIONS TAKEN	

ENVIRONMENTAL DETAILS

NATURE OF IMPACT AND SEVERITY (Volume/ of spillage, area impacted, wildlife/vegetation/ erosion, etc) DME severity classification: 1 2 3 4 <i>Refer to pages 3 to 5 of the Draft Guideline - Environmental incident reporting under Section 29 of the Mining Management Act (July 2012) [167kb]</i>	
CURRENT SITUATION (Potential / ongoing / ceased / etc)	
DETAILS OF ANY SAMPLES TAKEN (when / where / type / number / time for results /etc)	

OPERATOR INTERNAL REPORTING

Has the incident been reported internally? YES / NO If so, to whom	Name:
	Position:
Operator reference number (where applicable/available)	

HAS THE DEPARTMENT BEEN NOTIFIED EARLIER?	☐ YES ☐ NO
WHO WAS NOTIFIED	
HOW (phone/email/fax)	
WHEN (date & time)	
BY WHOM	

Signed: _____ Date: _____

NAME: _____

POSITION: _____

OFFICE USE ONLY	
RECEIVED BY	
DATE	TIME

Appendix C – NT WorkSafe Sections 35 to 39 Incident Notification Form

Incident Notification Form

Witnesses

Name of person(s) who saw the incident or was first on the scene

Details of Injured/Deceased Person(s)

Full Name:					
Date of Birth:		Occupation/Job Title:			
Direct Worker ☐	Contractor ☐	Member of public ☐	Other ☐		
Address:					
Suburb:		State:		Postcode:	
Work number:		Mobile number:			
Email:					

Injury/Illness

Provide a description of any injury or illness

Did the person receive treatment following the injury/illness? If yes, describe treatment below

Yes ☐ No ☐

Action

Describe any Action taken/intended, if any, to prevent recurrence of the incident

Declaration

Date form submitted:		Signed:		I have submitted this form electronically (signature is not required)	☐

GHD

GHD, 999 Hay Street, Perth, WA 6000

P.O. Box 3106, Perth WA 6832

T: 61 8 6222 8222 F: 61 8 6222 8555 E: permail@ghd.com.au

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Appendix K – Drainage, Erosion and Sediment Control Plan



TNG Limited
Mount Peake Project
Drainage, Erosion and Sediment Control Plan

November 2015

Limitations

This report has been prepared by GHD for TNG Limited and may only be used and relied on by TNG Limited for the purpose agreed between GHD and TNG Limited as set out in this report.

GHD otherwise disclaims responsibility to any person other than TNG Limited 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 TNG Limited 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.

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Appendices

Appendix A – Site Visit Photograph Log (28/01/13 and 08/04/13)

1. Introduction

1.1 Overview

GHD has been commissioned by TNG Limited to prepare an Environmental Impact Statement (EIS) for the proposed Mount Peake Project (the Project) to support key Commonwealth and Territory Government approvals. The Terms of Reference for the preparation of the EIS was issued by the Northern Territory Environment Protection Authority (NT EPA) in March 2014.

The Project will be constructed on Stirling Station, approximately 235 km north-northwest of Alice Springs. The Project will comprise:

- Mining of a polymetallic ore body through an open-pit truck and shovel operation;
- Processing of the ore to produce a magnetite concentrate;
- Road haulage of the concentrate to a new railway siding and loadout facility on the Alice Springs to Darwin railway near Adnera; and
- Rail transport of the concentrate to TNG's proposed Darwin Refinery located at Middle Arm, Darwin (the refinery is the subject of a separate assessment).

This preliminary Drainage, Erosion and Sediment Control Plan (DESCP) has been prepared to provide a framework for the management of drainage, erosion and sediment during construction, operation and closure of the Project. The preliminary DESCP will be developed further as the design of the Project matures and details of individual Project components are refined.

1.2 EIS term of reference

The Terms of Reference (ToR) for the preparation of an EIS (NT EPA 2014) identified erosion and sediment movement as a key risk. Specifically, the ToR identified the following risks that needed to be addressed:

- Construction of linear infrastructure that crosses, is adjacent to, or situated within waterways may alter the hydrology and rates of erosion and sedimentation;
- Disturbance of soils may allow mobilisation of sediments, erosion, and sedimentation of waterways; and
- Surface water quality may be impacted by spills to surface water and runoff containing hazardous substances or elevated sediment concentrations.

The ToR require that management measures for erosion and sediment controls be identified for both the construction and operational phases of the following Project components:

- Mine infrastructure such as temporary haul roads, stockpiles, ore dumps, construction of tailings facilities and surface works relating to mine rehabilitation/closure;
- Off-mining lease construction works, vegetation clearance and/or infrastructure development such as roads and pipelines;
- Transport, load-out facilities and associated stockpile areas; and
- Sites of creek and river crossings by mine infrastructure and roads.

1.3 Scope of the DESCP

The purpose of this preliminary DESCP is to provide an outline of the Drainage, Erosion and Sediment Control (DESC) strategy that should inform the development of the Project design. The DESCP should be an active document that should be adapted to address specific DESC matters associated with the final designs, specific construction methods and stages of the Project.

The primary objective of this preliminary DESCP is to minimise the potential for erosion and sedimentation during the mine's life. The preliminary DESCP provides conceptual details of the controls identified to divert stormwater runoff away from disturbed areas. It also provides an outline of the following management measures associated with Project components:

- Prevention of the release of sediment laden stormwater from disturbed areas into the surrounding environment;
- Rehabilitation of the construction site through appropriate revegetation and stabilisation strategies;
- Requirements to maintain DESC structures during the operation of the mine; and
- An overview of DESC following closure.

The preparation of the DESCP included the following:

- Site inspection;
- Site description;
- Plans depicting the general areas of disturbance;
- Recommended DESC measures for the site addressing general disturbance areas; and
- Identification of general drainage patterns and location of watercourses on site.

As the designs progress, the DESCP should be updated to include the following:

- Plans depicting the specific limits of disturbance;
- Detailed topographic survey and identification of specific drainage patterns and overland paths;
- Recommended DESC measures for the site addressing specifically identified disturbance areas;
- Location of erosion, sediment and drainage control measures shown on a site plan;
- Documentation of installation, maintenance and removal requirement for all temporary and permanent DESC measures; and
- Documentation of monitoring and requirements for all temporary and permanent DESC measures.

Although only preliminary, this DESCP is consistent with the following guidelines:

- Best Practice Erosion and Sediment Control for Building and Construction Sites (IECA 2008);
- Erosion and Sediment Control (Catchments and Creeks 2010);
- Erosion and Sediment Control Guidelines: Built Environment (DNREA 2007); and
- Erosion and Sediment Control Plans Fact Sheet (Land Management Unit, Natural Resources Division).

2. Site Description

2.1 Project Overview

A detailed description of the Project is provided in Chapter 2 of the EIS. The Project includes the following key components:

- Open cut mine;
- Waste rock dump (WRD);
- Run of mine (ROM) pad;
- Four long term stockpiles;
- Processing plant;
- Concentrate stockpiles;
- Tailings storage facility (TSF);
- Access road between the mine site and Adnera Loadout Facility;
- Concentrate loadout facility and rail siding at Adnera;
- Borefield and associated water pipeline;
- Water treatment and sewage treatment plants;
- Fuel farm;
- Gas fired power station;
- Explosives and detonator magazines;
- Accommodation village; and
- Administrative buildings, laboratory, workshops and warehouses.

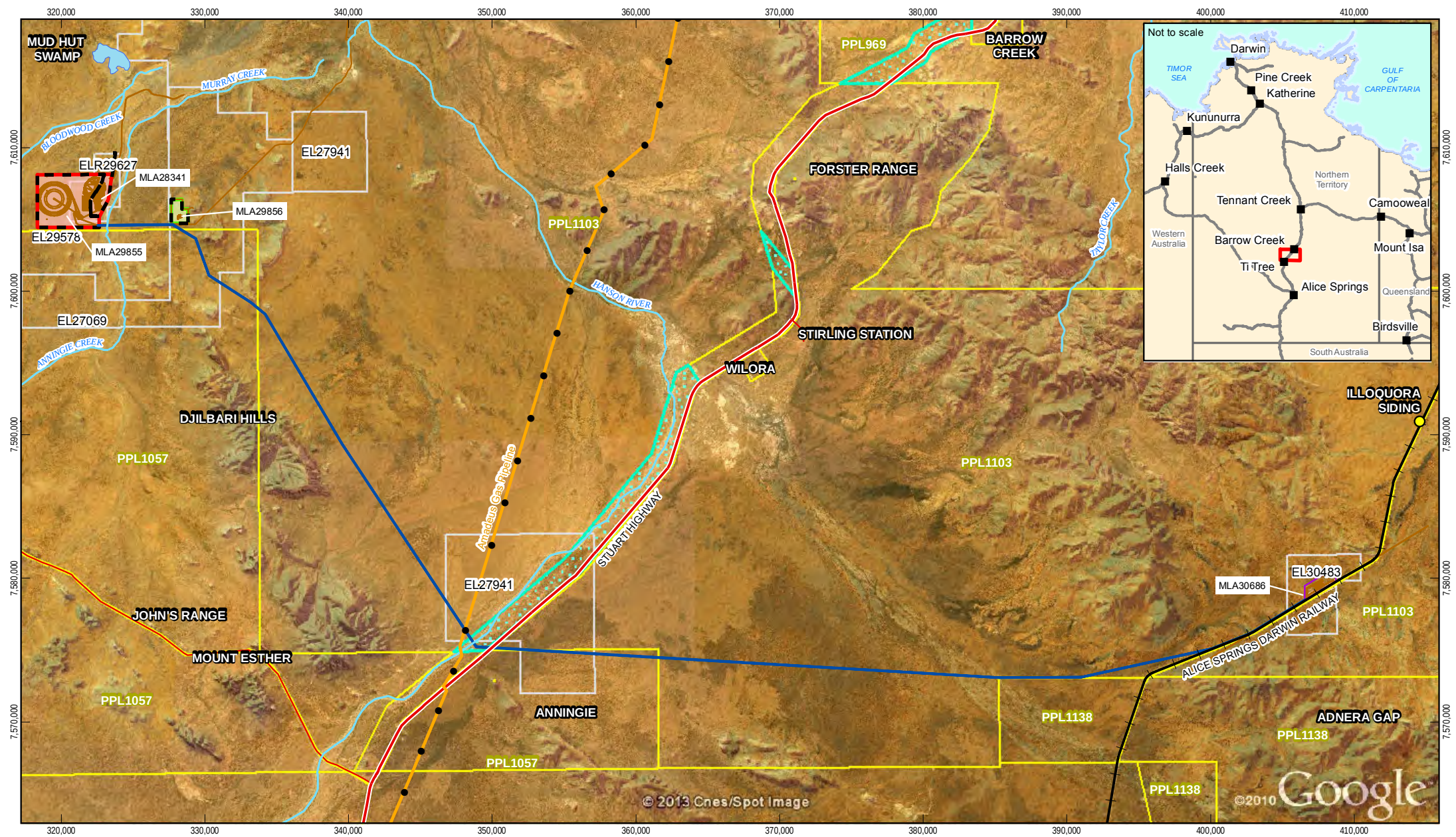
A layout for the overall Project site and detail of the mine site layout are provided in Figure 2-1 and Figure 2-2 respectively.

TNG proposes to commence construction in late 2016, which is anticipated to take two years to complete. Mining will continue for 15 years. The life of the project is expected to be 19 years inclusive of construction (2 years), mining and production (15 years) and closure and rehabilitation (2 years).

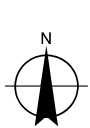
2.2 Site Overview

The Erosion and Sediment Control Guidelines: Built Environment (DNREA 2007) indicate that there are five factors which determine the potential occurrence and severity of erosion, these being:

- Rain or wind;
- Soil erosion risk;
- Runoff velocity;
- Vegetation; and
- Erosion control techniques.



Paper Size A4
0 2.5 5 7.5 10
Kilometres
Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 53



LEGEND

● Illoquora Siding	— Amadeus Gas Pipeline	■ Crown Land
— Principal Road	— Mine Site Facilities	■ Mount Peake Granted Tenements
— Minor Road	■ Mud Hut Swamp	■ Mount Peake Mineral Leases
— Major Watercourses	■ Rail Siding Loading Facility	■ Cadastral Boundaries
— Railway	■ Mount Peake Mining Area	■ Access Road
	■ Camp Facilities	



TNG Ltd
Mount Peake EIS

Job Number 61-29057
Revision A
Date 23 Oct 2015

Project Location
Mount Peake Project Area

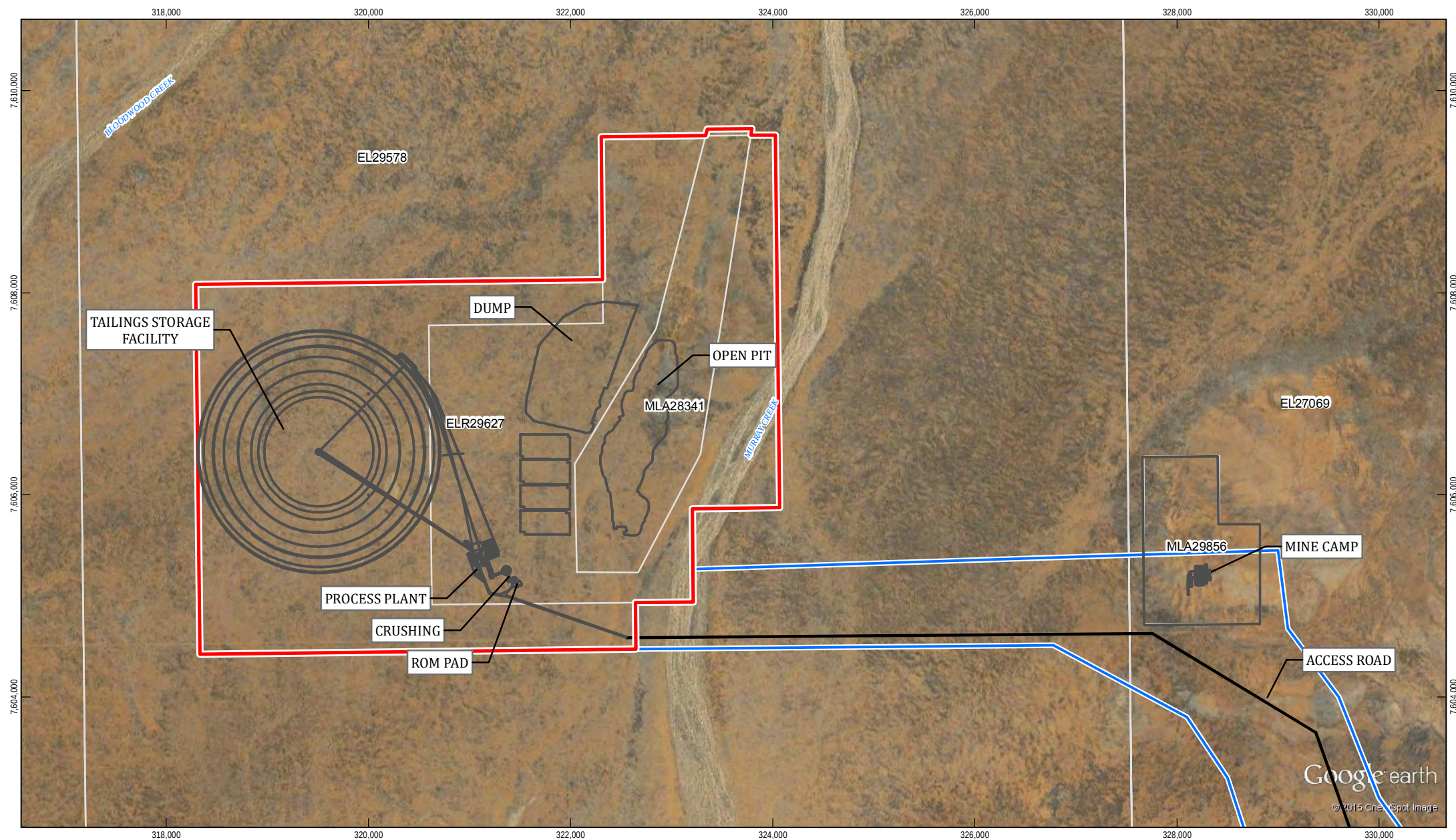
Figure 2 - 1

G:\61\29057\11 GISMaps\MXD\6129057_001_Fig1ProjectLocation.mxd

239 Adelaide Terrace Perth WA 6004 Australia T 61 8 6222 8222 F 61 8 6222 8555 E permail@ghd.com.au W www.ghd.com.au

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Data source: TNG - Gas / Slurry Pipeline Study Corridor, Camp Facilities, Transport Study Corridor, Mount Peake Mining Area, Mount Peake Granted Tenements (2015). Geoscience Australia - Waterways, mainland, placename, road (2008). Google Earth Pro - Imagery (Date extracted: 13/02/2014). Created by: RB

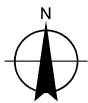


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Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 53



LEGEND

- Mine Site Facilities
- Mount Peake Granted Tenements
- Mount Peake Mining Area
- Access Road
- Transport Study Corridor



TNG Ltd
Mount Peake EIS

Job Number 61-29057
Revision A
Date 26 Oct 2015

Mine Site Detail
Mount Peake Project Area

Figure 2-2

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Google: Imagery - 20150910; TNG Ltd: Mine site facilities, access road, mining area, Tenure - 20151021

2.2.1 Rainfall

Rainfall occurrence and intensity is a key consideration for DESC planning.

The Project site is at the southern extent of the Australian monsoon belt and in the centre of the Australian continent. The climate is arid to semi-arid with an annual rainfall of approximately 320 mm recorded at the Bureau of Meteorology (BoM) Station 15525 at Barrow Creek, which is located approximately 50 km east of the Project site. Observed records at Barrow Creek show that:

- The annual rainfall is highly variable and ranges from 70 mm in 1963 to 1,150 mm in 2010;
- Rainfall is also highly seasonal and average monthly rainfalls range from 67 mm in February to 6 mm in August (Figure 2-3); and
- The majority of the rainfall occurs as thunderstorms.

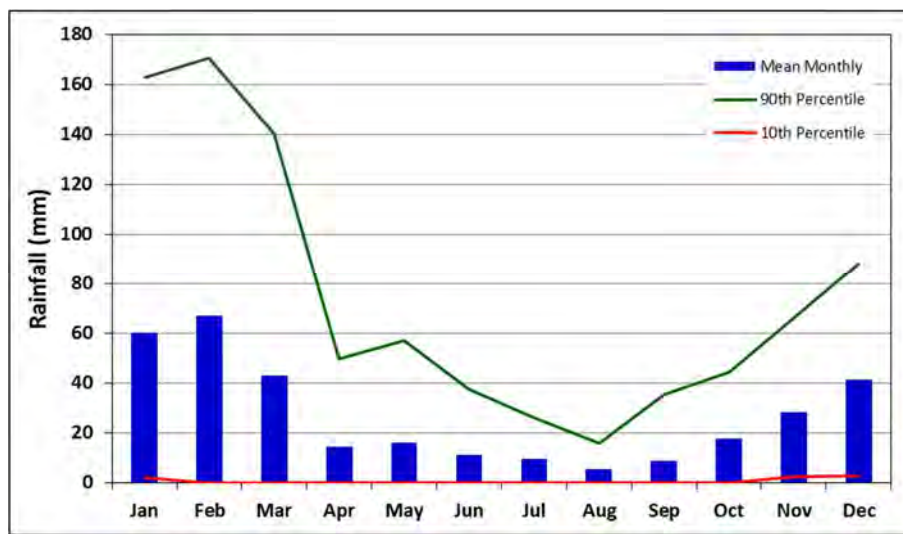


Figure 2-3 Monthly rainfall statistics at Station 15525 (Barrow Creek)

2.2.2 Wind

Wind speed and direction is also important for the development of a DESCP. The rose of wind direction versus wind speed at the BoM Station 15525 at Barrow Creek depicted in Figure 2-4 indicates that the predominant wind direction is from the southeast. Accordingly, wind erosion protection measures, such as shelter belts, should be aligned perpendicular to this direction. Further, areas to be stripped for borrow material should also be aligned perpendicular to this direction. The widths of cleared areas exposed to wind erosion should be narrowest in the predominant wind direction to ensure soil loss for future rehabilitation is minimised.

2.2.1 Soils and Land Capability

The Project is within the Arunta Province in the Burt Plain Bioregion. The Bioregion is dominated by undulating stepped plains, consisting generally of red soils, with earthy sands and red siliceous sands also occurring extensively across the plain (Neave *et al.* 2006). Mapping of surface geology identifies predominantly alluvial floodplains in the vicinity of the Project area (NRETAS 2009, 2009a).

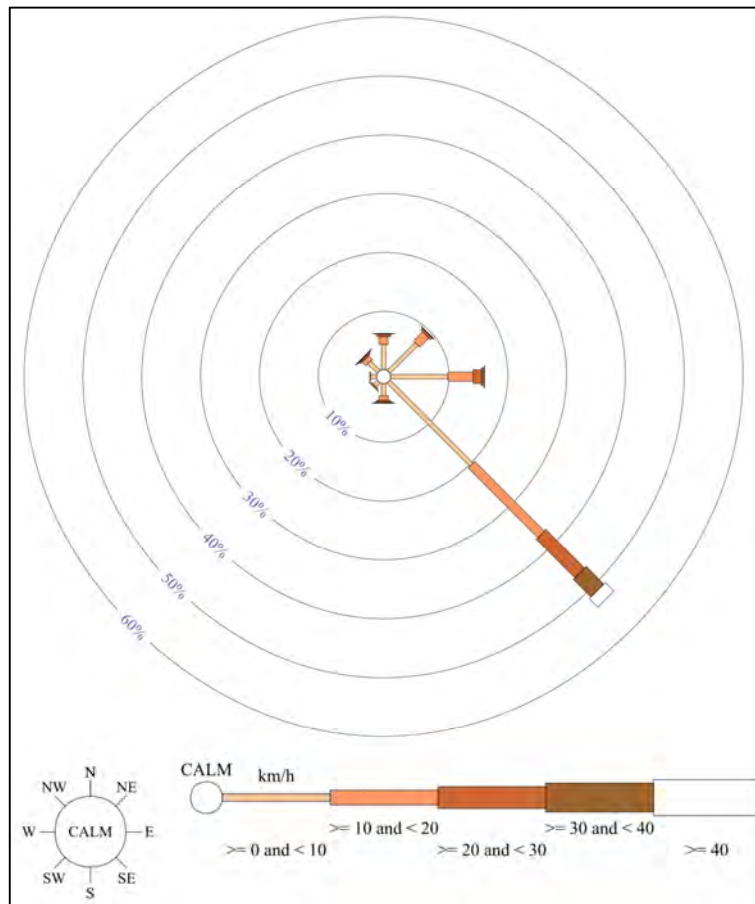


Figure 2-4 Wind Rose at Station 15525 (Barrow Creek)

The surface geology in the vicinity of the mine site is Quaternary sediments, with red earth soil around the mine site itself and alluvial deposits present in active channels and on flood plains. The surficial deposits can generally be divided into two units either relating to the current cycle of weathering or erosion, or relating to earlier cycles of weathering.

Immediately northeast of the proposed pit, an outcrop of the Mount Stuart Formation forms a small rise immediately adjacent to Murray Creek. This also forms high ground to the east of the proposed mine camp area. It is a mix of grey conglomerate and minor limestone and reddish purple coarse feldspar-quartz sandstone.

The surface geology along the access road consists of alluvial deposits, with older Cainozoic sediments at the Hanson River, and units of the Central Mount Stuart Formation present north and south of the road near the Alice Springs Darwin Railway.

A borefield is proposed on the western bank of the Hanson River where the surface geology consists of alluvial deposits covered by sheet sand and alluvial/red soil plain deposits. These are reddish brown mottled sediments.

A site visit conducted in January 2013 identified that the main soil types across the Project area are a red soil with fine and clayey material, and with riverbeds consisting of white/yellow coarse grained sand overlying a clay base. A summary of the site conditions are provided in Appendix A along with narrative regarding the erosion and sedimentation risks. The potential presence of dispersive soils in the Project area was noted. Erosion is potentially an issue in areas where dispersive clays are present.

2.2.2 Vegetation

A detailed description of the vegetation at the Project site is provided in GHD (2015).

The Burt Plain Bioregion is broadly characterised by plains of acacia shrubland, tussock grassland, hummock grassland, acacia and eucalypt woodlands, and mountain ranges in the east, north and west of the bioregion (Neave *et al.* 2006). Vegetation cover in the vicinity of the Project correlates with the landforms across the region with *Eucalyptus camaldulenses* (River Red Gum) found along drainage channels and *Acacia aneura* (Mulga) dominating shrublands within the alluvial plains.

Rehabilitation of disturbed areas with native vegetation will be highly dependent on rainfall. Too little rainfall and plants will not take, and too much rainfall and the area could become damaged due to erosion. Accordingly, ESC measures will be required until such vegetation takes root.

2.2.3 Topography, Drainage and Surface Water

A detailed description of the surface water systems is provided in GHD (2015a), the localities of which are provided in Figure 2-5.

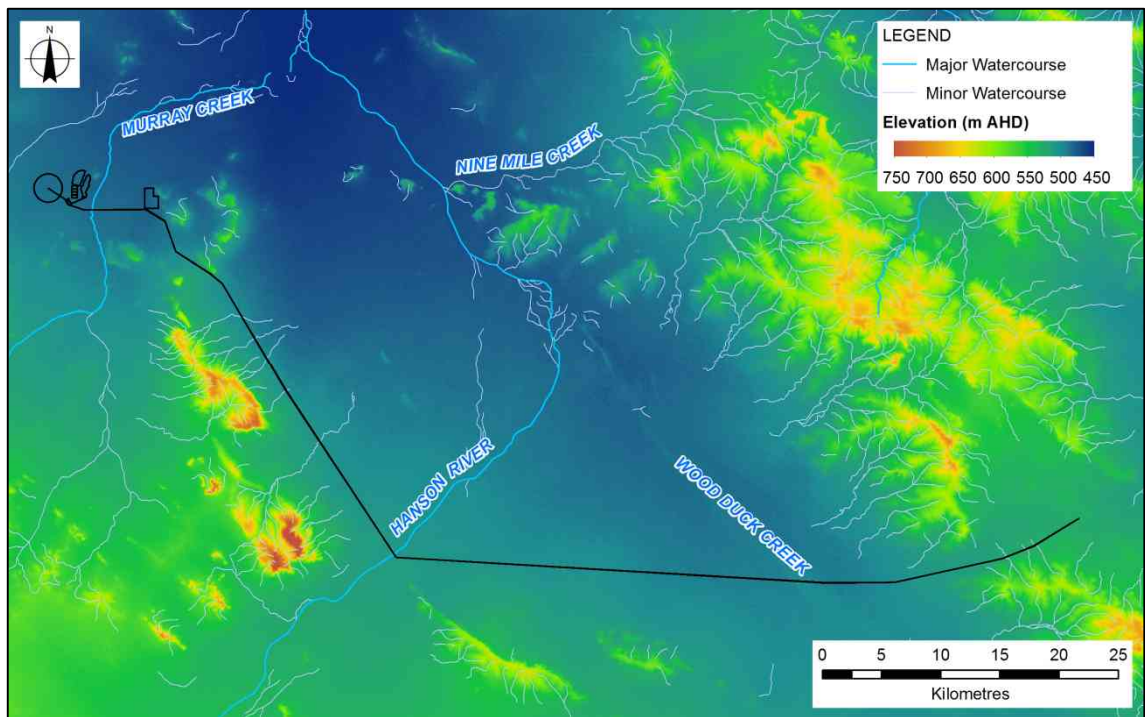


Figure 2-5 Locality Plan Depicting Major Waterways

There are three major water features that run through the Project area; the Hanson River, Murray Creek and Wood Duck Creek. The proposed mine site is in the watershed of a fourth river, Bloodwood Creek, which is a potential receptor of water running off the mine site.

There are also numerous ephemeral dendritic drainage systems, with a number of smaller watercourses originating out of rocky outcrops into the surrounding plains. Drainage across the site consists of both annular water courses, generally controlled by geology, to highly distributed channels associated with the formation of extensive alluvial fans.

The water courses are typically sandy and highly braided, with surface water flow within them likely to spread laterally from channels across the extensive floodplain environment as low energy sheet flow.

Sheetflow processes are likely to occur along the access road within the alluvial plains to the east of the Stuart Highway.

3. DESC Strategy

3.1 Overview

This DESC provides a framework for managing the risk of erosion and release of sediment to the receiving waters or the contamination of stormwater. The drainage management strategy for the site entails runoff separation and catchment classification for water quality and management planning purposes.

The key strategy for uncontaminated stormwater is for this to be discharged from site via appropriately designed and constructed ESC structures. Potentially contaminated stormwater will be collected, treated and disposed of appropriately. The preliminary contaminant risk assessment reported in GHD (2015a) proposed control measures for the management of water quality. It is emphasised that this preliminary plan considers only the management of erosion and sediment.

The prescribed staged approach to assess and determine appropriate ESC controls is:

- Identify land uses at risk of erosion and release of sediment to the receiving waters or the contamination of stormwater;
- Undertake a risk assessment to assess impact on downstream water quality and requirement for intervention (e.g. monitoring, maintenance or new control);
- Determine type and location of control measure based on land use using the IECA (2008) ESC fact sheets and ESC matrix; and
- Design, construct and maintain control measure.

Whilst most areas of the mine site may have a combination of control requirements, there will generally be an emphasis on one dominant control requirement. The control requirements will depend on the nature of the flow, intensity of rainfall and soil type as is outlined in Figure 3-1. Examples of the different options for control measures are presented in Table 3-1.

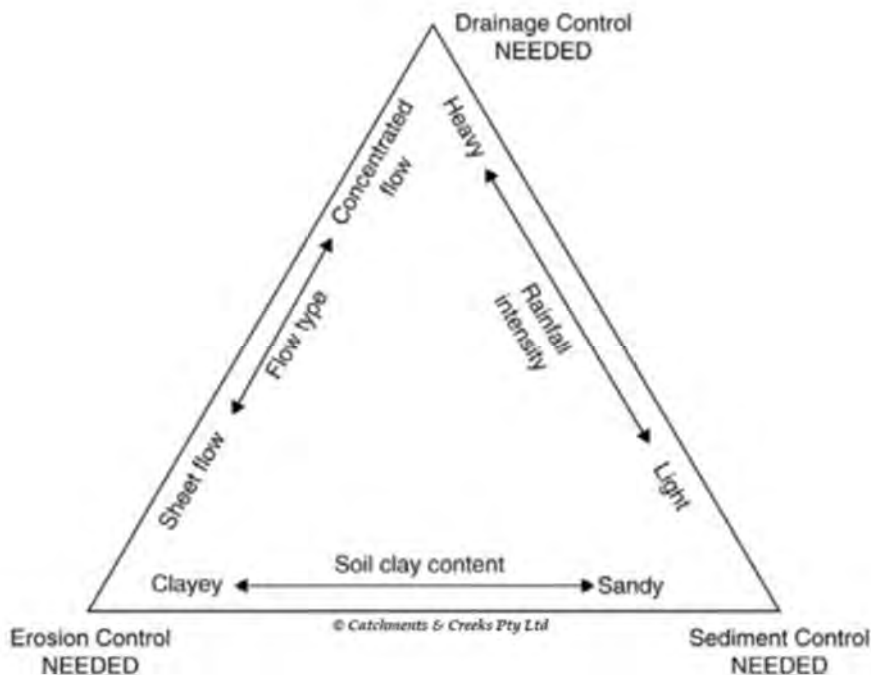


Figure 3-1 Control Guide for Site Conditions

Table 3-1 Typical ESC Measures

Drainage control	Erosion control	Sediment control	Instream Flow and Sediment Control	Miscellaneous
Chute & Channel Lining Catch Drains & Chutes Other Drainage Structures	Application of Natural Materials Application of Synthetic Products Filters Basins & Tanks	Entry-exit controls Sheet flow controls Minor concentrated flow controls Stormwater Inlet Controls Type 1 & 2 Controls	Flow diversion measures Sediment Control Measures	General construction practice Assessments and inspections

3.2 Treatment Measures

3.2.1 Treatment Selection Criteria

Management of erosion and sedimentation is based on the following principles:

- Minimise the extent and duration of soil disturbance;
- Control the location and velocity of drainage flow;
- Minimise soil erosion initiated by wind, rain or concentrated flow;
- Minimise sediment flow from site;
- Promptly revegetate/stabilise all exposed and/or unstable soil surfaces; and
- Install, operate and maintain appropriate ESC measures.

The extent and type of ESC measure depends on the likelihood and intensity of expected rainfall and sheet flow.

The treatments and approaches in this preliminary DESCP are based on the following categories:

- Erosion control measures;
- Drainage control measures; and
- Sediment control measures.

3.2.2 General Design and Construction Approach

All works on site should be undertaken with due consideration to the potential drainage, erosion and sediment risks. Sites to be disturbed for mining or associated activities should consider the prevailing preferential drainage routes, including existing rivers and minor creeks. Areas showing existing erosion or sedimentation should be avoided where possible.

Sites that have been cleared should not be left without treatment for an extended period of time. Bunding and drainage should be constructed to ensure that runoff from disturbed areas is discharged without appropriate ESC treatment.

3.2.3 Drainage Controls

The drainage control measures are principally used to:

- Divert un-impacted runoff from up-gradient areas around disturbed areas; and
- Contain and transport potentially contaminated stormwater through disturbed areas to treatment measure(s).

Measures may include channels, drains and bunds to divert or contain flow and direct it towards an appropriate discharge point or treatment area. Open channels and drains should be stabilised with the dimensions and layouts in line with relevant standards to minimise the risk of erosion and sedimentation. Open unlined drains and v drains are generally not acceptable.

Bunding should be installed around all mining infrastructure and disturbed areas to divert un-impacted runoff from up-gradient areas and to contain potentially impacted runoff for treatment prior to discharge. The bunds should be stabilised to reduce maintenance requirements and minimise risk of washout during large storm events.

Culverts are recommended where it would be unreasonable to divert water, such as to allow water to flow under a road. Floodways are recommended for road crossings of major creek lines where the large and mobile sediment loads would make culverts impractical. Culverts spaced at short intervals are recommended in areas of sheetflow to prevent sheetflow shadow zones. The design of these should be checked with hydraulic and hydrologic modelling prior to construction.

3.2.4 Erosion Controls

Erosion control measures are required to minimise movement and loss of sediments at the source, and typical measures include:

- Minimise the area and duration of disturbance;
- Minimise soil and stockpile erosion caused by wind and rain; and
- Minimise turbidity levels in stormwater runoff by minimising the exposure of soil to rain and stormwater flow.

Large cleared areas such as stockpiles, laydown areas and haul roads are at risk of erosion. These should be bunded (or windrows in the case of haul roads), and located away from floodplains and watercourses. During dry windy days, these areas should be wetted to minimise wind erosion.

Stabilisation of disturbed areas should be undertaken as soon as practically possible. Stabilisation options could include revegetation and gravel. The stabilisation of a site with these methods provides:

- Physical protection against raindrop impact;
- Barrier between the earth and flow;
- Increased surface roughness that reduces erosive flow velocities; and
- Increased absorption of rainfall by the soil-profile, reducing the volume of runoff.

Revegetation should be carried out on exposed soil surfaces that have the potential to erode and cause sediment movement into the surrounding environment during rain events.

Revegetation is an effective long-term ESC measure. Ideally, plants should be native to the area, have good soil binding capability and compete successfully with weed species.

All topsoil stripped during clearing works should be stockpiled as near to the stripped area as practical and kept conditioned for use during closure works.

3.2.5 Sediment Controls

Sediment controls are measures that trap and retain sediments, removing sediment from the stormwater flow. Where practical, sediment should be trapped close to its source, reducing break-down of soil particles and the release of dispersive clays, which are of particular concern at the Project area. An additional control is usually required immediately prior to discharging stormwater from the site.

Sediment controls have the greatest maintenance requirements of ESC measures. A sediment control structure may not work properly if it does not have sediment-removal (maintenance) after a storm event.

Sheet flow is anticipated along the access road east of Stuart Highway, and may also occur on a smaller scale throughout the site. Sediment and debris washed from the road may impact sheetflow. Options such as sediment fences and buffer zones along road verges are recommended. Buffer zones are flat or gently sloped areas with a rough surface, for example a grassy area or gravelled area. Multiple controls can be used at the same time. Sediment fences provide physical filtration and create a settling area behind them.

Settling ponds or sediment basins and other treatment options should be utilised where water is to be captured, for example after it runs off the WRD. Sediment basins can retain particles down to 0.045 mm, and are generally designed to be cleaned out on a regular basis.

3.3 Maintenance

Drainage and ESC measures require ongoing maintenance, and the following should apply:

- Mitigation measures requiring minimal regular maintenance or simple maintenance procedures would be preferred; and
- Appropriate access should be provided if maintenance is required on any structure.

An example maintenance program for the ESC measures is outlined in Table 3-2. A checklist should be developed that records maintenance problems likely to occur for each of the ESC measures adopted on site, and identifies the person responsible for implementing, maintaining, inspecting, repairing and modify controls.

A monitoring checklist should be kept of all ESC measures, with entries made following inspection and maintenance activities detailing the following:

- Removal of DESC measures;
- Condition of DESC structures and stabilised surfaces;
- Repair of any damage to DESC structures; and
- Rainfall, including duration and times.

Corrective actions should be investigated and implemented within 24 hours where practicable where findings of the DESC monitoring indicate a non-conformance.

Table 3-2 Typical ESC Maintenance Requirements

Item	Inspection Frequency	Maintenance Requirement	Maintenance Activities
Culvert	Prior to wet season After a major rainfall event	When sediment accumulates to the extent that it interferes with through flow	Remove accumulated debris and sediment Dispose of removed material in appropriate facility Repair any damage to erosion protection measures
Floodway	Prior to wet season After a major rainfall event	When sediment accumulates to the extent that it interferes with cross flow or trafficability	Remove accumulated debris and sediment Ensure that there is no impediment to cross flow Dispose of removed material in appropriate facility Repair any damage to erosion protection or drains along approaches
Drainage lines including channels, drains and bunds	Prior to wet season After a major rainfall event	When sediment accumulates to the extent that it interferes with throughflow or damage is observed	Remove accumulated debris and sediment Dispose of removed material in appropriate facility Repair any damage to erosion protection Reform shape of drainage line if required
Sediment Basin	Prior to wet season After a major rainfall event	When debris has accumulated or sediment has filled 10% of the sediment basin volume (indicated by marker posts)	Remove accumulated debris and sediment Dispose of removed material in appropriate facility Repair of any scouring damage to inlet and outlet and embankment vegetation Pump-out of retained water to maintain capacity for subsequent inflow events
Revegetation	Weekly After a major rainfall event	When areas of mulch have been eroded or if vegetation does not establish in the required time	Re-application of mulch and take action to prevent future damage Assess if vegetation has established and to identify if any erosion, channeling or weed problems occur Watering, reseeding and weeding to maintain a dense, vigorous growth of vegetation. Fertiliser should be kept to a minimum. Regular watering during establishment period with possible soil conditioning Application of additional mulch as required Maintenance of any upslope diversion channels or protective fences

4. Specific DESC Considerations

4.1 Mine Pit

4.1.1 Design

The Mine Pit is proposed approximately 1 km west of Murray Creek and immediately southwest of the outcrop that forms a rise immediately adjacent to Murray Creek. Overland drainage in the vicinity of the Mine Pit is predominantly from south to north. Inspection of topographic data and aerial photography provided for this location indicates that extreme flow events may result in overbank flow departing the alignment of Murray Creek and flowing overland to the west of the above-mentioned rise (Figure 4-1). This will need to be confirmed with a detailed topographic survey.

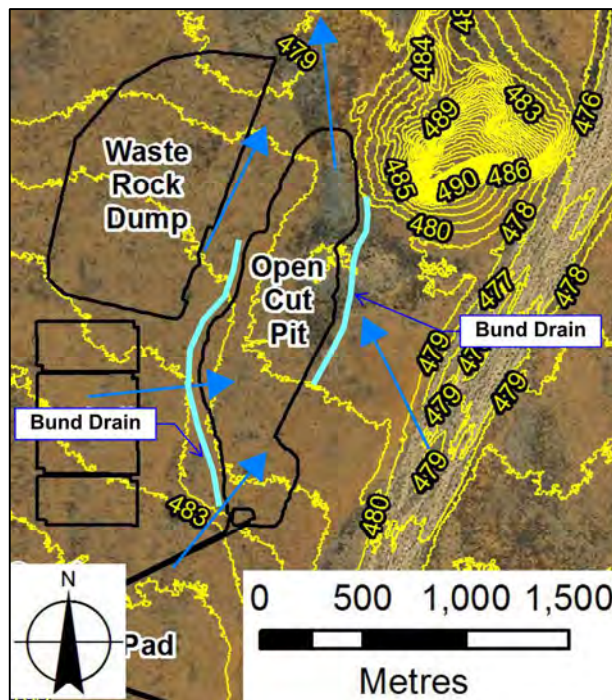


Figure 4-1 Drainage Associated with Mine Pit

The ultimate pit shell will be reached through five intermediate but overlapping stages and, once complete, the pit will be approximately 2,000 m long, 600 m wide and 125 m deep.

The boundaries of the mine pit should be protected to prevent ingress of surface water runoff. Protection, such as bunds, should be provided along the southwestern boundary of the pit to divert runoff and prevent surface water ingress to the pit (Figure 4-1). Further, given the indication that flooding from Murray Creek may occur, an assessment of flood risk and appropriate protection measures along the eastern boundary of the pit should be undertaken.

The mine pit should be designed with slopes that will maintain stability and prevent erosion both during operation and after closure. A benched approach will reduce the velocity of water down the sides of the pit, and provide an opportunity to drain runoff toward a suitable pathway for collection in a sump/sediment basin within the pit. Runoff collected in sump should be transferred to the Process Water Dam for reuse.

4.1.2 Construction/Operation

Areas to be cleared for excavation should be grubbed of trees and larger vegetation and the topsoil, where present, should be removed and stored for future use in rehabilitation. Topsoil stockpiles should be protected with appropriate ESC structures and stabilised to prevent excessive wind erosion. Vegetation clearing and topsoil removal should be carried out shortly before the area is required for construction to limit the risk of erosion.

Protection measures to prevent ingress of surface water runoff and potential flooding from Murray Creek can be implemented in stages that commensurate with each pit stage. Staged drainage within the mine pit will also be required based on location of operations and progressive shapes of pit shell. In particular, careful attention will need to be given to locating sediment basin(s) for treatment of runoff.

Visual inspections of the pit walls, roads and sedimentation basins should be carried out after rainfall events for signs of erosion and sedimentation, and any damage made good.

4.1.3 Closure

The open pit void will remain after closure of the site. The walls of the mine pit should be stabilised for closure of required, which may include re-grading the slope and application of stabilisation techniques such as coarse material, geofabrics and revegetation. The following objectives should be applied in this regard:

- Entry into the pit is restricted by the presence of landforms and abandonment bunds; and
- Clean water catchments are excluded from the pit.

Drainage should be set up during closure and remain in place after closure to divert water around the pit.

4.2 Waste Rock Dump

4.2.1 Design

The conceptual design for the Waste Rock Dump (WRD) is for an ultimate height of 40 m and a footprint of 90 ha with capacity to store up to 70 Mt of waste. The proposed footprint of the WRD and natural drainage lines are depicted in Figure 4-2.

The WRD will be located along the western side of the pit. The base of the WRD is expected to be unlined. The profile of the WRD (e.g. height and slope angles) should be designed to ensure that the final structure is safe, stable and not prone to significant erosion. The final shape of the dump should blend into the surrounding landscape providing that surface stability can be achieved and surfaces remain non-erodible in the long term.

Preliminary design criteria for construction of the WRD are:

- Batter height: 10 m;
- Ramp width: 27 m; and
- Ramp gradient: 1 in 10.

Control of erosion will depend on slope angle and length both during construction and at re-contouring for closure. Initial waste placement during construction should be such that slope angles and length are both stable and minimise the earthworks required for re-contouring and rehabilitation.

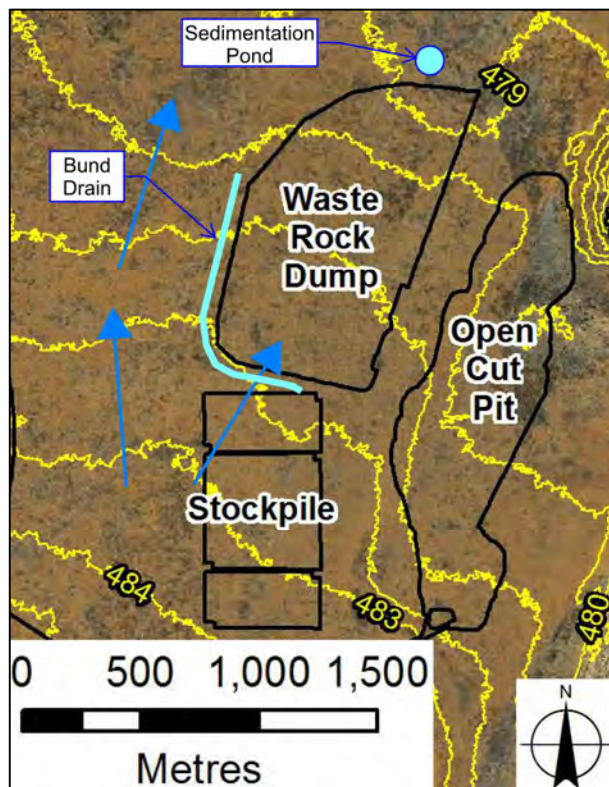


Figure 4-2 Drainage Associated with WRD

Drainage in the vicinity of the WRD is predominantly from south to north. Bunding should be provided along the up-gradient boundary of the disturbed area to divert runoff from these areas away from the WRD (Figure 4-2). The top of the WRD should be shaped for water to drain inwards therefore preventing runoff during operation. Runoff from the disturbed and working areas downgradient of the bund should be conveyed to an appropriately sized sedimentation basin. Discharge from the basin should be directed to natural drainage lines ensuring that no further erosion occurs. After settling, surplus stored water could be used for dust suppression purposes.

4.2.2 Construction/Operation

The construction of the WRD should allow progressive rehabilitation. Topsoil should be cleared and stockpiled progressively to provide the greatest opportunity for soil to remain viable for rehabilitation. Areas cleared should be sufficient for construction only and further clearing to accommodate expansion of the landform for the shallower slopes at closure should only occur prior to rehabilitation. Clearing should be staged to allow for progressive ~5 year stages of operation.

The WRD should be built up progressively from the southern end of the pad northwards. Out-facing batters should be constructed along at least one half of the boundary and the remaining open area should be used to expand into as the need arises. The initial placement should be along the southern boundary (i.e. aligned with the berm drainage system) to prevent runoff from up-gradient areas into the working operations of the WRD.

A small bund (~0.5 m) should be constructed around the outer edge of berms to reduce surface water overflow down the waste dump wall. Runoff from all disturbed areas should be directed to the sedimentation basin via appropriately designed and constructed drainage banks/berms. Ongoing inspection of the sedimentation basin and drainage banks/bunds will be required through operation. Sediment collected from the basin should be disposed of back on the WRD.

4.2.3 Rehabilitation

The sediment basin and other drainage and ESC treatment infrastructure for operation of the WRD can be removed and rehabilitated during closure. The completed outside faces should be rehabilitated early in the operation when the viability of the topsoil is highest.

Previously cleared topsoil should be spread over all surfaces at a thickness of up to 20 cm (depending on the nature of the under-lying waste rock and availability of viable topsoil). The surfaces should be deep ripped (minimum 1 m) on contour at appropriate spacing. Rip lines on outer slopes are to be survey controlled to ensure that they are horizontal to prevent propagation erosion. Re-seeding should occur at a time to maximise the benefit of annual rainfall events.

The following design criteria should be considered for re-contouring at closure:

- Slopes: $\leq 20^\circ$ (or shallower to allow for safe machinery operation);
- Bench interval: ≤ 10 m;
- Bench width: ~ 5 m;
- Bench slope 0.5° (along contour); and
- Bench angle: 5° (back-slope).

After re-contouring, stormwater collected on the benches should be conveyed to vertical drains. The number of vertical drains should be appropriate for the final slope angles and individual catchment areas should not exceed 1 ha on 20° slopes. All water from vertical drains at the base of the slope should dissipate and discharge in a manner that will not cause any erosion.

Drainage structures should be maintenance free to ensure that no failures occur before vegetation is well established. Waterways should be lined with rock. Vertical drains should be excavated so that they are lower in profile than the dump slope after placement of rock material. Wing banks should be constructed to direct runoff to the drain.

4.3 Tailings Storage Facility and Dams

4.3.1 Design

The Tailings Storage Facility (TSF) will be located to the south west of the WRD. Clearing to the extent of ~ 475 ha will be required for the construction of the TSF. The tailings deposition will be from the centre and the area covered will expand horizontally as the work progresses. Although the TSF will be developed in stages allowing for the incremental raising of the central access ramp, the complete perimeter embank will be constructed at the outset (Figure 4-3). The embankment will have a height varying between 1 m and 4 m across the site.

Drainage in the vicinity of the TSF is predominantly from south to north. The perimeter embankment will impound the tailings and divert runoff from up-gradient areas. To control surface runoff and avoid erosion of the perimeter embankment, surface runoff collector drains will be constructed along the downstream toe of the perimeter embankment. These drains will collect clean surface runoff and direct the flow away from the TSF.

Runoff and decant from the tailings area will be collected in a return water pond(s) and transferred to the Process Water Dam for reuse. This will ensure that no water affected by the tailings is discharged. An emergency spillway will be constructed at the lowest part of the perimeter area for discharge into Bloodwood Creek.

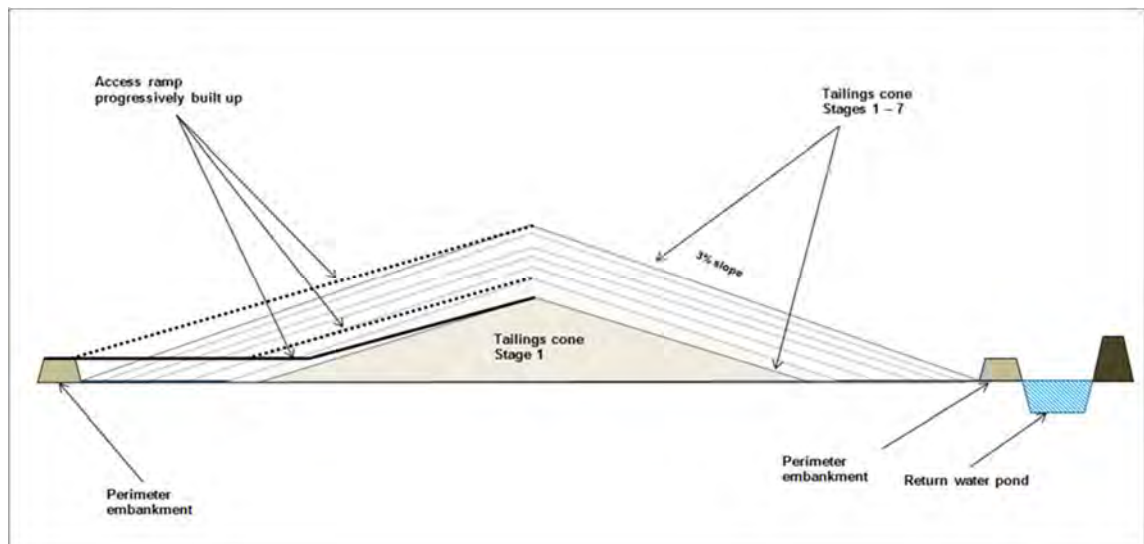


Figure 4-3 Section Depicting TSF Concept

4.3.2 Construction/Operation

Topsoil should be cleared and stockpiled in a manner to ensure that it remains viable for rehabilitation. Should the TSF be constructed during the wet season then a temporary bank/bund should be constructed along the southern extent to divert any runoff from the disturbed area. Routine inspections of the collector and toe drains should be undertaken, which should be maintained in proper working order throughout the life of the mine.

4.3.3 Closure

At closure, the TSF will be capped and stabilised. Ponds will be deconstructed and the perimeter embankment will be lowered or removed to ensure that the final landform blends in with the natural landscape. The 3% slope of the TSF may be problematic regarding erosion following rehabilitation. Accordingly, surface treatment for revegetation must break ground compaction in the plant root zone, enhance infiltration and water from rainfall and runoff. Contour ripping may be necessary and this operation should graft the topsoil layer into the underlying cap material. The final land form should be blended into the flatter landscape so that it does not form a barrier to flows or concentrate flows.

4.4 Areas of Stockpiled Material

4.4.1 Design

There are a number of areas proposed across the site where drainage, erosion and sedimentation controls will be required, namely:

- Ore stockpiles;
- ROM pad;
- Concentrate stockpiles; and
- Loadout facilities.

Stockpiled materials should be placed in areas graded to be relatively flat. Drainage protection should be placed to divert clean runoff around the pads towards natural drainage lines. Runoff from the working areas should be conveyed to appropriately sized sedimentation basins. Discharge from the basin should be directed to natural drainage lines ensuring that no further erosion occurs. After settling, surplus stored water could be used for dust suppression purposes.

The locations of the proposed stockpiles and related topography have been provided. Drainage in the vicinity of the ore stockpiles is predominantly from south to north. Bunding should be provided along the up-gradient boundary to divert runoff. The potential locations of the bund and sedimentation basin are depicted in Figure 4-4.

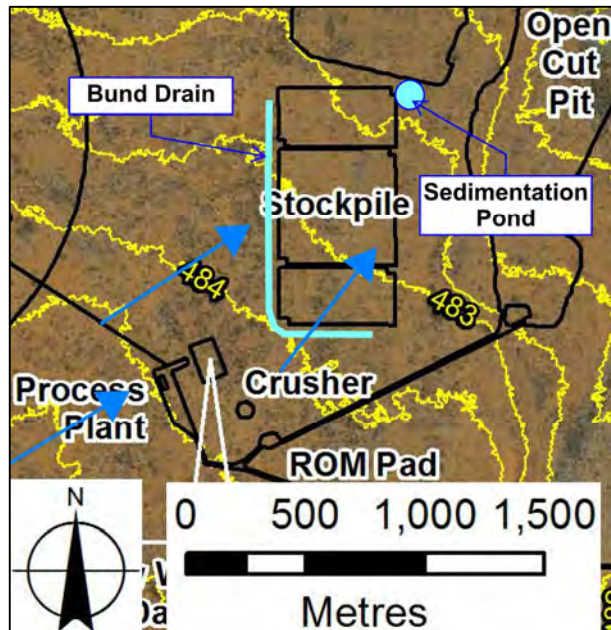


Figure 4-4 Drainage Associated with Stockpiles

4.4.2 Construction/Operation

Topsoil should be cleared and stockpiled in an appropriate manner for soil to remain viable for rehabilitation. Runoff from all disturbed areas should be directed to the sedimentation basins via appropriately designed and constructed drainage banks/berms. Ongoing inspection of sedimentation basin and drainage banks/bunds will be required through operation. Sediment collected from the basin should be disposed of back on the WRD.

4.4.3 Closure

The pads constructed for stockpiling will remain after closure, with all other areas removed. These should be landscaped to fit with the surrounding areas and revegetation and mulching should be completed as soon as practical. Where possible, topsoil from the site itself should be used in the revegetation. Gravel and other stabilising materials may be required to stabilise the pad while revegetation is occurring.

4.5 Access and Haul Roads

4.5.1 Design

An access road connecting the mine site with the Adnera Loadout Facility will be constructed along with a number of smaller haul roads around the mine site. The access road will be approximately 100 km long, with two 5 m traffic lanes and a 0.5 m shoulder on either side. All roads should be designed according to the appropriate Australian Standard.

Key aspects in the construction of the access road that need to be considered for drainage, erosion and sedimentation measures are:

- Borrow pits;
- Clear and stockpile material for remediation works;

- Road drainage; and
- Rehabilitation of road batters including cutting of drainage swales.

The details of the road design and construction have not yet been finalised. Roads without good drainage will degrade very quickly. Where possible, table or V drains should be constructed to remove the run-off water from the edge of the road for treatment. Catch drains should be constructed along slopes parallel to the road to divert runoff from up-gradient areas across the road alignment via culverts.

Adequate drainage should be provided to carry away the maximum expected rainfall, with minimum puddling, pot-holing or water entry into road sub-base. Roads should be provided with constant cross falls and drains to divert water from the road surface. In the case of in-pit haul roads and those in close proximity to other operations, safety berms are required. Road drainage design should give due consideration to the maintenance of both safety berms and drainage.

The general design principles for road drainage, erosion and sediment control on mine sites are:

- All roads need to be properly drained;
- Open drains steeper than 8% should be rock protected to prevent erosion; and
- Road drains should channel water to diversions and on to appropriately sized sedimentation basins.

Waterway road crossings will be either via culverts or floodways. Floodways are proposed across the Hanson River and Murray Creek, as both have been identified to have mobile sediment loads. In this way, there will be no impediment to flow in these larger waterways. However, these will not be passable during flooding and may require clearing following large flow events. The approaches and departures to the floodways will be through more erodible bank material so should be formed to prevent concentrated runoff from the road surface. All drainage measures should be appropriately protected to prevent erosion.

The access road crosses Wood Duck Creek at a point where the channel is braided and there is no one main flow channel. Regular culverts are proposed at this road crossing. Culverts are also proposed at all other road crossings of minor waterways.

Sheetflow processes are likely to occur along the access road within the alluvial plains to the east of Stuart Highway. Creation of sheetflow shadow zones may be detrimental to vegetation health. Appropriate cross-drainage should be provided in these areas to prevent sheetflow shadows. The approach to shaping and rehabilitating the road batters, including the cutting of table drains and/or drainage swales, needs to be cognisant of any sheetflow requirements. Erosion protection measures may be required in these areas.

4.5.2 Construction/Operation

The general maintenance principles for road drainage, erosion and sediment control on mine sites are:

- All road drains need to be inspected and maintained;
- Sedimentation basins should be inspected and any excess sediment removed and disposed of appropriately;
- Drains and culverts should be kept clear of obstructions to minimise potential erosion factors; and
- Ongoing maintenance is required to maintain cross slopes, remove spills and to fill and smooth surface depressions.

It should also be noted that consideration could be given to staked hay bales as temporary sediment traps during construction.

Water trucks will be required during the dry season to minimise wind erosion. Measures to maintain the Stuart Highway underpass trafficable should be identified including the management of stormwater and sediment build up.

4.5.3 Closure

The access and haul roads will be maintained until closure is complete. Post-closure, the floodways will be permitted to wash out without requiring resurfacing.

4.6 Borefield

The water supply borefield will be established within the alluvial aquifer of the Hanson River and a water supply pipeline will be constructed between the borefield and the Raw Water Dam predominantly along existing tracks. It is noted that the borefield is within the flood out zone of the Hanson River. As such, the bores will be constructed on drill pads constructed to be above the level of the 1:100 year flood event. The headworks, generators and all other support equipment will be located on top of these pads.

To this end, the drill pad embankments should be designed to be geotechnically stable when inundated and adequate erosion protection should be provided to maintain such stability. Drill pad embankments should be inspected following flood out events and maintained if required.

Although the pipeline will follow existing tracks, further clearing will be required to accommodate the pipeline and access road. Rehabilitation of the area should ensure that appropriate erosion protection is provided and that runoff flow paths along the length of the pipeline are diverted.

4.7 Hydrocarbon Affected Water

As mentioned in Section 3.1, the drainage management strategy entails runoff separation and catchment classification for water quality and management, with potentially contaminated stormwater being collected, treated and disposed of appropriately.

Activities where hydrocarbon (and other) contamination is possible should be confined to specific work areas, such as the workshops, vehicle wash down areas and refuelling facilities. These areas should be properly contained with appropriate protection measures (e.g. bunds, grading) to divert runoff from up-gradient areas and to collect runoff from the specific work areas for further treatment. Runoff from such areas should be diverted to sedimentation basins and appropriate treatment facilities and, where possible, reused.

All areas where hydrocarbons were stored should be rehabilitated following closure. Hydrocarbon affected soils and sediments should be treated in an appropriate facility and disposed of in the WRD following treatment.

4.8 General infrastructure

The construction of general infrastructure (buildings etc.) should avoid erosion and sedimentation. Entry-exit controls, including rock pads and wash bays, should be implemented at the entrance to the mine site.

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Appendices

Appendix A – Site Visit Photograph Log (28/01/13 and 08/04/13)

Photograph	Details
	Example of Mulga shrubland on sandy red earths, mainly occurring on alluvial plains along the alignment of the access road east of Stuart Highway. Mulga is surface water dependent and is indicative of the occurrence of sheet flow. Creation of sheetflow shadow zones may be detrimental to vegetation health. Clayey red earths may be dispersive in places and death/clearing of vegetation may result in sheet erosion. The construction of the access road may result in sheetflow shadow zones and consideration will need to be given to appropriate cross-drainage.
	Example of large watercourse and drainage channels (photo is of Hanson River, but Murray Creek is similar). Soils comprise unconsolidated coarse sands and gravels with clay hardpans. Sediment transport will depend on event magnitude, with larger events responsible for sediment transport and channel formation. Disturbed sites are likely to result in soil erosion and sediment transport will require stabilisation.
	Example of large watercourse and drainage channels (photo is of Hanson River, but Murray Creek is similar). Banks are well defined and fringed with riparian woodland. Surface water flows spread laterally from channels across the low energy and extensive floodplains. Disturbed sites are likely to result in soil erosion and sediment transport, particularly river banks. The construction of the access road will require cutting into such banks and care should be taken with the design of the approach and departure ramps and angles.

Photograph	Details
	Example of alluvial floodplains and flood out areas. Soils typically comprise of fine textures sands and clay hardpans. Areas may also be indicative of ephemeral perched groundwater systems. Surface water flows are shallow and low energy with little erosion potential. Disturbed sites which are cleared of vegetation may be prone to wind erosion until vegetation is re-established. Clearing should be minimised and managed.
	Example of smaller water course along the alignment of the access road west of Stuart Highway. Soils comprise unconsolidated sands/fine sands with clay hardpans. Sediment transport will depend on event magnitude, with larger events responsible for sediment transport and channel formation.
	Example of gulley erosion of banks of watercourses and drainage channels. Active processes observed included bank erosion and sediment transport in the alluvial creek beds. Localised erosion with the potential to alter surface water flow pathways is possible and may result in gulley erosion.

Photograph	Details
	Example of sheet erosion along gently sloping access track used by cattle and vehicles. Localised erosion with the potential to alter surface water flow pathways is possible and may result in gulley erosion.
	Example of sedimentation at Middle Well in the flood plain of the Hanson River. The water troughs shown here have filled with sediment deposited by previous flood outs and possibly by wind. Mine equipment will require protection from potential deposition of sediments on and around the equipment. Wind erosion may be an issue for equipment.

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Appendix O

AMD Assessment and Management Plan





TNG Limited
Mount Peake
Acid Mine Drainage - Assessment and
Management Plan

December 2015

Executive summary

This report presents the findings of a desktop review of geochemical data and mine development information relating to the risk of development of acid, metalliferous or saline drainage (AMD) at the Mount Peake site.

The mine site is located approximately 235 km north-northwest of Alice Springs and approximately 50 km west of the Stuart Highway. The Mount Peake Project will comprise open pit mining of a polymetallic ore body from which the ore will be processed to produce a magnetite concentrate. The process will produce onsite tailings, stored in a Tailings Storage Facility, and waste rock, stored west of the pit in a dedicated Waste Rock Dump (WRD).

The WRD will have an ultimate footprint of 90 ha with capacity to store up to 70 Mt of waste. It is proposed to use up to 5 Mt of waste from pre-production for project construction requirements. An engineered drainage channel will surround the WRD, with dedicated monitoring points to gauge runoff volumes and assess water quality. Minimal seepage is expected from the waste rock.

The waste rock can be categorised into four broad lithological units: Unmineralised gabbro (58% of waste material, granite (10% of waste material), alluvials (32% of waste material) and fault material (less than 1% of waste material).

The intrusive ore body and surrounding igneous units have only minor alteration and structural disruption. The gabbro was formed from a calc-alkaline (calcium and magnesium-rich) oxidising melt and consequently any primary sulfur occurs as oxidised sulfate minerals.

Extensive geochemical testing has been undertaken on the orebody and waste material. This includes X-Ray Fluorescence (XRF) analysis during various drilling programs and on targeted samples (predominately waste material) on chip tray samples. The combined dataset included 6324 samples within and immediately surrounding the pit shell. Geochemical relationships were formulated from the data to build an understanding of the AMD risk at Mount Peake. The approach was based on industry guidelines (DITR 2007 and INAP 2009).

Key findings from this assessment indicated the following:

- 99.35% of the samples analysed for sulfur returned values of below 0.3% total sulfur. This equates to 99.35% of the samples having a Maximum Potential Acidity (MPA) of less than 10 kg of H_2SO_4 per tonne. This assumes that all sulfur is present as reactive pyrite and is therefore an inherently conservative assessment as it discounts non-acid forming sulfur species or any inherent neutralising capacity
- Where sulfur was detected at concentrations above 0.3%, they tend to be in relatively thin bands and at a variety of depths, but predominately in the upper 40 m and typically occurring over less than 3 m intervals
- The Acid Neutralising Capacity (ANC) of each sample was assessed based on the assumption that calcium and magnesium are present as carbonates. The ANC is then compared to the MPA to produce a Net Potential Ratio (NPR). An ANC:MPA ratio of less than 1 indicates the material is likely to be Potentially Acid Forming (PAF) as it contains more acid generating material than acid neutralising material. Approximately 98.5% of samples had an NPR of greater than 2, classifying them as Non Acid Forming (NAF)
- Only one sample (alluvial waste) would be classified as PAF according to the ANC:MPA ratio. This was from a surface sample (0 to 1 m at 12MPRC044). As this was from the XRF data from 2015, there was no magnesium data, so with additional data, this data point may have more neutralising capacity which would suggest it may not be PAF

- The Net Acid Producing Potential (NAPP) calculation was used to calculate the severity and extent of acid producing potential for the dataset. This indicated that approximately 99.7% of the samples have a NAPP value of <10 kg H₂SO₄/t, indicating these samples are all likely to be NAF
- The greatest potential for acid generation is potentially found within the fault zone located in the far west of the pit, where limited data has indicated generally higher sulfur content. However there is also relatively high calcium data for this unit suggesting a good buffering capacity. The actual volume of the fault related material is expected to be very low.

Although the geochemistry indicates a low risk of AMD, the management plan takes in to consideration the highest AMD risk material observed. PAF material, or material with potential to leach metals or salinity, should be encapsulated within the WRD, and potentially returned to the pit progressively if mining schedules allow. The key aspect of the management plan is early identification of PAF material through additional analyses.

Additional AMD testing (static NAG and NAPP, kinetic NAG and ABCC testing) will be carried out. The results of these tests will be reviewed to develop revised combined sulfur/calcium/magnesium based PAF cut-off grades which can be further developed within a revised block model. The results of the test will be used to validate the currently available data and modify the AMDMP and MMP if necessary. In addition to the pre-production testing, a program of regular testing as part of ongoing grade control and regular updating of the AMD model is required.

Abbreviations

Acronym	Description
ABA	Acid-base accounting
ABCC	Acid buffering characteristics curves
AC	Acid consuming
AMD	Acid Mine Drainage
AMDMP	Acid Mine Drainage management Plan
ANC	Acid Neutralising Capacity
ASLP	Australian Standard Leaching Procedure
CEC	Cation exchange capacity
DITR	Department of Industry, Tourism and Resources
DME	Department of Mines and Energy
GAI	Geochemical abundance indices
ICPMS	Inductively coupled plasma mass spectrometry
INAP	International Network for Acid Prevention
KNAG	Kinetic Net Acid Generation
LC	Low Capacity
LOR	Limits of reporting
Ma	Million years ago
MMP	Mine Management Plan
MOG	Magnetite-rich olivine gabbro
MPA	Maximum Potential Acidity
Mt	Million tonnes
NAF	Non-acid-forming
NAG	Net Acid Generation
NAPP	Net Acid Production Potential
NPR	Net Potential Ratio
PAF	Potentially-acid-forming

Acronym	Description
PAFLC	Potentially-acid-forming - Low Capacity
ROM	Run of mine
TDS	Total Dissolved Solids
tpa	Tonnes per annum
TSF	Tailings Storage Facility
UC	Uncertain category
WMP	Water Management Plan
WR	Waste Rock Dump
WRD	Waste Rock Dump
XRF	X-Ray Fluorescence

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Appendices

Appendix A – Assay-based total sulfur and NAPP histograms by lithology

1. Introduction

1.1 Purpose of this report

This report presents the findings of a desktop review of geochemical data and mine development information relating to the risk of development of acid, metalliferous or saline drainage (AMD) at the Mount Peake site. Based on this data review, the level of risk of AMD generation has been identified and an AMD management Plan (AMDMP) is provided, to inform TNG of the various waste rock types and ore, according to their risk of AMD generation.

The report was based on interpretation and a detailed review of the raw geochemical data, comprising total element analyses, as well as previous documents noted in Section 1.3. It is noted that additional assay is currently being undertaken and not available for inclusion at the time of this report.

1.2 Scope and limitations

The scope of works for this study included:

- Collate data sets and review AMD and general geochemical data
- Manipulate data by lithological unit and undertake geostatistical analysis
- Develop AMD risk assessment
- Develop context to AMD Management Plan
- Develop context to AMD Monitoring Plan.

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1.3 Data sources

The following key data sources were used in this assessment:

- TNG's geochemical databases noted in Section 3.2
- The site Water Management Plan (WMP) (GHD 2015)
- Discussions with TNG exploration manager Kim Grey.

1.4 Project summary

The mine site is located approximately 235 km north-northwest of Alice Springs and approximately 50 km west of the Stuart Highway. The Mount Peake Project will comprise:

- The mining of a polymetallic ore body through an open-pit truck and shovel operation
- Processing of the ore to produce a magnetite concentrate
- Storage of tailings at an onsite Tailings Storage Facility (TSF)
- Road haulage of the concentrate to a new railway siding and loadout facility on the Alice Springs to Darwin railway near Adnera
- Rail transport of the concentrate to TNG's proposed Darwin Refinery located at Middle Arm, Darwin.

The Project will mine at a rate of up to 8.4 million tonnes per annum (Mtpa) and, following processing, will produce up to 1.8 Mtpa of magnetite concentrate.

This concentrate will be processed at TNG's proposed Darwin Refinery to produce 19,700 tonnes per annum (tpa) of vanadium pentoxide (V_2O_5) flake, 292,000 tpa of pigment grade titanium dioxide (TiO_2) and 856,000 tpa of pig iron ingots.

The life of the project is expected to be 19 years inclusive of construction (2 years), mining and production (15 years), and closure and rehabilitation (2 years).

1.5 Proposed waste rock management

Detail of the waste rock management process will be further developed in the Mine Management Plan (MMP) which will be submitted at a later date.

Substantial effort has been made to produce a site design which minimises the disturbed area footprint and long-term changes to the landscape.

The waste rock generated during pre-production mining would be mainly used to construct pads for infrastructure, a run of mine (ROM) pad, and product stockpiles. It is estimated that this volume would be up to 5 Mt. Waste rock generated by mining in subsequent years would be stored in the Waste Rock Dump (WRD) located to the west of the pit.

The WRD will have an ultimate height of 40 m and a footprint of 90 ha with capacity to store up to 70 Mt of waste. Due to the largely impervious nature of the waste (and unsaturated alluvial cover) (section 2.4), minimal groundwater is expected to drain from the waste rock. The WRD will be surrounded with an engineered drainage channel, with dedicated monitoring points to gauge runoff volumes and assess water quality.

Material to be excavated consists of between 2 to 16 m of overburden (WR) overlying the main ore body. The orebody is hosted by a mafic intrusive rock, a gabbro sill. The sill is up to 250 m thick with gabbro both below and above the ore zones. The orebody comprises the magnetite-rich portion of the sill, which forms a flat-lying body that is oriented north/south. The intrusive has only minor alteration and structural disruption. It was formed from a calc-alkaline (calcium and magnesium-rich) oxidising melt and consequently any primary sulfur occurs as oxidised sulfate minerals.

The surrounding waste material is predominately calc-alkaline gabbro, with some granitic material west of the orebody. Trace sulfide observed in the ore/intrusive was introduced by post-crystallisation hydrothermal fluids within structurally controlled fracture zones. The other rock types that will contribute to the waste dump also have relatively low sulfide content.

Mining will commence with a “starter pit” accessing high grade and low strip ratio ore. Drilling and blasting, to loosen rock ahead of mining, will be undertaken to produce rock sizes that conform to processing requirements.

Extracted high grade ore will be transported by haul truck from the pit to the ROM pad and directly fed into the process plant.

Four long-term stockpiles will be established according to grade. The higher grade stockpile will be used to balance the mining and processing rates and will be of similar quality to the direct feed material. Medium and low grade stockpiles will be depleted towards the end of the mine life with the higher grade material used first.

Waste material will be trucked to the WRD that will progressively develop to the west of the pit. Waste and ore volumes are presented below as Figure 1 and Table 1. As highlighted by the below table and figure, the waste rock total accounts for 61 Mt, representing 44% of the total of the pit volume. A general layout of the mine site is shown in Figure 2.

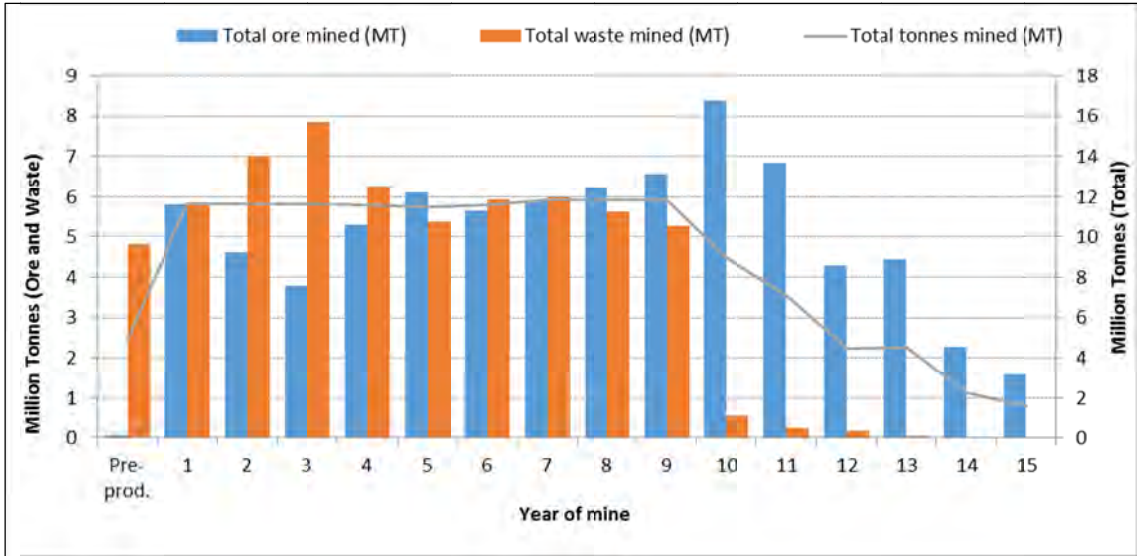


Figure 1 Waste and ore volumes for each year of mining

Table 1 Waste and ore volumes for each year of mining

Year	Total ore mined (Mt)	Total waste mined (Mt)	Total tonnes mined (Mt)	Strip ratio (waste to ore)
Pre-production	0.06	4.82	4.88	82.2
1	5.8	5.84	11.64	1.01
2	4.62	7.02	11.64	1.52
3	3.79	7.85	11.64	2.07
4	5.31	6.26	11.57	1.18
5	6.12	5.37	11.49	0.88
6	5.65	5.93	11.58	1.05
7	5.87	5.98	11.85	1.02
8	6.23	5.62	11.85	0.9
9	6.57	5.27	11.84	0.8
10	8.39	0.55	8.94	0.07
11	6.83	0.26	7.09	0.04
12	4.3	0.18	4.48	0.04
13	4.44	0.05	4.49	0.01
14	2.26	0	2.26	0.01
15	1.6	0	1.6	0
Total	77.84	61	138.84	

AMD-specific investigations (detailed within this AMDMP) during mining would include:

- Demarcation, control and monitoring of excavated materials during mining
- On-going monitoring and assessment to refine potential impacts on local ecosystems and downstream environments
- Gradual removal and disposal of any potentially-acid-forming (PAF) materials in a dedicated cell with continuous compaction and capping;

Where geochemically identified as uncertain (UC), mineral waste materials will undergo further assessment prior to classification and storage as either non-acid-forming (NAF) or PAF. If after the x-ray fluorescence (XRF) and paste pH tests there is still uncertainty, taking cognisance of acid-base accounting (ABA) testing during earlier grade control, the materials would be disposed of as PAF. The general waste classifications are summarised in Table 2.

Table 2 Waste rock classifications and fate

Material	Code	Final location
Ore body	Ore	Stockpiled and then off site
Non-acid-forming waste rock	WRNAF	Waste Rock Dump
Potentially acid-forming waste rock	WRPAF	Encapsulated in cell of Waste Rock Dump (if any identified)

Due to the nature of the orebody and the host rocks/cover material, there is little likelihood of significant volumes of sulfide or saline mineralisation.

Waste rock will be stored within the WRD, with dedicated drainage works engineered to collect runoff. Runoff will also be assessed against appropriate assessment criteria.

Prior to and during mining, additional testing will be carried out to confirm the low AMD risk of all material and confirm the appropriate management procedures.

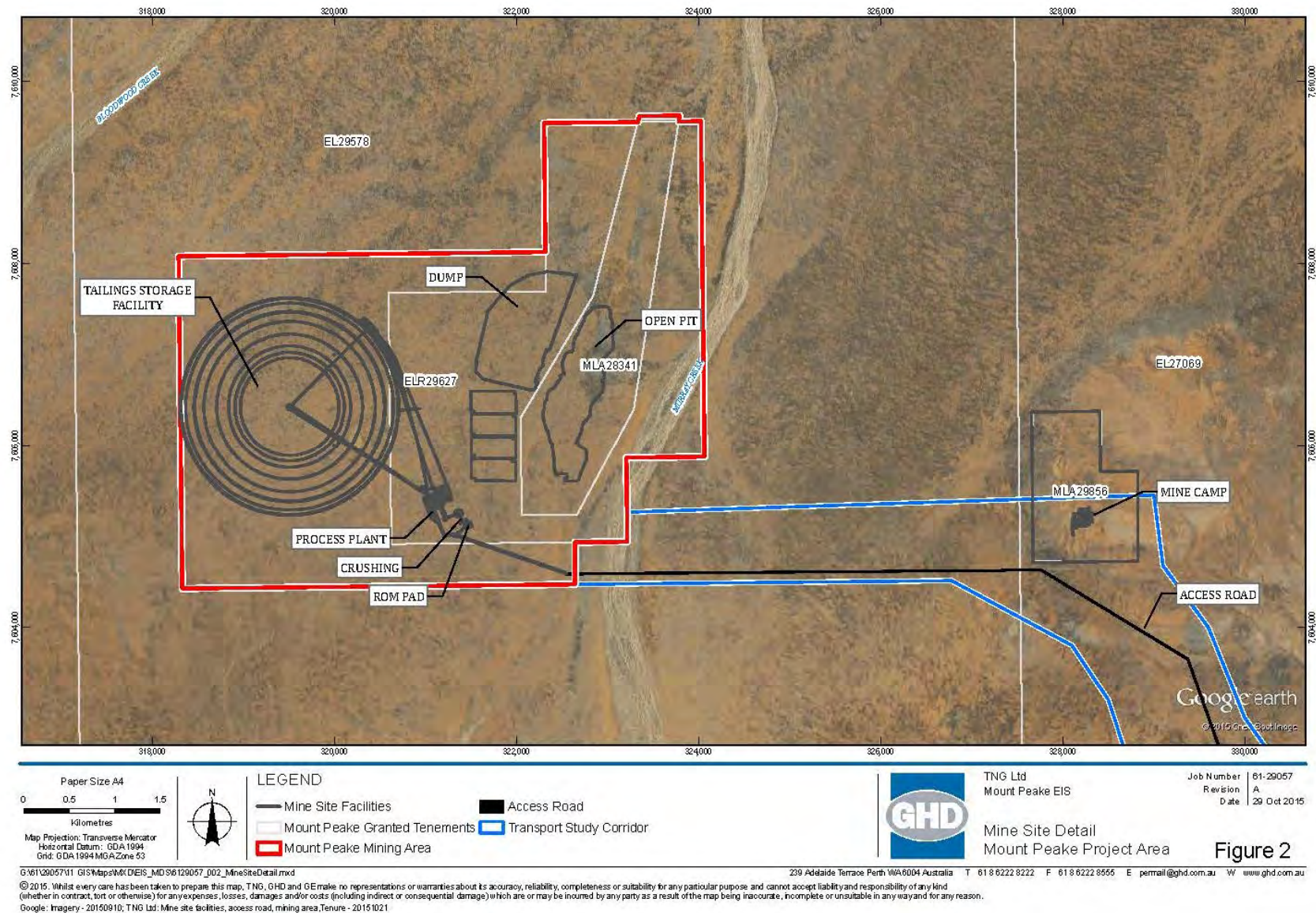


Figure 2 Project layout

2. Project setting

The 'Environmental setting' Section provides an overview of the Project's environmental setting and introduction of potential AMD risks on the region's key environmental receptors, when considered within the context of the proposed Project activities. Additional environmental details can be found in the Project EIS.

2.1 Climate

The Project site is at the southern extent of the Australian monsoon belt and in the centre of the Australian continent. The climate is arid to semi-arid with an annual rainfall of approximately 320 mm recorded at the Bureau of Meteorology (BoM) Station 15525 at Barrow Creek (BoM, 2013), which is located approximately 50 km east of the Project site.

Annual rainfall is highly variable, with records at Barrow Creek ranging from 70 mm in 1963 to 1,150 mm in 2010. Rainfall is highly seasonal with the majority of rainfall occurring as thunderstorms between November and March.

2.2 Regional geology

The Mount Peake Resource lies in the north-central portion of the Paleoproterozoic Arunta region Aileron Province (Figure 3). The deposit lies on the boundary between the older Aileron Province schists, gneisses and granites to the west and south, and the overlying Cambrian Georgina Basin sediments to the east and north.

The near flat-lying and un-metamorphosed shales, siltstones and sandstones of the lowermost Georgina Basin range from 800 to 500 Ma (Million years old) and are exposed to the east of the Mount Peake deposit, and form the range from the Džilbari Hills to Central Mount Stuart (10-40 km to the SSE) as well as the distinctive flat topped hills around Barrow Creek (20-50 km ENE). They unconformably overlie the metamorphosed Aileron schist basement, which is Proterozoic (1700-1880 Ma) in age.

In the vicinity of the Mount Peake deposit, the basement includes schists and gneisses of the Lander Rock Formation, together with relatively undeformed granitic and porphyritic felsic intrusives. To the west of the deposit is a potassium feldspar megacrystic granite porphyry.

The resource is hosted in an intrusive gabbro sill which intrudes the lowermost Georgina basin sediments, the Amesbury Quartzite (800 Ma) and Central Mount Stuart Formation (550 Ma), making the deposit younger than 550 Ma.

The gabbro sill complex is quite extensive (based on magnetic interpretation and scattered outcrops) covering an area of up to 20 x 40 km. It crops out poorly and has not been mapped at surface as more than 50 m thick, however in the shallow sub-surface it can reach 250 m thick and may exceed 300 m.

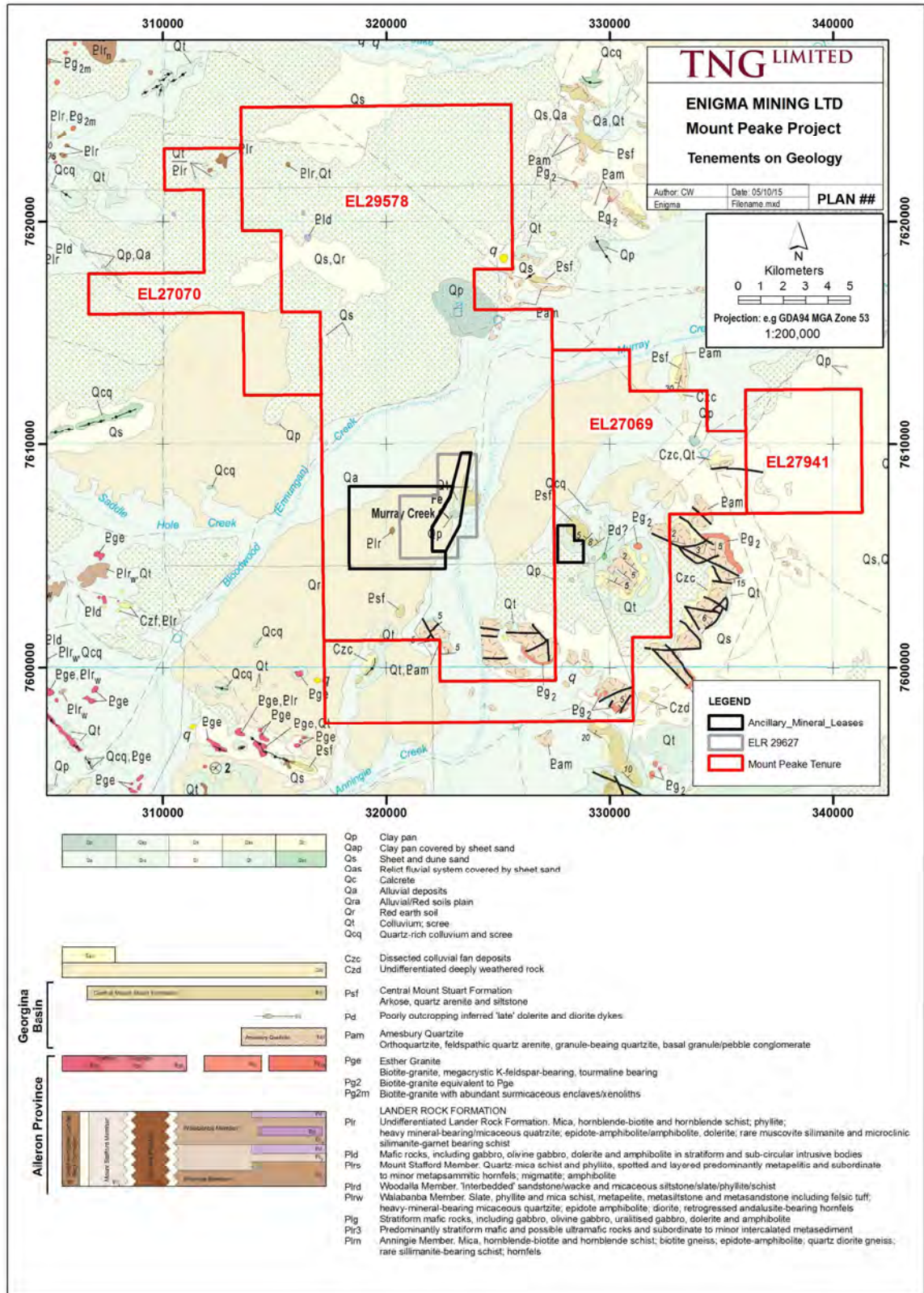


Figure 3 Regional geology

2.3 Geology of the Mount Peake Deposit

The Mount Peake deposit is hosted within a layered calc-alkaline gabbro sill, with the orebody comprising a particularly magnetite-rich portion in the middle.

The sill is overlain by between 2 to 16 m of Cainozoic desert sand and aeolian/alluvial sediment cover and does not crop out. Cover thickens to the east, towards Murray Creek, and south. The nearest outcrop is a hill a few hundred metres northeast of the deposit exposing basal Georgina Basin sediments.

The deposit was discovered by interpretation of aeromagnetic geophysical data, as the magnetite ore produces a strong magnetic anomaly.

The sill is bound to the west by a moderate west-dipping and NNE/SSW striking fault, with porphyritic granite to the west. The sill continues under sand cover to the east, north and south, but it and the magnetite-rich unit thins dramatically. Magnetite-bearing gabbro has been intersected in exploration drill holes immediately below thin transported cover both 1 km and 5 km to the east of the resource.

In the vicinity of the orebody the sill is at least 250 m thick and has three broad layers. The upper unit forms the hanging wall over the southern and northern parts of the orebody while it is eroded away in the central area. It is equigranular and coarse-grained with less than 3% magnetite content. The footwall gabbro has very coarse plagioclase crystals and only trace magnetite content.

The Mount Peake deposit comprises the entire central gabbro intrusive unit (MOG – magnetite-rich olivine gabbro), which is characterised by magnetite contents from 5 to 45%, cumulate¹ magnetite and olivine grains (to 5 mm glassy green), and is up to 150 metres thick. The magnetite grains are 1-4 mm in size and contain almost all of the vanadium, titanium and iron content of the ore. The MOG unit is quite homogeneous, showing only a gradual decrease in magnetite content from top to bottom.

Vanadium and titanium are both found within the magnetite – vanadiferous titanomagnetite. There is minor amount of the iron tied up in silicates (pyroxene and olivine) that is not recovered, a smaller portion of the titanium hosted in ilmenite, which is still recoverable, and a very small proportion of the vanadium locked up in pyroxene.

2.4 Hydrogeology

In general the basement rocks of the Arunta and Georgina geological provinces are not well studied in terms of their groundwater potential, largely as a result of the region's remoteness. The deep basins may offer groundwater resources, but groundwater drilling investigations have generally focused on providing water for communities or for stock watering. As such only relatively minor yields have been required so drilling of production bores would tend to cease at relatively shallow depths once sufficient yield was obtained (Ride 2007).

¹ Cumulate is a concentration of minerals due to contrasting density, a slow-cooling magma body, in this case heavy magnetite, and olivine crystals accumulating at the base of a gabbroic intrusive body.

Regional aquifer mapping by the Department of Land Resources Management (Tickell 2013) summarises that the general Project area contains two predominant aquifer types that are termed local scale aquifers only:

- Fractured and weathered rocks with minor groundwater resources
- Fractured and weathered rocks.

The fractured rock aquifers are likely to offer generally low groundwater yields. In addition to the two units that dominate the Project region, the Hanson River palaeovalley is of Project significance, providing the water source for the mine. The Hanson River palaeovalley is located 20 km north east of the mine site.

Groundwater drilling within the alluvial channel associated with the Murray Creek just east of the mine did not produce any significant flows of groundwater.

An investigation of the groundwater potential in the area of the pit was undertaken in March 2014 through airlifting of existing exploration holes. The airlifting program aimed to determine the likely groundwater in-flow to the pit area. A total of eleven holes were assessed at locations both within and adjacent to the pit area. Groundwater was measured at a depth around 20 to 22 m with salinity generally between 6000 and 8000 mg/L TDS.

During air-lifting of the exploration holes, low volumes of groundwater were able to be purged with only a low flow volume sustained in five of the sites at rates less than 12 L per minute (0.2 L/s). The air-lifting tests also allowed the determination of indicative aquifer parameters through the analysis of groundwater recovery data at each test site.

The testing demonstrated that the pit area will not be subject to significant groundwater inflow, and as such, there is no indication the pit will require substantial dewatering infrastructure.

3. Geochemical assessment

3.1 Introduction

The objective of the geochemical assessment was to provide an overall understanding of the AMD risk at Mount Peake based on information supplied to GHD from previous work.

The geochemical assessment was informed by the following main components:

- **Laboratory X-Ray Fluorescence (XRF).** Assessment of TNG's laboratory XRF database sourced during exploration and resource definition drilling (2012 RC drilling and 2015 PQ core drilling). The laboratory XRF dataset consisted of a suite of 20 elements on a total of 5301 primary samples (5002 from the 2012 drilling program, and 299 from the 2015 drilling program)
- **XRF Assessment of select chip tray samples.** In order to provide additional assay data on waste material (in particular sulfur data at low detection levels), a full 'soils' suite assessment was undertaken on 1023 primary samples
- **Metals data.** Geochemical abundance indices (GAI) were calculated using the above datasets to assess if any metal species of potential environmental risk were concentrated in the ore and waste, relative to average crustal values for similar geological provinces. The metals data helps inform potential metalliferous drainage risk.

The above-listed assessments informed the AMD risk assessment.

3.2 Method

3.2.1 Assay-based ABA

Data set

The project XRF dataset included 6324 samples within and immediately surrounding the pit shell. Geochemical relationships were formulated from the data in both datasets to build an initial understanding of the AMD risk at Mount Peake. The approach was based on industry guidelines (DITR 2007, INAP 2009). The following relationships were established as described below.

Total sulfur

Total sulfur distribution provides an initial, conservative indication of the potential acid generation capacity of a sample. The assessment assumes that all sulfur is present as reactive pyrite. It is therefore an inherently conservative assessment as it discounts non-acid forming sulfur species or any inherent neutralising capacity.

This observation would be particularly relevant for total sulfur as identified in the deposits at Mount Peake formed from oxidised melts, where there would remain little potential for non-oxidised, sulfide species, with sulfur likely to be present as sparingly soluble secondary sulfate minerals, such as gypsum. Total sulfur values of less than 0.3 % S or 10 kg H₂SO₄/t are considered uncertain (DITR2007).

Net Potential Ratio (NPR)

An analysis of the ratio of likely acid-neutralising elements (calcium and magnesium) to acid-forming elements (sulfur) was undertaken to identify the units that may present a risk of producing acid. This was based on the assumption that all calcium and magnesium is present as carbonates and sulfur is present as reactive pyrite, and therefore available to consume and produce acid respectively. It is important to note that calcium and magnesium may be present as non-neutralising silicates, hence the assay-derived NPR should be used with caution.

It should be noted that for the 2015 XRF program, magnesium could not be included in the XRF suite due to the requirements to detect low levels for sulfur. As such, only calcium was used to assess the ratio of acid-neutralising compounds to acid-forming elements. This could result in an underrepresented value for the acid-neutralising capacity (i.e. its conservative). For all data, magnesium data is not available for 1021 of 6321 samples with data.

The calcium and magnesium to sulfur ratio can be converted to be reported as maximum potential acidity (MPA) for total sulfur, and acid neutralising capacity (ANC) for calcium and magnesium. This relationship is the identical to the Ca+Mg to S ratio; however, is reported in kg H₂SO₄ rather than as a percentage.

The ANC:MPA ratio is also known as the net potential ratio (NPR) (INAP 2009), and is another way of reporting the laboratory data to ascertain initial AMD risk. Generally speaking, and depending on the mineralogy, a NPR of less than 1 indicates the material is likely to be acid forming as it contains more acid generating than acid neutralising minerals. An NPR ratio of between 1 and 2 generally indicates an area of uncertainty that requires additional investigation, while an NPR of greater than 2 generally indicates that the material is likely to be self-buffering upon oxidation, again depending on which minerals are present (AMIRA 2002).

The NPR ratio was used to initially classify the AMD risk of the ore and waste material classes at TNG Deposit C as outlined in Table 3.

Table 3 NPR-based AMD classification

AMD classification	NPR value and MPA value
Potentially acid forming (PAF)	NPR of <1
Uncertain (UC)	NPR of between 1 and 2
Non-acid forming (NAF)	NPR of > 2

Further to the above classification, samples with an MPA of less than 10 kg/t would at worst be classified as Low Capacity (LC) PAF

Net Acid Production Potential (NAPP)

NAPP calculates a theoretical net acid producing (or consuming) value of a sample by subtracting the theoretical acid neutralising capacity, or ANC of a sample (CaO + MgO in this instance), from the maximum potential acidity (MPA) of a sample (total S in this instance). The calculation provides an overall indication of the potential for acid generation from the key lithological units at TNG.

The NAPP value was used in the geochemical assessment to confirm the initial AMD risk classification developed using the NPR method above. The classification scheme adopted for the preliminary geochemical assessment is provided in Table 4. The NAPP value was calculated using Equation 1; a summary equation for various stoichiometric adjustments.

$$\text{Equation 1: } \text{NAPP (kg H}_2\text{SO}_4 / \text{tonne)} = [\% \text{ Total S} * 30.6] - [(\% \text{CaO} * 17.5) + (\% \text{MgO} * 24.3)]$$

Table 4 NAPP classification categories

AMD classification	NAPP value (kg H ₂ SO ₄ /tonne)
Potentially Acid Forming (PAF)	≥ 10
Uncertain (UC)	0 -10
Non-Acid Forming (NAF)	-50 to 0
Acid Consuming Material (AC)	< -50

1: Adapted from Miller (1996)

3.2.2 Metal assay and Geochemical Abundance Index (GAI)

XRF data were used to calculate a Geochemical Abundance Index (GAI) to identify any elevated elemental concentrations. A direct comparison of the results was made against the average crustal abundance.

As the abundance of elements varies significantly, a log base 2 index has been historically developed to simplify comparison of measured values with average abundance. The index, called the global, or geochemical abundance index (GAI), and method, is documented in INAP (2009).

INAP (2009) describes the Geochemical Abundance Index (GAI) as a measure to compare the elemental concentration in a sample to the median abundance in the most relevant media (soils, crustal abundance etc.). It was initially described by Förstner *et al.* (1993). The purpose is to provide a relative indication of any elemental enrichment that may be of environmental importance. The GAI for an element is calculated by:

Equation 2:
$$GAI = \log_2 [C / (1.5 * S)]$$

Where: C is the elemental concentration in a sample; and S is the median content for that element in the reference material.

The GAI is measured on a scale of 0 to 6; whereby 0 indicates the element is present at a concentration equal to median global abundance, and 6 indicates an approximate 100 fold, or greater, enrichment above global abundance. As a general guide, a GAI of 3 or above is considered significant, and such enrichment may warrant further investigation.

It is important to note that the GAI only considers total concentration and does not take in to account solubility/mobility or bioavailability in the environment nor does it take in to account the toxicity of the element. Consequently, some elements that are highly elevated but immobile may not represent a risk of environmental harm, whereas other more soluble or toxic metals at much lower concentrations may present a risk. The GAI is only considered as an indicator of elements to be assessed in more detail.

3.3 Sample density, numbers and locations

3.3.1 Sample density

Geochemical sample density is a critical parameter to ensure that a statistically significant data set has been captured, such that the AMD risk assessment is based on sound mineral waste characterisation.

There is arguably no 'right' number of samples that should be collected for geochemical characterisation; rather, demonstrating a level of confidence for the stated purpose statistically is the preferred method. In that regard, several publications provide guidance toward obtaining a representative sampling density. For example, Price (1997), Miller (1996) and the (then) Queensland Department of Mines and Energy (DME) (1995) have provided guidance on geochemical sampling numbers / density. The correct number, however, relates to a level of statistical significance for which the AMD risk becomes acceptable based on the proposed development.

For example, Price (1997), Miller (1996) and DME (1995) provide the following recommended sample number by major lithological unit as shown in Equation 3.

Equation 3 $n = 25 \times \sqrt{x}$. (Where x = Million tonnes (Mt) of material per major lithological unit)

Therefore, and based on the above formula, a rule of thumb to be quasi-representative is around 250 samples per 100 Mt of waste material, per major geological unit. At TNG, all waste material can broadly be divided into three main types, gabbro, granite and Quaternary alluvials.

With regard to sampling densities, DITR (2007) recommends that at pre-feasibility stage; "Several hundred representative samples of high and low grade ore, waste rock and tailings should be collected for geochemical test work i.e. sufficient samples to populate a block model with a reliable distribution of net acid production potential (NAPP) data on ore, waste and wall rock". This was completed at TNG in the form of the TNG's laboratory XRF dataset.

Further, DITR (2007) recommends that at feasibility stage, the proponent should; 'Improve density of NAPP data for block model if necessary, and conduct sufficient Net Acid Generation (NAG) test work to cross check NAPP data for key lithologies. If there are still insufficient data to assess AMD potential and provide a convincing Management Plan for approval, additional sampling, test work and refinement of block models will be required. TNG has included recommendations for NAG and NAPP testing herein as discussed later in this report.

3.3.2 Lithological units

For the purposes of this assessment, the datasets have been divided by key lithological units. This will allow for assessment of ore and waste properties to be developed based on each lithological unit. The units used can be separated into waste and ore as follows:

- **Ore** - All ore material (representing 56% of the total pit volume). This material will be processed on site, with tailings separated from the ore and deposited at the site Tailings Storage Facility (TSF)
- **Waste** - The waste material (61 Mt, representing 44% of the total pit volume) will be largely deposited at the WRD, with a smaller volume used during construction (i.e. pad constructions). The waste is separated into four key lithological units:
 - **Gabbro** - This includes the surrounding gabbro host rock, predominately hanging wall gabbro, with minor magnetite (oxidised). Makes up approximately 58% of waste material (35 Mt)
 - **Granite** - granitic rocks mostly present to the west of the orebody, coarse porphyritic potassium feldspar. Makes up approximately 10% of waste material (6 Mt)
 - **Alluvials** - overlying cover of Quaternary sand deposits, loose, weathered and unconsolidated (alluvial and aeolian, but grouped here as alluvials). Makes up approximately 32% of waste material (19.5 Mt)

- **Fault** - a minor unit classed as faulted material. This is present in the far west of the pit and only encountered in three drill hole records within a narrow depth range of around 3 m in each hole (09MPRC011, 11MPRC041 and 11MPRC042). Makes up less than 1% of waste material.

3.3.3 Sample numbers

The number of samples within the TNG laboratory XRF dataset are shown in Table 5. The data is grouped by the sampling program and the main lithology.

Table 5 Number of samples by lithology and sample program

Lithology	2012 assay	2015 assay	2015 XRF	Total
Ore body	2387	12	130	2529
Waste - Gabbro	2482	218	484	3184
Waste - Granite	19	34	119	172
Waste - Alluvial	112	34	282	428
Waste - Fault	0	0	8	8
Waste Total	2613	286	893	3792
Total	5000	298	1023	6321

The samples outlined above are in excess of the minimum assay numbers recommended especially considering the low-risk presented by an oxidised relatively uniform deposit.

3.3.4 Sample locations

The sample locations are shown on Figure 4. The drillhole distribution show good coverage for the different areas of the pit, with sample numbers sufficient within each unit to allow characterisation. A total of 76 drillhole locations are included in the assessment, with samples depths ranging from the top to the base of the hole (average sample depth of 60 m).

3.3.5 Summary

Based on the low geological risk, available analytical parameters and the commitment to acquire additional samples prior to mining, the number and density of analyses available are adequate for the current stage of the project.

3.4 AMD Assessment results

3.4.1 Mineralogy

Sulfur minerals

During logging of the resource drilling, there have only been rare occurrences of visible sulfides. Rarely do they comprise more than a few percent of the sample over a few metres. Generally the sulfides seen are associated with structural zones and faults/fractures. The majority of fracture zones are less than one metre thick, irregularly developed, and not able to be correlated between holes.

Core logging and assays show the sill is sulfur-poor, and there are no indications that sulfides concentrations may be present at lower stratigraphic levels in the sill.

The lack of observed sulfide mineralisation is consistent with the very low sulfur content observed at the site and is consistent with the oxidised nature of the source magma.

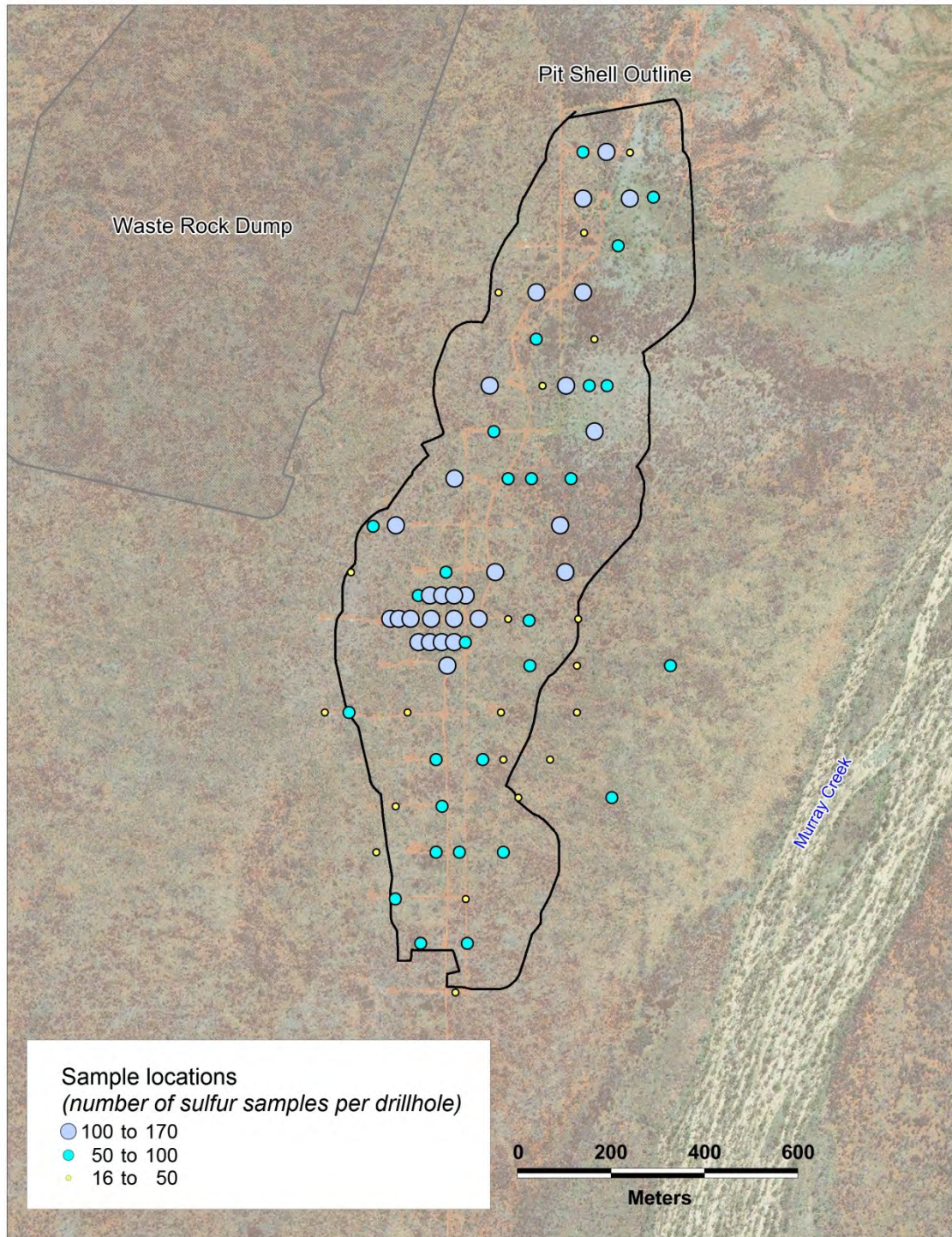


Figure 4 Sample locations showing number of samples (for sulfur)

Carbonate, calcium and magnesium-bearing minerals

Carbonate veins have been encountered in various locations generally near-surface within the oxidised magnetite olivine gabbro. Assays of the diamond core suggest carbonate alteration is more widespread than the carbonate veining. Open space filling carbonate crystals are present along deformation zones in fresh rock, and can be identified from elevated Ca values. The carbonate alteration/veining is related to weathering and probably related to thin zones of calcrete found along drainages.

There is also a small amount of pedogenic carbonate present in the lower weathered zone in the gabbro that sits on the orebody.

The mineralogy discussed above, lacking in sulfides with the presence of carbonate material, suggests that the risk of acid generation is very low, although there may be only moderate buffering capacity due to the possibility of Ca and Mg being present as slow-reacting silicates.

3.4.2 Assay-based ABA

The mineral waste and ore were classified using three evolving methods, each refining the last. They were:

- A worst-case *total sulfur* based, maximum potential acidity (MPA) method
- A net potential ratio (NPR) using the sum of calcium and magnesium oxide-derived ANC divided by the total sulfur-derived MPA (noting that no reduction for sulfate sulfur was used)
- A net acid production potential (NAPP) value, calculated using the sum of calcium and magnesium oxides subtracted from the total sulfur content (noting that no reduction for sulfate sulfur was used).

Total S-based maximum potential acidity (MPA)

The MPA method was refined by re-classifying the units by comparing the theoretical stoichiometric acid-producing to acid-consuming minerals using the data.

The dataset included 6321 sulfur analyses which were assessed to determine the statistical distribution of sulfur. Conservatively assuming that total sulfur is a surrogate for reactive pyrite, this gives an indication of the maximum potential for acid generation to occur.

Table 6 provides statistical summaries for all sulfur data and for each waste and ore type.

The maximum sulfur values for each drillhole are presented on Figure 5, which shows an overall good distribution of sample locations.

Figure 6 presents the sulfur data for those drillholes locations where more than 2 samples were measured above 0.3 % (equivalent to 10 kg H₂SO₄/t). The sulfur data are plotted against the depth of sample and highlights that where sulfur concentrations are elevated, they are in relatively thin bands and at a variety of depths, but predominately in the upper 40 m. The elevated sulfur readings typically occur over less than 3 m intervals. The highest sulfur values of 4.5%S in ore (Hole 09MPRC014) appears to coincide with the water table which could relate to accumulation of sulfate or supergene sulfide.

Table 6 Statistical summary of sulfur data by lithology

	All data	Ore	Gabbro	Granite	Alluvials	Fault	All waste
Mean	0.040	0.040	0.034	0.063	0.065	0.478	0.039
Median	0.025	0.027	0.018	0.052	0.041	0.191	0.021
Std Dev.	0.109	0.146	0.044	0.053	0.144	0.648	0.067
Minimum	0.001	0.001	0.001	0.001	0.003	0.065	0.001
Maximum	4.552	4.552	0.632	0.271	2.009	1.972	2.009
99% UCL	0.237	0.175	0.199	0.248	0.833	1.892	0.244
Count	6321	2529	3184	172	428	8	3793
Count above 0.3%	41	17	11	-	11	2	23
% above 0.3%	0.6%	0.7%	0.3%	0.0%	2.6%	25.0%	0.6%

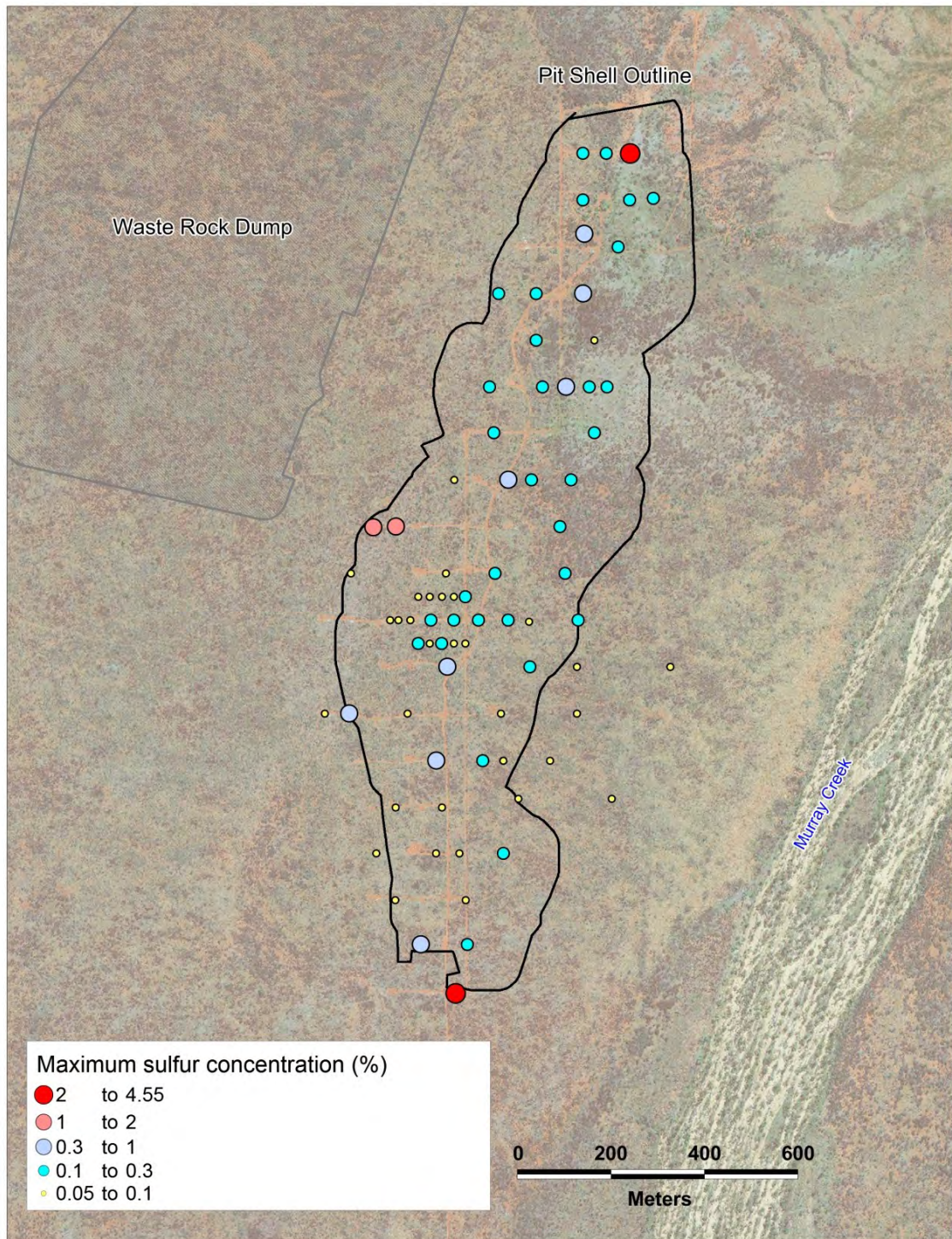


Figure 5 Sulfur data (maximum of sulfur for each drillhole location)

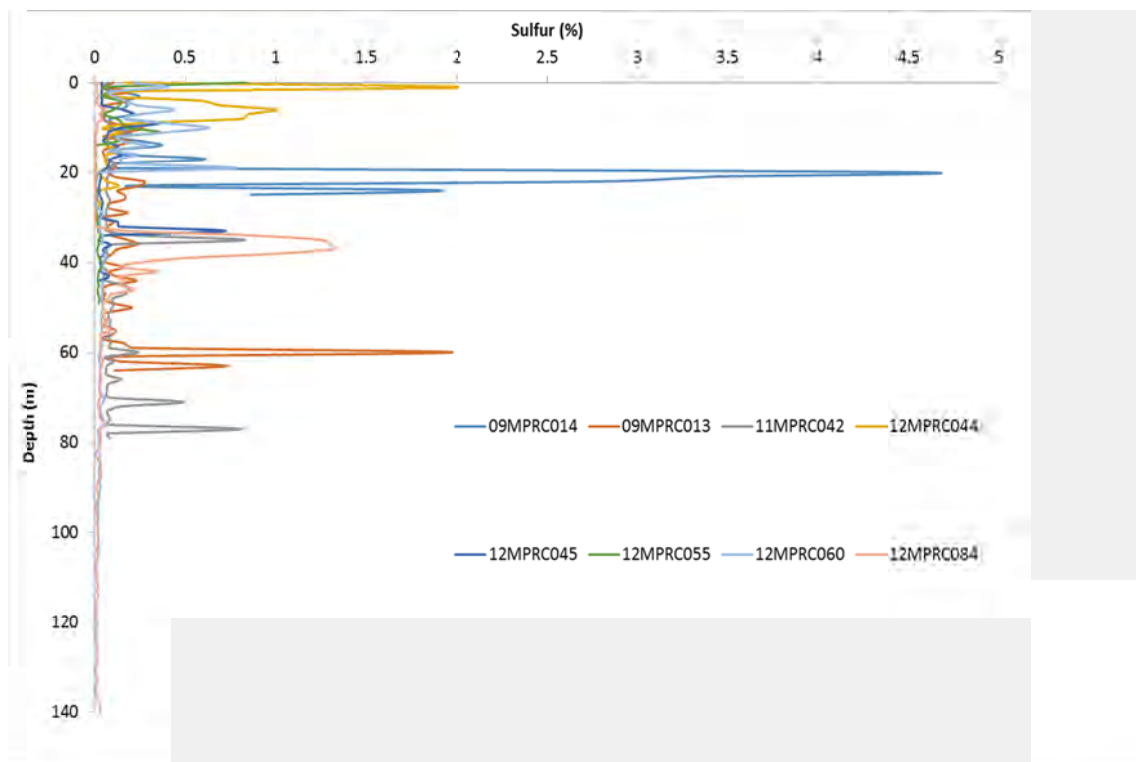


Figure 6 Sulfur data for drillholes where more than two readings are above 0.3%

All data

The total sulfur statistical distribution for the full XRF assay dataset is outlined in Figure 7, and shows that 99.35% of the total 6321 samples returned values of below 0.3% total sulfur (i.e. a MPA value of less than 10 kg H₂SO₄/t).

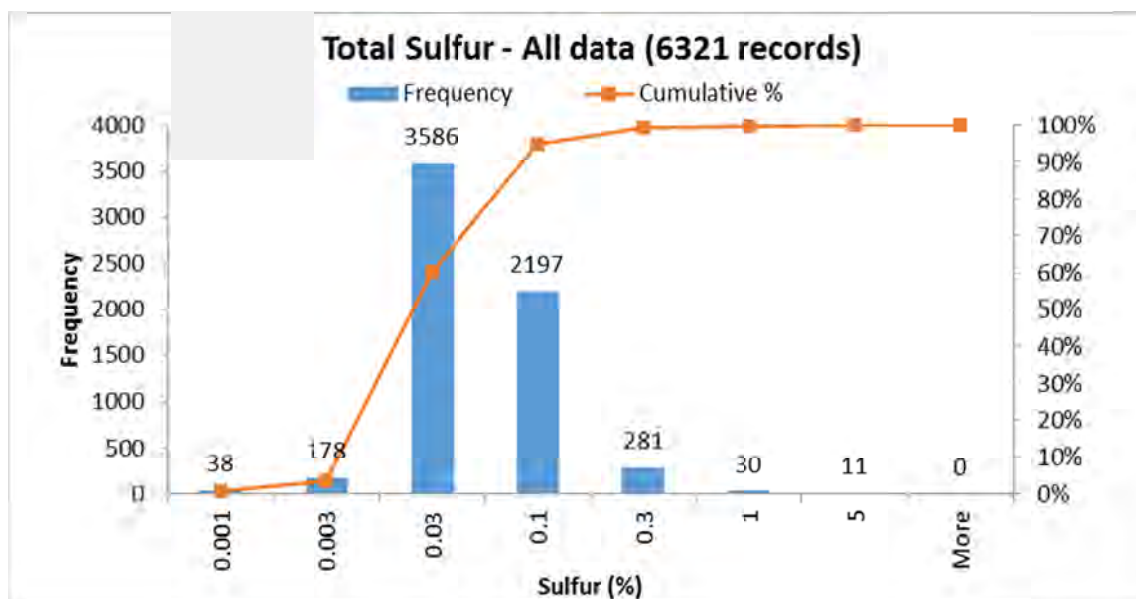


Figure 7 XRF data – all data Total Sulfur distribution

The average total sulfur value is 0.04% for an MPA value of 1.2 kg H₂SO₄/t, with a median value of 0.025% for an MPA value of 0.8 kg H₂SO₄/t, a standard deviation of 0.1%. This demonstrates the primary deposit has a consistently low sulfur content and that the exceedance of the typically accepted “low capacity” (DITR 2007) value of 10 kg H₂SO₄/t is not significant, either statistically or in terms of the number of samples. In contrast, the fault material has elevated sulfur, albeit based on limited sampling.

Only 41 of the 6321 XRF samples contained greater than 0.3% sulfur. Of these, 17 were in the ore, 11 in the gabbro, 11 in the alluvials and 2 in the fault zone. All of these samples tended to be in the upper regions of the pit, with an average depth of 24 m for samples over 0.3% sulfur. This generally represents material at or above the watertable.

The total sulfur statistical distribution for all waste is shown below on Figure 8. The waste data shows that 99.39% of the total 3793 samples returned values of below 0.3% total sulfur. The average total sulfur value is 0.039%, with a median value of 0.021%, a standard deviation of 0.07%.

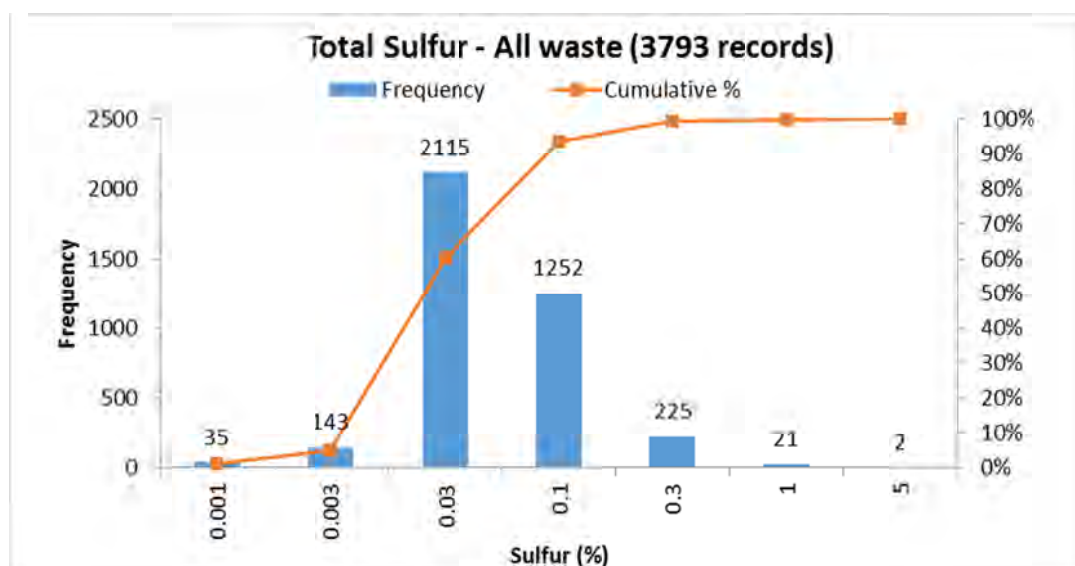


Figure 8 XRF data – all waste data total sulfur distribution

In addition to the collated waste data, distribution plots for alluvial and gabbro waste are shown below as Figure 9 and Figure 10 respectively. The data shows that the alluvials tend to have generally higher sulfur content in comparison to the gabbro waste. For the alluvials 97.4% of the total 428 samples returned values of below 0.3% total sulfur, whereas for the gabbro this was 99.65% for 3184 samples.

Figure 11 is the distribution for the orebody, which shows a similar distribution for sulfur content to the gabbro unit, as would be expected based on their mineralogy and oxidation states. For the orebody 99.33% of the total 2529 samples returned values of below 0.3% total sulfur. The average total sulfur value is 0.034%, with a median value of 0.027%, a standard deviation of 0.044%.

The results indicate that the TNG data returned low concentrations of total sulfur, with more than 99% of the samples being below 0.3% S.

All lithologies had a 99% UCL below 0.3% S; thereby classifying them in the lowest risk category possible of UC, using the NAPP classification method as shown in Table 4.

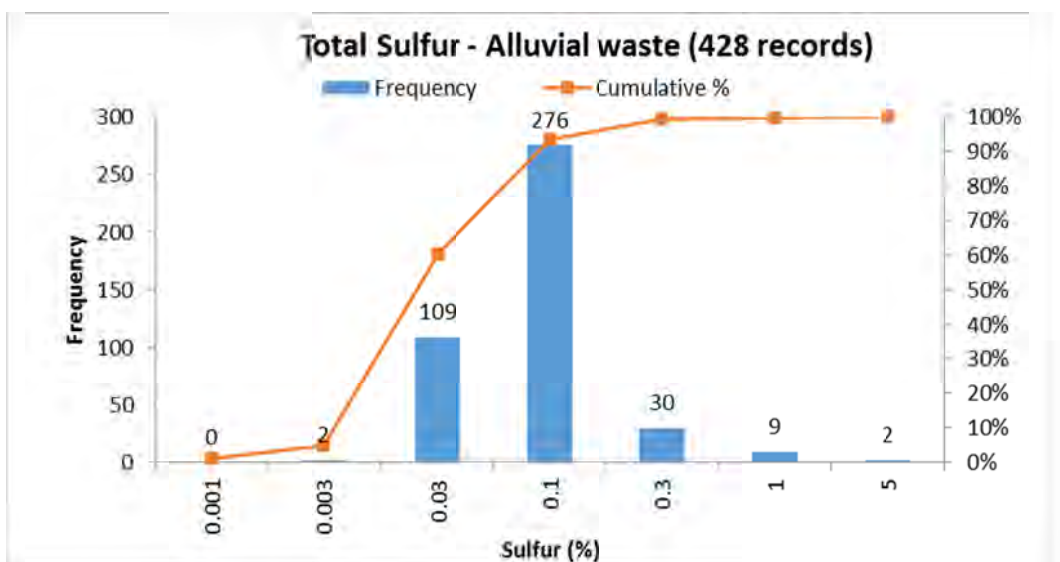


Figure 9 XRF data – all alluvial waste data total sulfur distribution

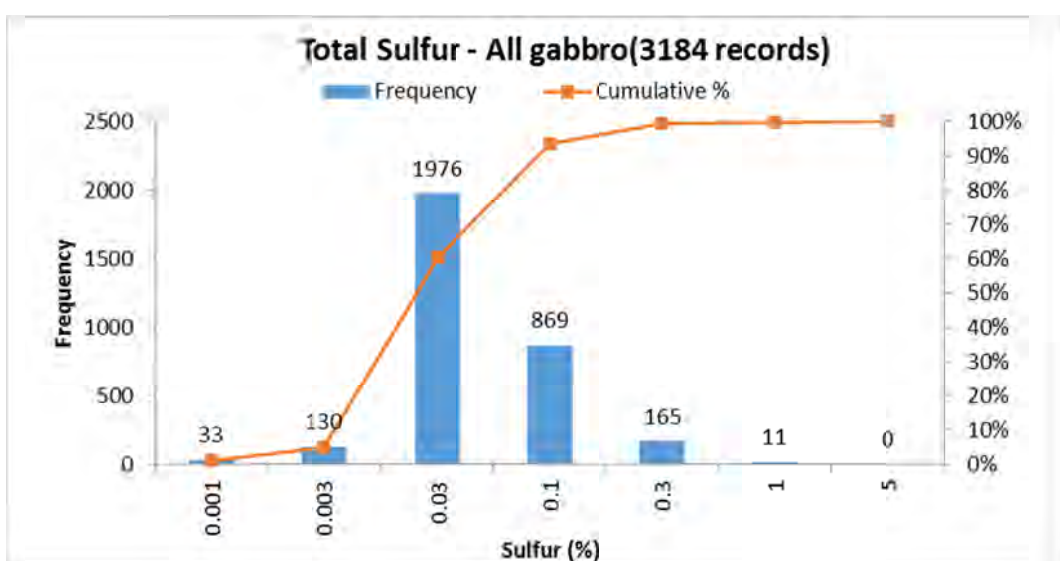


Figure 10 XRF data – all gabbro waste data total sulfur distribution

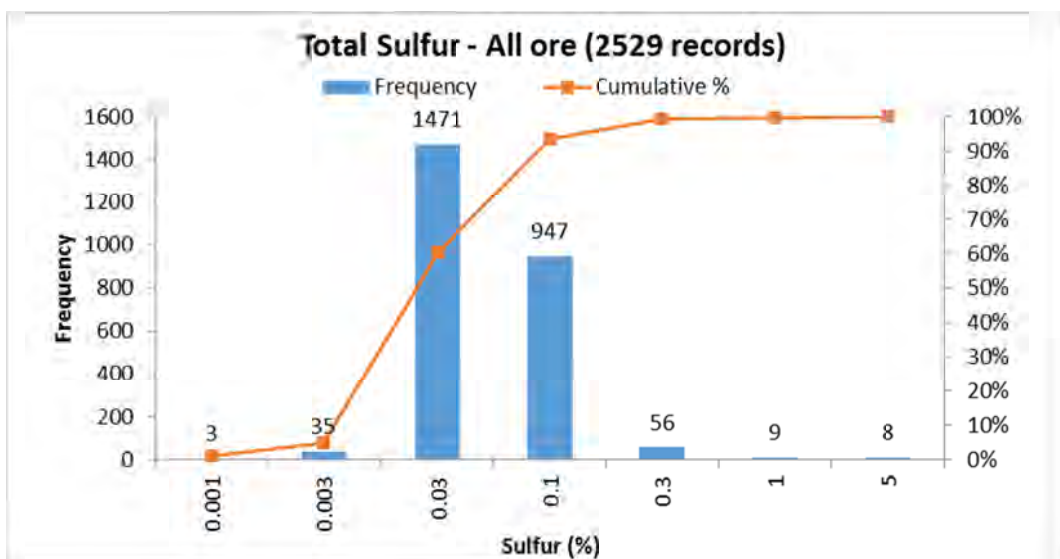


Figure 11 XRF data – all ore data total sulfur distribution

The data presented in Table 6 and the above graphs indicates that the median total sulfur values for all lithologies fall below 0.2% with the 99% upper confidence limit below 0.3%.

Based on total S, in the worst case that all total sulfur is present as reactive pyritic sulfur and assuming an absence of any neutralising minerals, all lithologies and product streams are in the lowest possible risk category 'uncertain' (UC) or PAFLC, as summarised in Table 7.

Table 7 AMD data S-based PAF classification summary

Waste / Ore Class or lithology	Mean Total S	Mean PAF Classification (based on Total S%)
All data	0.04	UC
Ore	0.04	UC
Waste - Gabbro	0.03	UC
Waste - Granite	0.07	UC
Waste - Alluvials	0.07	UC
Waste - Fault	0.48	UC

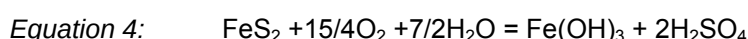
Net Potential Ratio (NPR)

The MPA method described above can be refined by re-classifying the units by taking in to account the theoretical acid neutralising capacity (ANC), based on the assumption that calcium and magnesium are present as carbonates. This is done by comparing the theoretical stoichiometric acid producing (S) to acid consuming (Ca and Mg) minerals using the XRF data to calculate an ANC:MPA ratio, also known as the net potential ratio (NPR) It is the next step in utilising acid base accounting data to ascertain the preliminary AMD risk.

An ANC:MPA ratio of less than 1 indicates the material is likely to be PAF as it contains more acid generating material than acid neutralising material. The ANC:MPA ratio therefore provides an indication of the relative margin of safety (or factor of safety) with respect to the potential for net acid generation.

The MPA and ANC values calculated as part of this assessment have been conservatively estimated by assuming all sulfur present is in the form of pyritic (FeS_2) or reactive sulfur. As highlighted in Section 3.2.1, a number of samples are lacking magnesium data, therefore the ANC value used in the calculation is likely to under-predict the neutralising capacity as it is not considering any magnesium present.

Using this assumption, we have assumed 100% of the sulfur present is available to form acid as per Equation 4.



Based on the balanced reaction stoichiometry provided in Equation 3, 1% pyrite by weight translates to 30.6 kg of H_2SO_4 per tonne of material ($\text{kg H}_2\text{SO}_4/\text{t}$). Therefore, the MPA has been calculated by multiplying the percentage of total sulfur in the sample by 30.6. As calcium and magnesium carbonates (Ca/MgCO_3) react with H_2SO_4 to neutralise the acid on a 2:1 stoichiometric ratio, then it is also useful to calculate the relative acid neutralising capacity (expressed in terms of $\text{kg H}_2\text{SO}_4/\text{t}$ equivalent) of the materials being tested based on calcium and magnesium content.

Figure 12 shows the NPR plotted for samples results collected from the samples grouped by waste stream and ore. The figure shows a dashed red line which indicates where ANC equals MPA (i.e. a ratio of 1:1), and a purple line that indicates a ratio of ANC to MPA of 2:1. Samples plotting below the dashed red line generally do not have sufficient inherent neutralising capacity, and therefore have the potential to generate acid drainage (PAF).

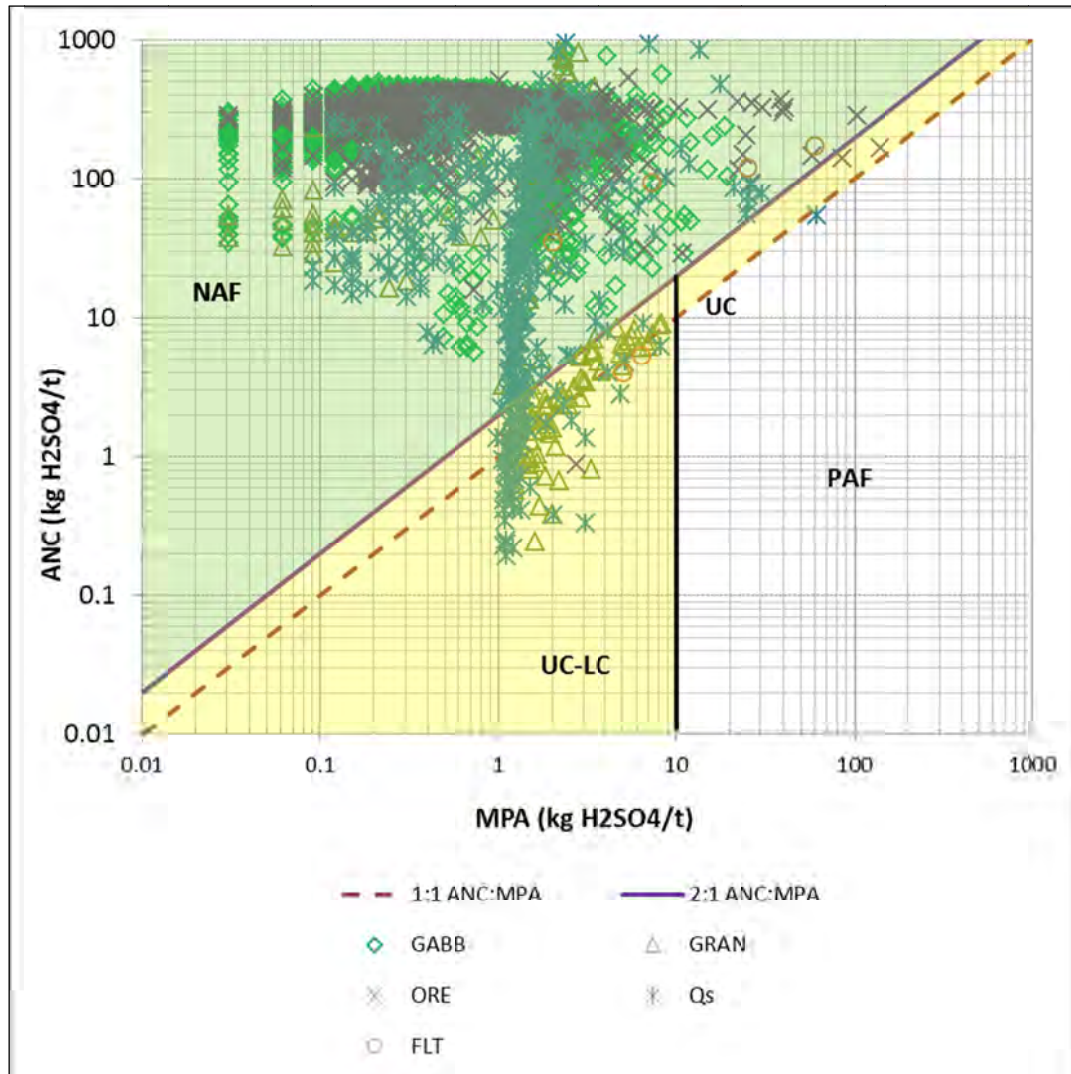


Figure 12 NPR classification by waste stream

Samples plotting above the purple line, with an ANC to MPA ratio of greater than 2:1, are theoretically unlikely to generate acid given the excess neutralising capacity present (AMIRA 2002) and are classified as NAF. Samples plotting between the lines generally fall into an uncertain (UC) category. Samples with an MPA of less than 10 kg H₂SO₄/t (equivalent to 0.3% S) are also unlikely to produce significant acidity even in the absence of neutralising capacity so are classified as UC.

Figure 12 shows that the results are relatively variable, due to the wide range of theoretical ANC values, but that the bulk of the material to be excavated is NAF, with almost all of the remainder falling within the UC-LC category. Individual plots for each of the waste categories are presented within Appendix A.

Only one sample (alluvial waste) would be classified as PAF. This was from a surface sample (0 to 1 m at 12MPRC044). As this was from the XRF data from 2015, there was no magnesium data, so with additional data, this data point may have more neutralising capacity which would suggest it may not be PAF. It is also unlikely to contain sulfide mineralisation and it is more likely that it contained sulfate salts such as gypsum.

If magnesium was included at 50% of the calcium concentration (considered appropriate based on the ratio of Mg:Ca where there is data, see Figure 13), then a large part of the data would be shifted further to higher ANC values and hence reduce the number of PAF and UC samples.

Approximately 99% of samples had an NPR of greater than 1, classifying them as either UC or NAF. Table 8 presents a statistical summary for the NPR ratio of the excavated material by waste and ore stream. All material groups have a median NPR of 3 or greater suggesting overall sufficient buffering capacity. The lowest NPR is seen in the granite and fault zone.

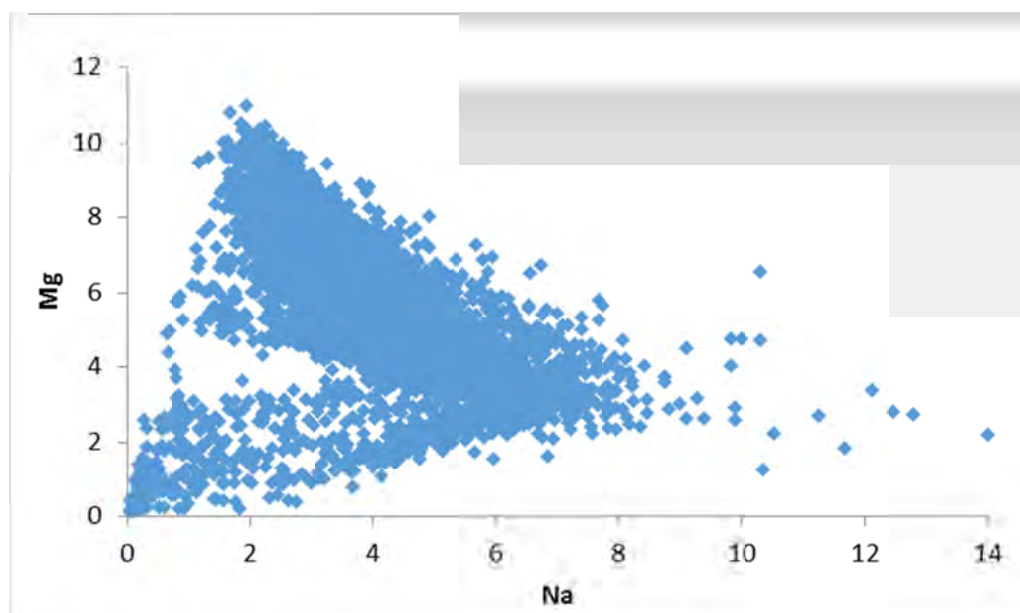


Figure 13 Magnesium to calcium ratio for samples with data

Table 8 NPR statistics and classification

Waste / Ore Class	Median NPR	Mean NPR	Mean NAF / PAF Classification (based on NPR)
All data	433	707	NAF
Ore	389	562	NAF
Waste - Gabbro	661	926	NAF
Waste - Granite	3.1	174	NAF
Waste - Alluvials	29	106	NAF
Waste - Fault	3.8	6.6	NAF

NPR Summary

Based on the median and mean NPR results (Table 8), all lithologies and all product streams are classified as NAF.

Net Acid Producing Potential (NAPP)

The Net Acid Producing Potential (NAPP) calculation identifies the severity and extent of acid producing potential across the site in general. Figure 14 shows a cumulative histogram of the whole dataset (5364 records with data) that shows approximately 99.7% of the samples having a NAPP value of <10 kg H₂SO₄/t, indicating these samples are all likely to be NAF. Additional histogram plots for each lithology are presented in Appendix A.

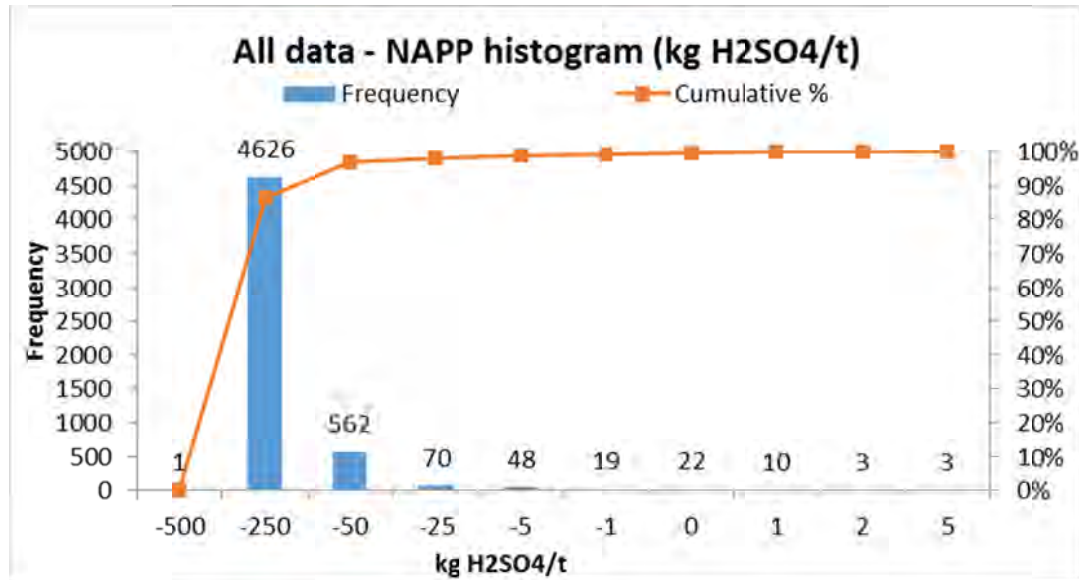


Figure 14 NAPP histogram for all data

Table 9 summarises all NAPP data for each ore and waste type. The data shows the dominance of negative NAPP values indicating a dominance of ANC material over MPA material. Of the 6262 data records where NAPP can be calculated, 5797 are classed as acid consuming (AC) with a NAPP of less than -50. There are a total of 5 records that have a NAPP value greater than 2 kg H₂SO₄/t, four of which are from the upper most sample in the alluvials (<2m), and one is from granitic waste at 55 m (09MPRC011).

Table 9 NAPP data (kg H₂SO₄/t) by ore and waste type

	All	Ore	All Waste	Gabbro	Granite	Alluvials	Fault
Mean	-314.1	-311.1	-314.8	-325.3	-63.8	-96.6	-54.7
Median	-321.6	-313.7	-333.3	-337.6	-2.1	-71.2	-59.9
Standard Deviation	91.5	65.4	111.2	98.6	116.2	82.4	50.9
Minimum	-515.4	-1125.6	-489.9	-756.5	-370.1	-387.0	-114.2
Maximum	2.8	-0.3	2.8	-0.8	2.5	2.8	1.1
95% UCL	-3.5	-89.2	-0.5	-22.9	1.6	1.8	1.1
Count	5364	2439	2960	2852	139	153	6
Count above 0	16	-	16	-	32	3	2
% above 0	0.3%	0.0%	0.5%	0.0%	23.0%	2.0%	33.3%

The overall NAPP-base classifications are summarised in Table 10.

Table 10 NAPP-based classification

Waste / Ore Class	Mean NAPP kg H ₂ SO ₄ /t	Mean NAF / PAF Classification (based on NAPP)
All data	-314	AC
Ore	-311	AC
All Waste	-315	AC
Waste - Gabbro	-325	AC
Waste - Granite	-64	AC
Waste - Alluvials	-97	AC
Waste - Fault	-55	AC

NAPP summary

Based upon the a review undertaken of the total sulfur, calcium and magnesium oxide and derived theoretical NAPP, all product streams are classified as AC, with no samples with a NAPP of greater than the UC limit (Table 4) of 10 kg H₂SO₄/t.

Assay-based ABA conclusions

Based on the findings from the XRF assay data, and within the limiting assumptions of S, Ca and Mg mineral types, none of the broad lithological or ore/waste stream groupings are classified as PAF. The greatest potential for acid generation is potentially within the fault zone where limited data has indicated generally higher sulfur content; however there is also relatively high calcium data for this unit suggesting a good buffering capacity. The actual volume of the fault related material is expected to be very low.

Table 11 Summary of Total S, NPR and NAPP-based geochemical assessments

Analysis Type	Summary	Outcome
Total sulfur distribution / MPA classification	Sulfidic material was relatively evenly distributed across lithologies and product streams. Concentrations were generally found to be low to negligible with only 0.6% of samples being greater than 0.3% total sulfur (i.e. < a MPA value of 10 kg H ₂ SO ₄ /t).	All materials and waste/ore groups are within the lowest risk category - UC.
ANC: MPA (NPR) ratio	The data showed a range of acid generating and neutralising properties. The majority of samples were found to be NAF (NPR ratio >2). A number of samples recorded an NPR of <1, however in all cases this was where there was no magnesium data.	Based on average values, all lithologies and waste/ore streams were classified as NAF.
Net Acid Producing Potential (NAPP) distribution	Statistical analysis of the database indicated that the majority of samples were either AC or NAF, with no samples having a NAPP of greater than the UC limit of 10 kg H ₂ SO ₄ /t	All lithologies and product streams classified as AC

3.4.1 Metal assay and GAI

Metals analyses for the data were compared to the average crustal abundance values. Due to the various rounds of analyses, the total number of samples per element varies, but was generally between 5000 and 6000 analyses. The assessment below only considers those results that were above the Laboratory/Equipment Reporting Limit.

Using this measure, the following elements presented in Table 12 recorded more than 1% of values in excess of a GAI of 3.

Table 12 GAI summary (results where >1% are above GUI x 3)

Element	Arsenic	Lead	Selenium	Vanadium
% of samples >3 x GAI	10%	3%	1%	38%
Sample size of detects (number above a GAI of 3)	382 (37)	4313 (131)	1441 (15)	6324 (2406)
Min	1.5	-1.1	0.1	-4.3
Median	1.8	1.0	0.1	2.4
mean	2.2	0.9	0.6	2.0
Max	8.3	7.6	3.7	4.3
99%UCL (assume norm. dist.)	2.3	0.9	0.6	2.0

As demonstrated by Table 12 only arsenic, lead, selenium and vanadium exceeded a GAI of 3 for over 1% of samples, considered to indicate significant elevation above “background” crustal abundance.

Given that the mean, median and 99% upper confidence level for all of the three metals were below a GAI of 3, they are unlikely to pose a risk of significant environmental impact. They should, however, still be assessed in more detail, including leachability, in the pre-production phase of the project.

It is notable that sulfur is excluded from the above table as less than 1% of values were above the 3 x GAI. Data for sulfur indicates that of the 6321 samples, 30 were above a GAI of 3, with a median and mean GAI of 0.6 and 0.1 respectively.

It is important to note that the GAI only considers elevation of total element concentrations and does not consider mobility, bioavailability or toxicity. It is therefore only useful as an indicator of which elements should be examined more closely.

3.5 Geochemical assessment conclusions

3.5.1 Potential to produce acidic drainage

The distribution and number of tests on samples is suitable from which to provide an assessment of the acidic drainage potential of the waste and ore. The results of the XRF assay sulfur and calcium + magnesium – based NAPP and NPR data indicate that the ore and waste material is primarily non-acid forming (NAF) and acid consuming (AC). Considering the full data set, there is not a statistically significant number of samples that would be classified as potentially acid-forming (PAF) by any of the assessment methods.

The small number of samples identified as PAF from the NPR-based methods are largely due to the absence of magnesium in the test data. If magnesium were included at 50% of the calcium concentration (considered appropriate based on the ratio of Mg:Ca where there is data), then most of the PAF data is removed and becomes UC (see Figure 13 for Mg:Ca ratio). The low volumes of sulfur in these samples suggest that any sulfide volumes would be extremely low. The NAPP classification assessment did not determine any samples within the PAF range (>10 kg H₂SO₄/t).

3.5.2 Potential to produce metalliferous or saline drainage

Although the total metal analyses indicate some samples contained arsenic, selenium and vanadium elevated above background values, average results were not significantly elevated. Leachate analyses would be required to determine if these elevated metals would pose a risk to receiving environments. However, runoff and seepage controls are to be included in the design in accordance with the Water Management Plan, therefore any runoff or seepage will be monitored on a regular basis and elevated concentrations detected and managed appropriately. Provision is made in the AMDMP for small quantities of PAF material isolated during the mining process.

Additional leachate testing will be carried out pre-production, to confirm leachate quality and additional leachate and groundwater analyses are required to confirm the relative risk levels.

4. Waste rock management strategy

4.1 Overview

A key component of waste rock management for the Project is the storage of waste rock within a designated WRD that will be designed and engineered to allow appropriate storage and segregation of waste should any potentially acid, saline or metalliferous leachate generating waste be encountered during excavation. This is consistent with industry best practice as detailed in INAP (2009).

TNG recognises that planning for closure is a fundamental component of mine planning (INAP 2009, DITR 2007, EPA/DMP 2011). Therefore, identifying any AMD material within the context of the mine plan and schedules is essential such that its management may proceed successfully. To that end, TNG has developed comprehensive AMD design and operational controls to minimise forward closure risks.

The Mine Closure Plan for the site includes overall WRD management such as ensuring that the final landform is geotechnically stable and the surface and outer slopes of the waste rock dumps resist erosion. Drainage from the WRD will not cause significant contamination of local surface waters or harm to local vegetation.

In this discussion, the term PAF includes non-acid material that generates saline or metalliferous leachate.

4.2 WRD encapsulation of PAF materials

The WRD for non-AMD material is to be constructed as an infrastructure platform to the west of the open pit during the first year of operations.

If any PAF is identified, a temporary PAF cell would be located within a designated area of the WRD. The cell would be constructed with side-walls and bases of crushed NAF materials up to 5 m thick. Following placement of the PAF materials, the cell will also be covered using crushed NAF materials to 5 m thick. The availability of AC material may also be sources from waste material and incorporated into the PAF cell to reduce potential impacts. Consideration of a PAF cell within the mined areas of the pit should also be considered.

The process of placement and covering will be continuous to facilitate immediate and permanent capping aimed at prevention of the interaction of PAF materials with the atmosphere, particularly with rainfall. If disposal of these materials due to operational activities cannot take place immediately, materials will be provisionally encapsulated with NAF materials to then adequately be disposed of when operations permit. On completion of mining, or progressively where the mine plan permits, PAF material will be returned to the pit for permanent encapsulation and flooding.

5. AMD risk assessment

5.1 Introduction

The following AMD ecological and human health risk assessment was undertaken to determine the AMD risk associated with the material identified for the project. It has been undertaken within the context of, and considering:

- PAF material identified during the geochemical assessment
- Metals leaching potential of the excavated material
- The mine plan and schedule
- Baseline environment and any sensitive receptors.

The AMD risk assessment is a source-focused risk assessment in that it is not an exhaustive study of downstream impacts. It has been completed to provide a high level understanding of AMD source risk on a greenfield mine within the context of the mine plan, such that any potential impacts from mismanaging the mine wastes may be identified based on the geochemical information as reported above. In that regard, it uses INAP's (2009) source→pathway→receptor model as shown below in Figure 15.

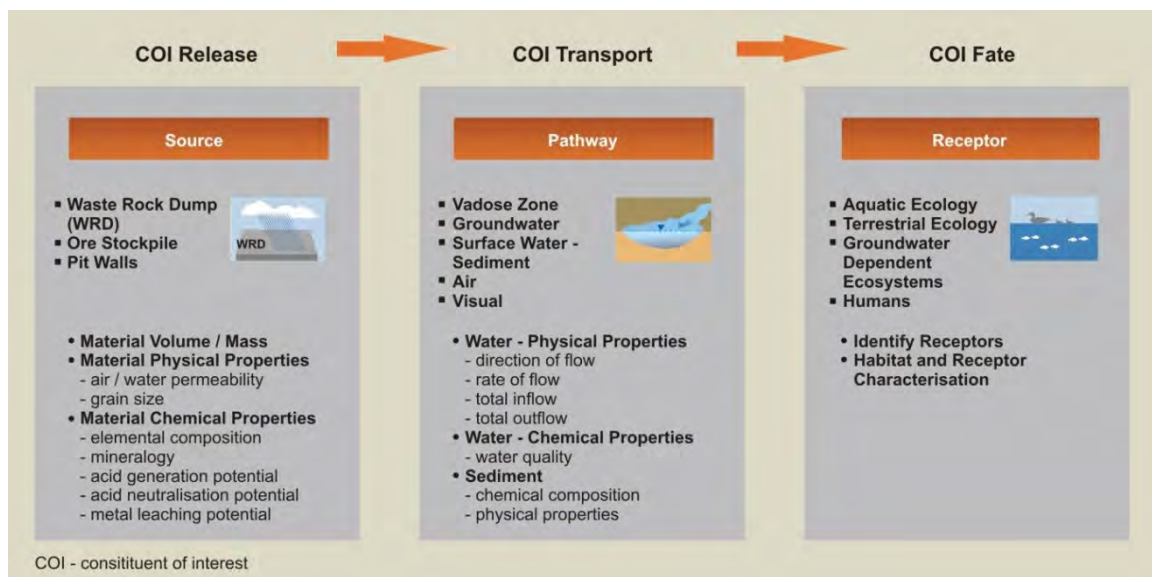


Figure 15 The AMD Source→Pathway→Receptor model

The general approach to the risk assessment followed standards and leading practice guidelines including:

- AS/NZS 4360:2004 Risk Management
- AS/NZS ISO 31000:2009 Risk Management – Principles and Guidelines
- Managing Acid and Metalliferous Drainage (DITR, 2007)
- The Global Acid Rock Drainage Guide (INAP, 2009).

The outcomes of the AMD risk assessment have informed the AMD management strategy and Plan.

5.2 AMD risk assessment and management process

5.2.1 Introduction

INAP (2009) notes that the geochemistry and risk assessment techniques related to AMD for a new mining development are not as yet calibrated for all situations. There will therefore remain a degree of uncertainty in terms of the confidence in the data collected and the reliability of the analysis and output. For this reason, a precautionary approach and contingency planning is an integral part of this AMD risk assessment, as it informs the AMD Management Plan.

The risk assessment recognises the limitations of the input data (i.e. no NAG, kinetic ABA testing or Australian Standard Leaching Procedure (ASLP) or column leaching tests). However, the use of a large laboratory and site XRF dataset, of generally in excess of 6000 samples, has provided a suitably sized input for the stated purposes of assessing AMD risk, and developing high level management strategies for site implementation throughout the operational mine stage and into closure.

The risk assessment also acted as a gap analysis, with any data gaps proposed to be filled by the collection of additional geochemical samples with subsequent analysis throughout the pre-production and operational stages. Additional data collected in the future would be fed back into the AMD risk assessment to better inform the process such that AMD management strategies may be fine-tuned as required.

INAP (2009) notes that the level of acceptable risk will vary from the local, regional, and national communities. In addition, the level of acceptable risk changes over time. Acceptable risks today may not be acceptable in the future, therefore, this risk assessment should be revised commensurate with updates to the AMD Management Plan.

5.2.2 Risk management

Risk is defined as the probability or likelihood that a certain event (hazard) will happen, multiplied by the consequence of the event (INAP 2009; Equation 4).

Equation 4: Risk = Probability × Consequence

Risk Management is essentially a five step process including:

- Step 1 – Establish the context
Step 1 of the process as shown in Figure 16 relates to the mining proposal at Mount Peake including the mine plan and schedule as discussed in Section 1.1, in addition to the existing environment at the site.
- Step 2 – Identify the risks
Step 2 of the process as shown in Figure 16 relates to geochemical assessment reported above. The information in Steps 1 and 2 were combined to generate a conceptual site model for AMD risk at the site (refer to Section 5.3).
- Step 3 – Analyse and evaluate the risks
Step 3 is the risk assessment provided in Table 17.
- Step 4 – Treat the risks
Management strategies to address Step are articulated in the AMD Management Plan.
- Step 5 – Monitor and review

Step 5 relates to the AMD Monitoring Plan discussed in Section 6 of this AMD Management Plan, the site validation procedure presented in Section 6.3 of the AMD Management Plan, and the continuous improvement feedback loop as discussed above.

Throughout each step it is essential that there is consultation and communication with all key stakeholders as they relate to AMD management. Figure 16 shows the process schematically.

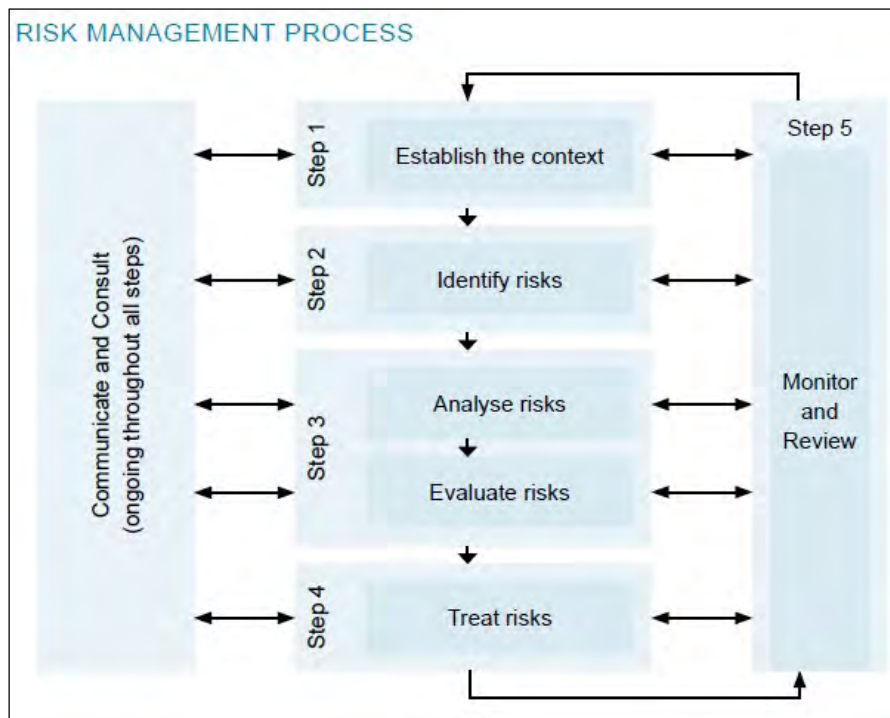


Figure 16 Risk management process

5.2.3 Likelihood, consequence and risk ranking

Step three of the risk management process, as described briefly above, includes semi-quantifying the risk using Equation 4, above, by using applicable likelihood and consequence scales. Table 13 provides the likelihood scales used herein, while Table 14 provides the consequence scale.

Table 13 Likelihood scale

Rating	Likelihood	Approximate Frequency	Probability of occurrence (%)
5	Almost Certain A very high likelihood of occurrence.	Weekly	≈ 90 to 100
4	Likely A high likelihood of occurrence.	Monthly	≈ 50 to 90
3	Possible Moderate likelihood of occurring.	Annually	≈ 10 to 50
2	Unlikely A low likelihood of occurrence.	Once in a decade	≈ 2 to 10
1	Rare A very low likelihood of occurrence.	Once per 100 years	≈ 0 to 2

Table 14 Consequence scale

Rating	Consequence	Approximate frequency
5	Catastrophic. Widespread irreversible environmental harm.	Most environmental objectives not achieved, and/or several severely affected.
4	Major. Widespread environmental impact, not immediately contained.	Several environmental objectives affected with considerable effort to rectify.
3	Moderate. Reversible environmental harm extending beyond site boundary, immediately contained.	Several environmental objectives affected with limited effort to rectify, or a single environmental objective affected with significant effort to rectify.
2	Minor. Reversible environmental impact; immediately contained.	A single environmental objective affected with limited effort to rectify.
1	Insignificant. Very low environmental impact; localised.	A very small impact, rectified by normal processes.

Multiplying likelihood and consequence provides a semi-quantitative risk ranking (Table 15) which can be used to allocate design and operational level risk mitigation and management strategies on a hierarchical basis as appropriate through a risk score and priority ranking system (Table 16). The risk ranking is then reconsidered with the design or operational level management control in place (e.g. a waste rock dump with PAF encapsulation cells). The residual risk ranking is then re-allocated a residual risk score and priority ranking system, with monitoring to assess the residual risk and the relative success of the design or operational level management strategy implemented.

Table 15 Risk score

	Consequence				
Likelihood	1. Insignificant	2. Minor	3. Moderate	4. Major	Catastrophic
5. Almost Certain	5 - Medium	10 - High	15 - High	20 - Extreme	25 - Extreme
4. Likely	4 - Medium	8 - Medium	12 - High	16 - Extreme	20 - Extreme
3. Possible	3 - Low	6 - Medium	9 - Medium	12 - High	15 - High
2. Unlikely	2 - Low	4 - Low	6 - Medium	8 - Medium	10 - High
1. Rare	1 - Low	2 - Low	3 - Low	4 - Low	5 - Medium

Table 16 Risk score and priority ranking

Risk score	Risk Priority
Extreme (16+)	1
High (10 – 15)	2
Medium (5 – 9)	3
Low (1 – 4)	4

5.3 Conceptual site model

The following conceptual site model (Figure 17) considers INAP's (2009) source→pathway→receptor model as shown in Figure 15. The source material risk was assessed in the geochemical assessment above, with the receptors drawn from the Mount Peake EIS.

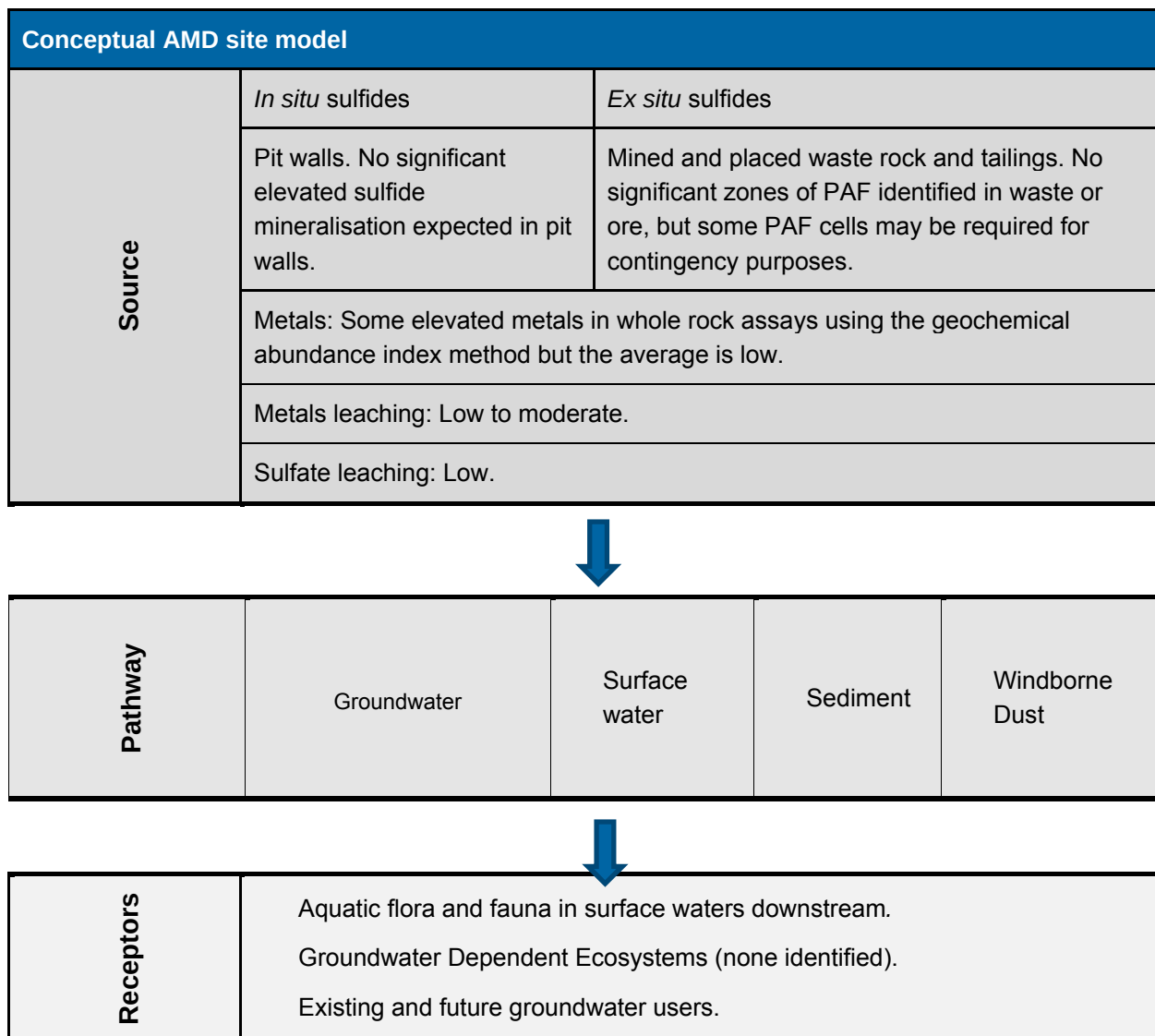


Figure 17 AMD Conceptual Site Model

5.4 AMD risk assessment

The AMD risk assessment was completed by appropriately qualified GHD representatives. The risk assessment is provided below in Table 17.

Table 17 AMD risk assessment

Item	Risk	Impact	Primary (unmanaged) risk level			Design control measure	Operational management measure	Residual (managed) risk level			Comments
			L	C	Risk			L	C	Risk	
1	In-pit AMD material present resulting in uncontrolled AMD	- Impact on groundwater quality. - Downstream (Murray Creek, Mud Hut Swamp) water quality impacts on ecological values from acidity, salinity or metals. - Impact on processing waters - Reputational risk.	2	3	6 Medium	- Testing to confirm chemical properties. - Contingency PAF encapsulation cells within WRDs. - Clean, dirty and contaminated water drainage systems. - Surface water management basins.	- Ongoing AMD sampling and analysis. - AMD Management Plan, with regular review. - Mine Management Plan. - Sediment and Erosion Control Plan. - Water Management Plan. - Selective materials handling and placement using mine schedule and geochemical model. - Controlled and managed site drainage and release.	2	2	4 Low	- Low sulfur content and significant apparent neutralising capacity in all lithologies (waste and ore). Average assay-based NAPP between lithologies ranges from -55 (fault zone) to -325 (gabbro) (Section 3.4.2). - Low total metals – only As, Pb, Se and Va exceeds GAI of 3 for some samples but average below 3 (Section 3.4.2). Leachability tests to be undertaken to confirm mobility. - Assumes that ongoing AMD validation monitoring is undertaken, and material classified, handled and placed according to the AMD Management Plan. - Additional AMD testing to be undertaken pre-production and during production.
2	Ex-pit AMD material present resulting in uncontrolled AMD	- Impact on groundwater quality. - Downstream (Murray Creek, Mud Hut Swamp) water quality impacts on ecological values from acidity, salinity or metals. - Impact on processing waters - Reputational risk.	3	2	6 Medium	- Testing to confirm chemical properties. - Dumps and fill areas profiled to shed and capture runoff. - Clean, dirty and contaminated water drainage systems. - Surface water management basins.	- Ongoing AMD sampling and analysis. - AMD Management Plan, with regular review. - Mine Management Plan. - Sediment and Erosion Control Plan. - Water Management Plan. - Selective materials handling and placement using mine schedule and geochemical model. - Controlled and managed site drainage and release - Compaction of construction material and waste rock. - Covering / lining any PAF with NAF in wet season. - Returning low volumes of PAF to pit on completion of mining.	2	2	4 Low	- Low sulfur content and significant apparent neutralising capacity in all lithologies (waste and ore). Average NAPP between lithologies ranges from -55 (fault zone) to -325 (gabbro) (Section 3.4.2). - Low total metals – only As, Pb, Se and Va exceeds GAI of 3 for some samples but average below 3 (Section 3.4.2). Leachability tests to be undertaken to confirm mobility. - Assumes that ongoing AMD validation monitoring is undertaken, and material classified, handled and placed according to the AMD Management Plan. - Additional AMD testing to be undertaken pre-production and during production.
3	WRD cover material and design appropriateness	- Rainfall ingress into WRDs resulting in excessive leachate generation leading to increased likelihood of Risks 1 and 2. - Erosion and exposure of waste rock. - Downstream (Murray Creek, Mud Hut Swamp) water quality impacts on ecological values from sediment and AMD. - Reputational risk.	2	3	6 Medium	- Use of appropriate cover material. - Cover materials resource assessment. - Cover trials to determine a suitable cover design.	- Mine Management Plan. - Sediment and Erosion Control Plan. - Water Management Plan. - Controlled and managed site drainage and release - Controlled placement of cover material. - Controlled and managed site drainage and release	2	2	4 Low	- Preliminary assessment indicates suitable material available – i.e. AC material. - Formal cover material resource assessment to be carried out as part of pre-production-detailed design work. - Ongoing WRD cover materials testing and design trials required.
4	Dispersive waste management	- Downstream (Murray Creek, Mud Hut Swamp) water quality impacts on ecological values from sediment. - Reputational risk.	2	3	6 Medium	- Identification and selection of appropriate cover material and cover design. - Clean, dirty and contaminated water systems	- Controlled and managed site drainage and release - Sediment and erosion control plan	2	2	4 Low	Additional sampling and analysis to assess dispersion risk proposed pre-production.

5.5 AMD risk assessment conclusions

Given the low sulfur content and low metals content, the primary (pre-management) risk level is currently medium. It is likely that with the proposed additional pre-production testing (Section 6.3.2), including additional kinetic AMD testing and sulfur speciation, the primary risk would be lowered. Taking in to consideration the proposed AMD management Plan (Section 6), the residual (managed) risk becomes low.

The risk assessment was informed by the geochemical assessment provided above, and the proposed mine plan and schedule. The geochemical assessment provided information pertaining to AMD risk by waste/ore stream and by geological unit, in particular the waste rock units (gabbro, granite, alluvials and faulted material) that would be stored in the WRD.

The AMD risk assessment as informed by the geochemical assessment also acted as an information gap analysis. This gap analysis has shown that the assay/XRF acid base accounting data set are appropriate, given the early stage of the project, uniform geology and the low risk posed by an oxidised orebody. Additional confidence is provided by the NAPP and NPR assessment, which indicated a low risk of acid generation.

To improve confidence in these data sets, additional sampling and analysis would be undertaken as detailed in the site procedure in the AMD Management Plan. The results would be used to validate AMD risk and management strategies in subsequent revisions of this document.

Additional testing to be done in the pre-production phase will include;

- Identification of suitable cover/capping/encapsulation material and testing for dispersion, exchangeable cation, and general capping geotechnical parameters
- Laboratory static NAG and NAPP testing including sulfate (or chromium reducible) sulfur
- Kinetic NAG testing to confirm relative availability over time of acid-generating and neutralising capacity and to provide an indication of likely reaction times
- Column and or barrel leach tests to commence to provide long-term leachate generation information
- Additional metals (ICPMS scan) to be added to the leachate and groundwater suites to cover the full range of likely contaminants
- Additional metals to be added to laboratory and field XRF analyses to cover the range of potentially elevated or mobile metals.

The XRF data set showed, on the whole, that there was not statistically significant PAF material present within the proposed pit area, with the possible exception of the small volumes of fault material, and the limited PAF within the current pit shell is likely to be excluded if testing of magnesium was undertaken on the samples, thus increasing the buffering potential. The XRF data set also showed that there were only moderately elevated metals concentrations present in some samples of the main lithological units on site relative to the median abundance of those same metals in similar lithologies. However, additional metals leaching analysis is required to cover low risk metals not analysed.

The high level AMD risk assessment presented in Table 17 shows that with appropriate design and operational control measures, the residual AMD risk on site is low. This residual risk would be monitored (AMD Management Plan) to confirm that the design and operational control measures are effective.

6. AMD management plan

6.1 AMD risk

The lack of kinetic geochemical data to inform likely contaminant release rates of ore and waste categories means that it is not possible to determine the rate of contaminant release. However, the fact that the pit is in the oxidised/weathered zone or in igneous rocks formed from an oxidising melt, it is therefore likely that a significant proportion of the primary sulfur would present as sulfate rather than reduced pyritic sulfur. This means that the excavated material has a low potential to form AMD. Some minor volumes of sulfidic sulfur may be present in post-crystallisation hydrothermal alteration in fault zones.

This is in addition to very low total sulfur content, which even with no consideration of acid neutralising potential indicates a low PAF risk.

Although the AMD risk is therefore considered low based on the data assessed, the management plan has taken the highest risk material in to account.

6.2 Waste rock and ore management

Details of the mining process, including waste rock management to minimise AMD risk will be further detailed in the Mine Management Plan and has been summarised in Section 1.5 of this document. The key components of the waste rock management include additional testing to provide further delineation of PAF/NAF material and ongoing testing during mining. Contingency design of a PAF cell will also be included (i.e. currently not required as no significant PAF material, but designed to allow storage if separable blocks of PAF material are identified during production).

6.3 AMD monitoring

6.3.1 Introduction

AMD monitoring provides critical feedback to confirm that the AMD controls are effective for their stated aim. In that regard, the following would be monitored:

- In-situ material scheduled for mining
- Constructed landforms; being WRDs, the ROM Pad, ore stockpiles
- Water (surface water and groundwater).

An outcomes-based approach would be used as informed by adaptive management to meet site-specific trigger values that would be developed over time as data is gathered. Currently, the 95% species survival trigger values (ANZECC & ARMCANZ 2000) have been nominated.

The following section provides an overview of the monitoring requirements. Note that the surface and groundwater monitoring is wholly captured by the Project's Water Management Plan (GHD 2015); therefore, it has not been reproduced herein. Please refer to that document for monitoring details.

Furthermore, the EIS includes commitments and monitoring requirements for the Project. This would include those required under this Plan.

6.3.2 Geochemical monitoring

Additional geochemical data requirements would be carried out as part of the pre-production phase of the project. The sampling plan is based on the assumption that as a minimum, S, Ca, Mg and As will be analysed as part of the standard AMD suite during any additional infill drilling and sampling. Additional metals (Pb, Zn, Cu, Cr, Cd) should also be included, especially those identified as elevated within the groundwater.

Note that blasthole geochemical analysis to determine PAF while mining will be undertaken with a suitable lead time by having XRF analysis run in an on-site NATA accredited laboratory or by hand-held XRF with the appropriate range of analytes, level of reporting and resolution.

Additional data requirements

The following are proposed to close data gaps in the geochemical assessment (Section 3) and add confidence to AMD management strategy.

Static AMD testing

A better understanding of the sulfur content and species and neutralising capacity are required to validate a simple XRF-based PAF cut-off. This will be achieved by having sulfate sulfur analysed in conjunction with additional NAG and NAPP testing, with corresponding S, Ca and Mg XRF analyses, to enable correction for non-acid-forming oxidised sulfur.

Recommended numbers as determined by the geochemical assessment are provided in Table 18 and are split to pre-production testing, and validation testing spread over the life of the mine.

Table 18 Recommended static samples

Geological unit (% of total)	Approx. final pit mined tonnes (Mt)	Pre-production Static NAG and NAPP	Mine production validation static NAG and NAPP*
Ore (56%)	78	100	100
Waste – Gabbro (25%)	35	142	142
Waste – Granite (4%)	6	62	62
Waste – Alluvials (14%)	19	106	106
Waste – Fault (<1%)	1	26	26
Total	139	436	436

*Depends on the relationship between S, Ca, Mg and NAG/NAPP

Note all samples to have corresponding S, Ca and Mg XRF analyses as a minimum

Total and leachable metal testing

Additional testing for a wide range of metals is required to add confidence to the observation of low GAls, pre-production and during mining.

ASLP leachate testing is also recommended to compliment the column leach testing and confirm the mobility of various metals.

The samples noted above (Table 18) will be analysed as per Table 19. Pre-production total and leachable metals will be analysed as the full ICPMS screen with complimentary field XRF analysis. Leachate will also be analysed for pH, EC and major ions. The need for production-phase testing will be reviewed based on the results of the pre-production testing.

Table 19 Recommended additional detailed total metal and ASLP testing.

Geological unit	Pre-production ASLP and total metals analyses	Mine production validation ASLP and total metals analyses
Ore	20	20
Waste - Gabbro	20	20
Waste - Granite	20	20
Waste - Alluvials	20	20
Waste - Fault	20	20
Total	100	100

Note all samples to have corresponding S, Ca and Mg XRF analyses as a minimum

Kinetic testing

The relative production of acid and neutralisation over time needs to be established to confirm that if any acidity is developed, it can be readily neutralised. The testing will also give an indication of the relative time taken for acid to develop, if at all, to inform appropriate stockpiling times prior to encapsulation of any PAF encountered. This will be determined using acid buffering characteristics curves (ABCC) and Kinetic NAG (KNAG) testing (Table 20).

Approximately 1 in 5 of the samples tested for static NAG and NAPP (Table 18) will be subjected to KNAG and ABCC tests (Table 20)

Leach columns are recommended (Table 20) using either the AMIRA (2002) free-draining column leach test method, Oxcon or similar, ensuring that the columns are representative of the different lithologies. This would require a total 10 columns, assuming duplicate columns for each major lithology. Leachate will be regularly analysed for pH, EC, major ions and metals, as indicated by the results of the total and leachable metals testing.

Table 20 Recommended kinetic samples

Geological unit	KNAG and ABCC	Column Leach
Ore	2	2
Waste - Gabbro	2	2
Waste - Granite	2	2
Waste - Alluvials	2	2
Waste - Fault	2	2
Total	10	10

Soil cover testing

The suitability of cover material will be assessed by delineating available clay resources and testing for cation exchange capacity (CEC) 1:5 pH and EC exchangeable sodium percent and Emerson class. A pre-detailed design geotechnical testing program will be developed to determine the detailed testing requirements.

6.3.3 Surface and groundwater monitoring

The locations, sampling procedures and schedule and analytes for AMD surface and groundwater monitoring are entirely consistent with the project Water Monitoring Plan and are therefore not reproduced herein. Analytes with specific reference to AMD monitoring include pH, EC, acidity and alkalinity, sulfate and metals. Baseline water quality data is also included in the Water Monitoring Plan.

Decreasing alkalinity is generally a good early indicator of deteriorating conditions in leachate from a WRD containing PAF material, and can therefore be tracked as an 'early warning' mechanism. Metals concentrations and declining pH values generally lag behind declining alkalinity; therefore, corrective actions can be implemented early should alkalinity decline.

Other trends that highlight the onset of AMD include increasing sulfate, increasing sulfate / alkalinity and sulfate to chloride ratio, decreasing pH values and an increase in soluble metals as a result. An initial set of groundwater samples will be assessed for the full suite of metals by ICPMS scan such that all metals elevated in the rock (e.g. arsenic) are covered by baseline sampling and to provide a comparison for ALSP results.

6.3.4 AMD management plan implementation and review

Implementation

The Plan is to be implemented throughout the pre-production and operational stages of the project. It will be updated as the project progresses.

Review

This plan will be revised annually until two years after the closure of the pit. Furthermore, any activity not previously authorised under the approved plan will be incorporated into a revised plan for review and approval by the appropriate state and or federal authorities. Revised plans would not be approved unless they provided equivalent or improved environmental outcomes over time.

This Plan will also be used to inform future revisions of project's Closure Plan; which also form an Attachment to the Mining Management Plan.

6.3.5 Contingency planning

Contingency plans are developed for those failure modes where residual risk remains after the application of AMD prevention and control approaches. A contingency plan should include targeted monitoring, trigger levels for actions, and specific responses in case a certain event occurs. For example, if a failure mode is the potential for AMD seepage from a waste rock pile, then monitoring can be established for sulfate concentrations in waste rock seepage as an early indicator of potential AMD formation. If significant increases in sulfate concentrations are measured, then contingency measures such as covers or drainage collection amendment might be implemented.

Contingency plans specific to AMD management at the site would include an exceedance in the ground or surface water monitoring against site-specific trigger values. The approach would be to undertake a 'root cause' analysis whereby the causal link for the water quality exceedance would be determined. Adaptive management would then seek to implement an appropriate alternate management strategy to eliminate any future risk of a repeat, given the nature of the incident.

Future revisions of this document would also inform forward AMD risk management by providing a more robust data set to inform AMD risk, and therefore, any adjusted management strategy.

7. Conclusion

7.1 Data reviewed

7.1.1 Sulfur assay data

A total of 6321 total sulfur analyses were used to provide a conservative (pessimistic) assessment of the risk of generation of acid drainage. This number of samples is well in excess of the sample rate recommended by Price (1996), Miller (1997) and DME (1995). When this is considered along with the project's low risk due to the oxidised nature of the material to be excavated, the number of sulfur analyses reviewed is more than sufficient.

Of the total 6321 samples, 99.4% returned total sulfur values of below 0.3% S (MPA 10 kg H₂SO₄/t), an average total sulfur value of 0.04% S (MPA 1.2 kg H₂SO₄/t, a median value of 0.025 % S (MPA 0.8 kg H₂SO₄/t) and an approximate 99% upper confidence limit of 0.24 %S. This demonstrates the deposit has a consistently low sulfur content and that the exceedance of the typically accepted "low capacity" (DITR 2007) value of 10 kg H₂SO₄/t is not statistically significant.

For those samples that did have >0.3% S, they tend to occur in the ore, gabbro, alluvials and fault zone in relatively thin bands and at a variety of depths but predominately in the upper 40 m. The elevated sulfur readings typically occur over less than 3 m intervals.

7.1.2 Metal data

Assessment of the risk of metalliferous drainage is based on the review of generally over 5000 samples per metal, including the key contaminants arsenic, copper, nickel, lead and zinc. Based on GAI calculations, 382 arsenic (10% of samples above LOR), 131 lead (3% of samples above LOR), 15 selenium (1% of samples above LOR) and 2406 vanadium (38% of samples) concentrations exceeded a GAI of 3 in more than 1% of samples. The mean, median and 99% upper confidence limit for all analytes was below 3.

A leachate assessment is recommended in order to determine the potential risk the elevated metals may have on local groundwater and surface water receptors. Additionally, ASLP and column leach testing are proposed for the pre-production stage of the project to further assess metal concentrations and mobility.

7.2 AMD risk

Based on the oxidised state of the primary magma that formed the orebody and host rock, and the oxidised state of weathered rock and alluvial overburden, it is unlikely that there would be significant quantities of unoxidised sulfide or soluble salts remaining within the material defined by the pit shell. The possible exception is minor sulfur, possibly as sulfide, within post-mineralisation faulting. The analyses indicated very low sulfur, with a significant potential for self- neutralisation, based on the predominantly negative NAPP values, however the additional proposed static and kinetic acid-base accounting testing (Section 6.3.2) testing would confirm the availability of that neutralising potential.

Based on the geology, geochemistry and overall environment, the primary risk of environmental damage from AMD is deemed moderate. With the inclusion of the nominated mining and waste management process set out in the Mine Management Plan and this document, the key component of which is on-going assessment, the residual risk is deemed to be low.

To further refine the AMD management process, validate the testing to date and address identified data gaps, additional testing will be carried out as part of the pre-production and detailed design process and this AMDMP (Section 6) will be amended as appropriate.

7.3 Proposed AMD management

Although the geochemistry indicates a low risk of AMD, the management plan takes in to consideration the highest AMD risk material observed. PAF material, or material with potential to leach metals or salinity, should be encapsulated within the WRD, and potentially returned to the pit progressively if mining schedules allow or on completion of mining, as outlined in the mine management plan as well as in this document (Section 6.2). The key aspect of the management plan is early identification of PAF material through additional analyses. The level of detail provided is adequate given the low risk, the early stage of the project and the limited likely volume of PAF and the availability of AC material.

7.4 Additional AMD assessment work proposed

Additional static NAG and NAPP (sulfate corrected), kinetic NAG and ABCC testing will be carried out and leach columns will be established. The results of these tests will be reviewed to develop revised combined sulfur/calcium/magnesium based PAF cut-off grades which can be further developed within a revised block model. The results of the test will be used to validate the currently available data and modify the AMDMP and MMP if necessary.

In addition to the pre-production testing, a program of regular testing as part of ongoing grade control and regular updating of the AMD block model, in parallel with the ore block model, has been defined.

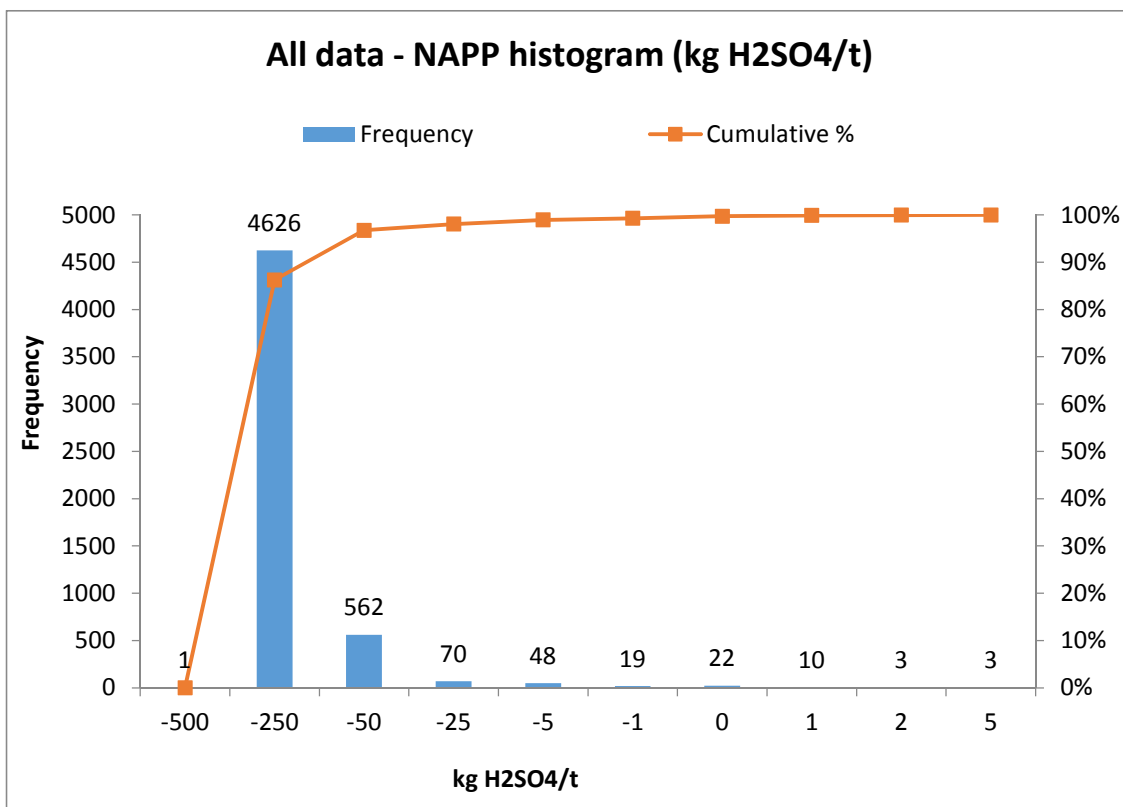
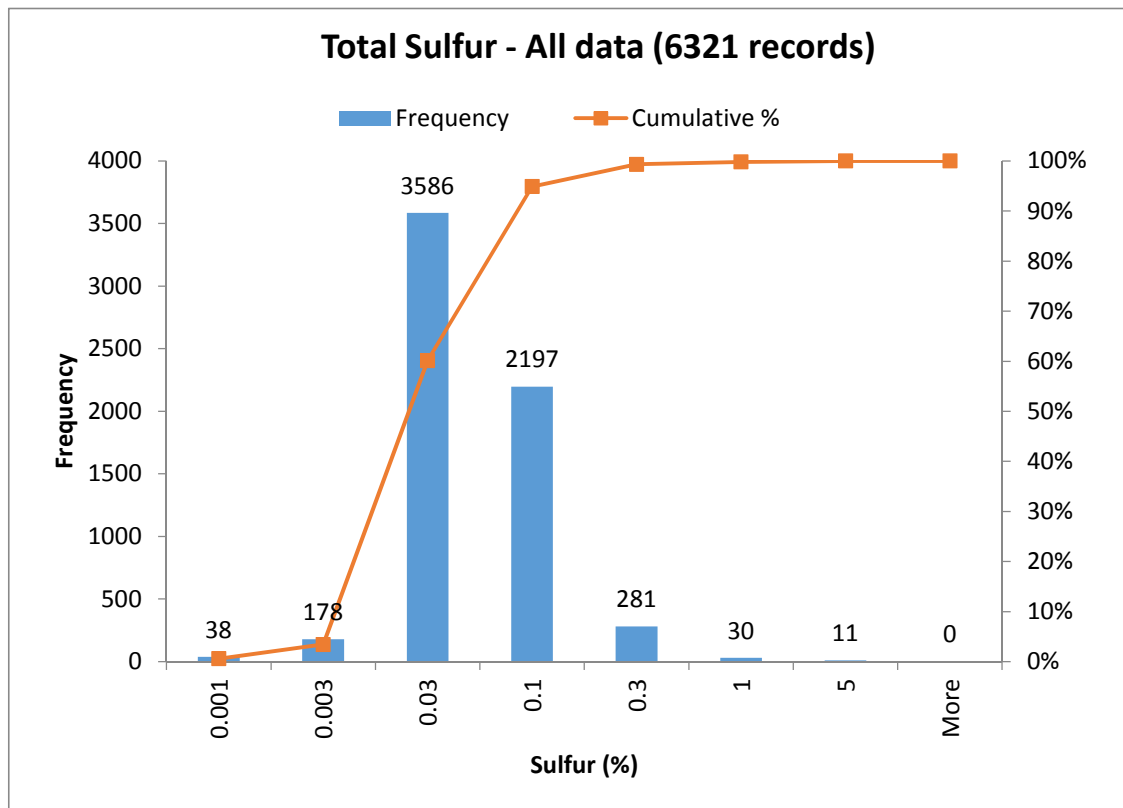
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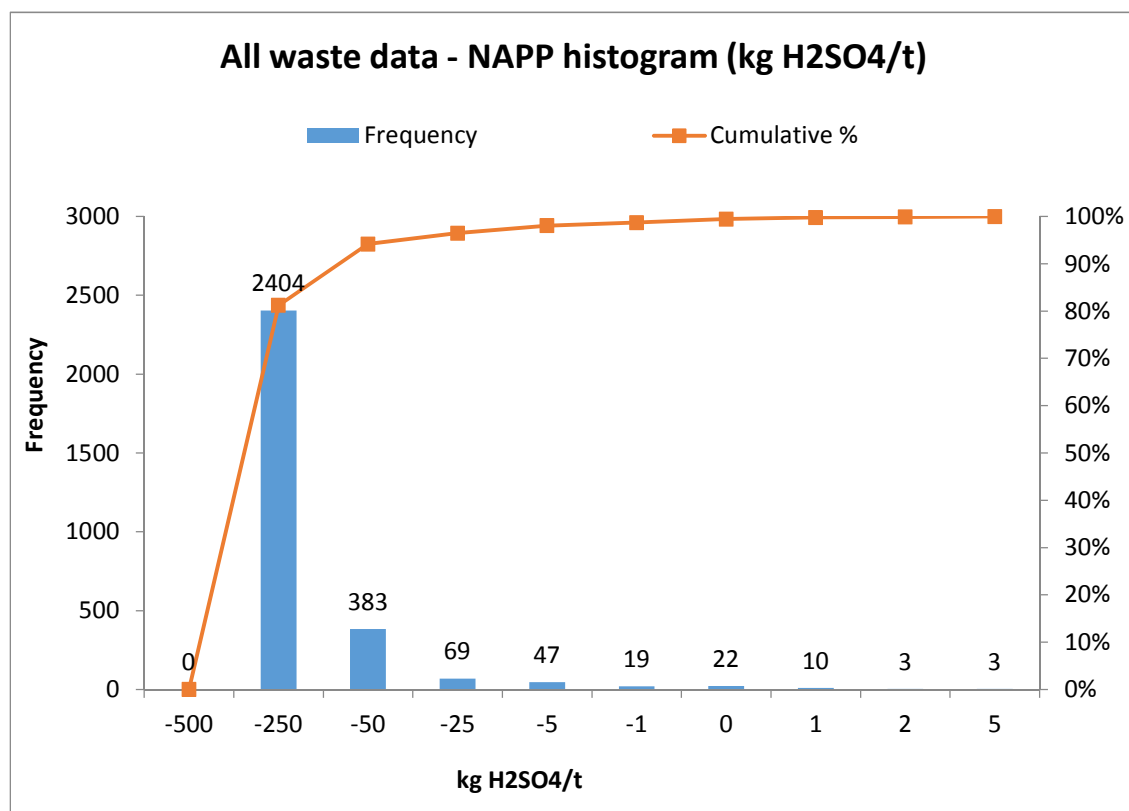
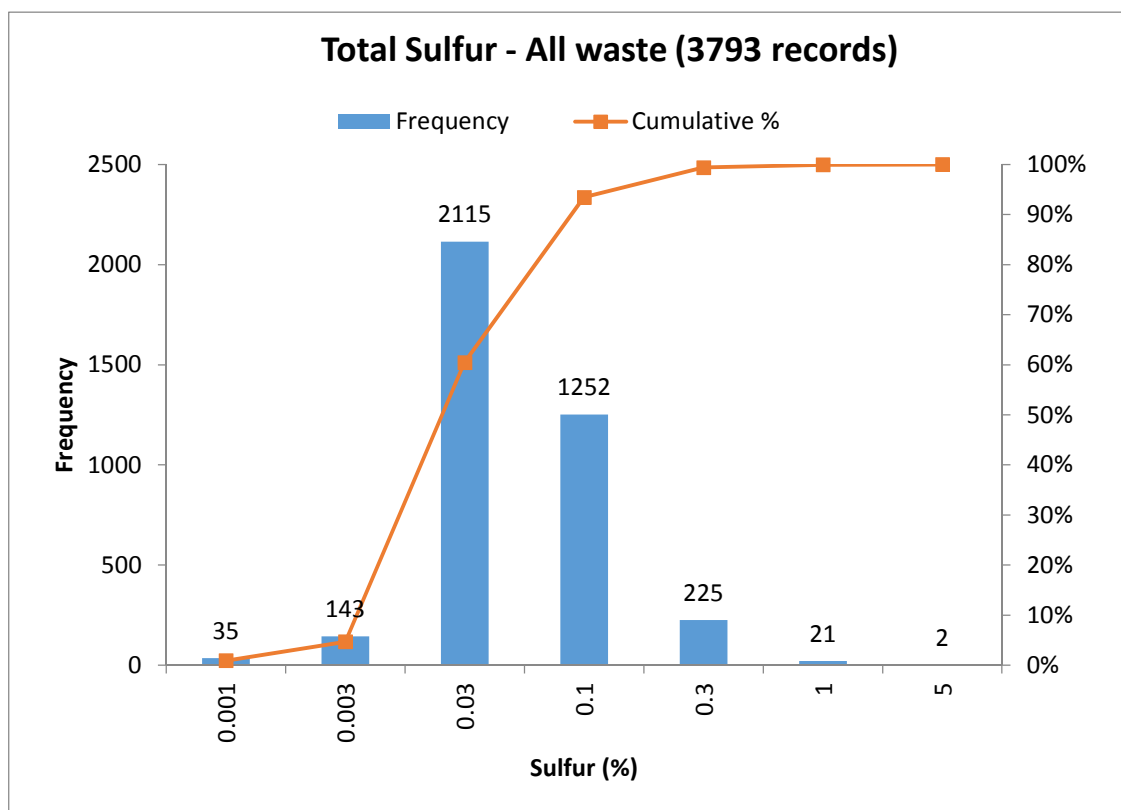
Appendices

Appendix A – Assay-based total sulfur and NAPP histograms by lithology

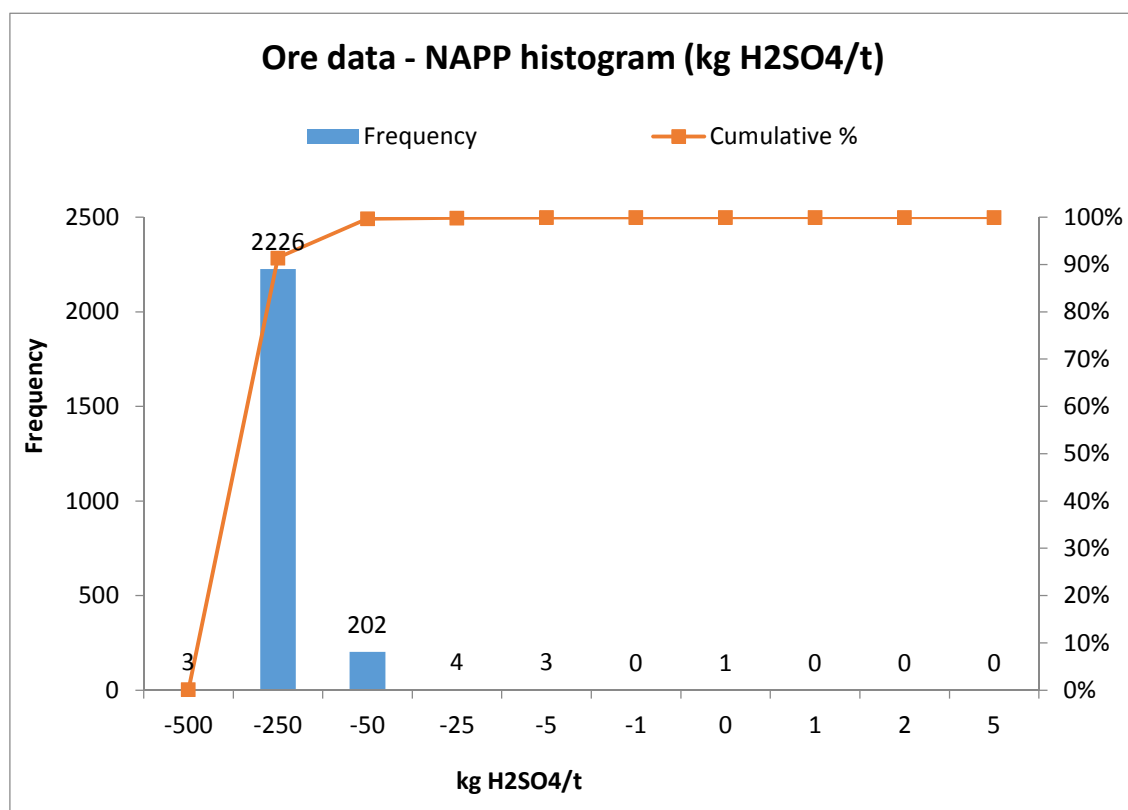
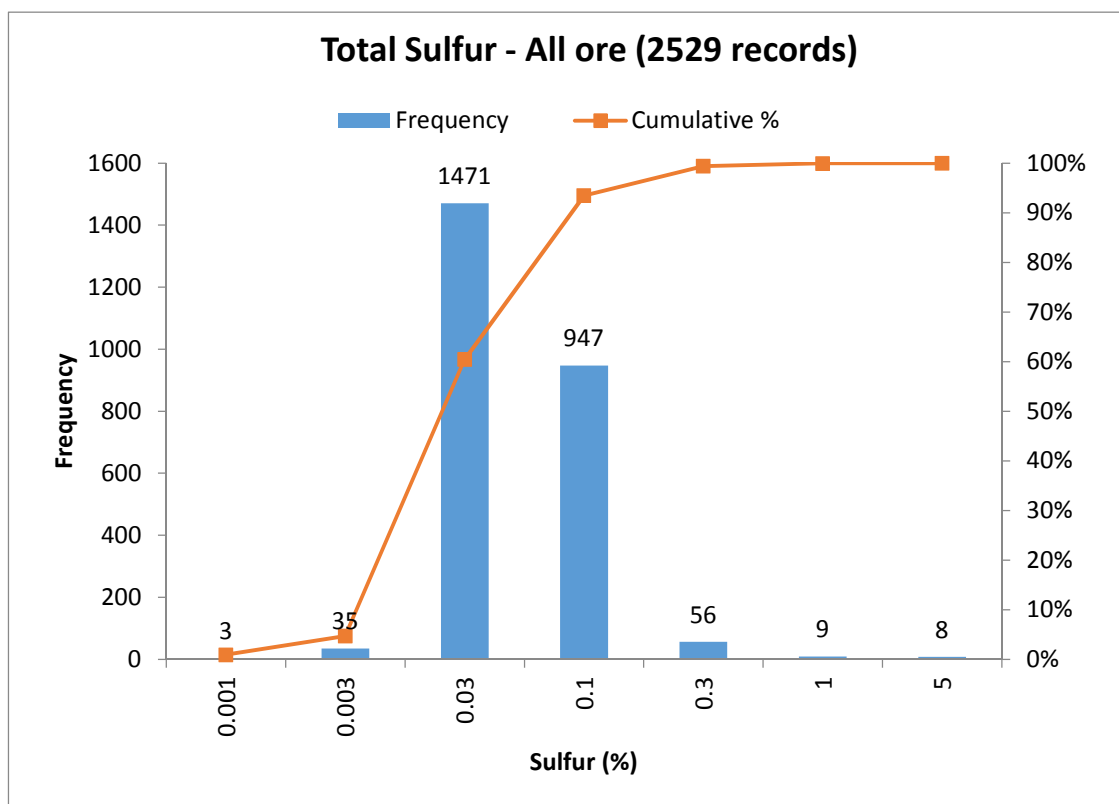
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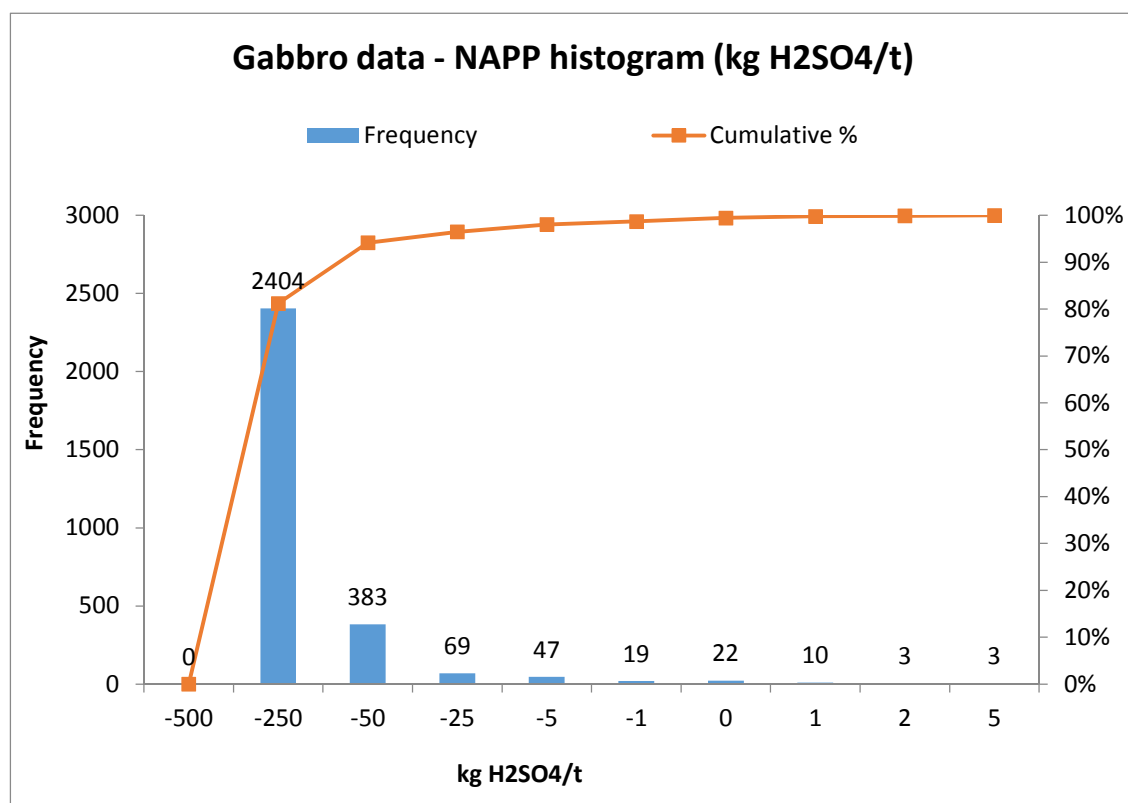
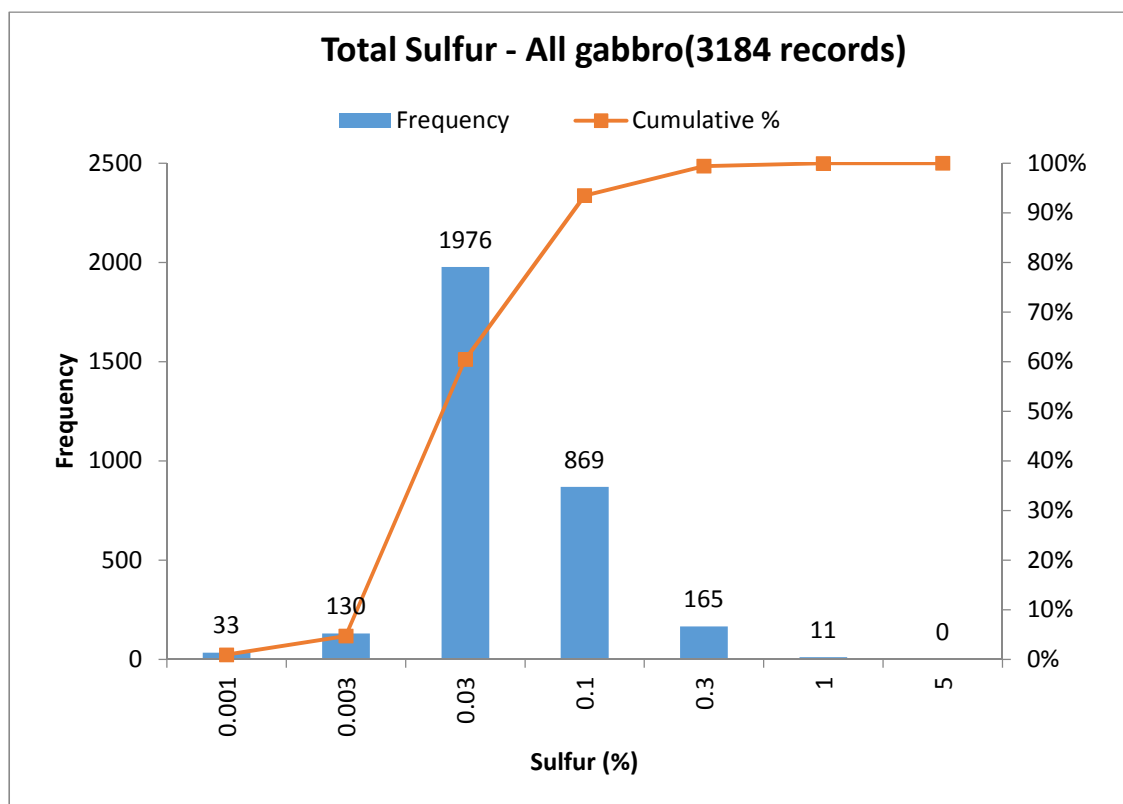
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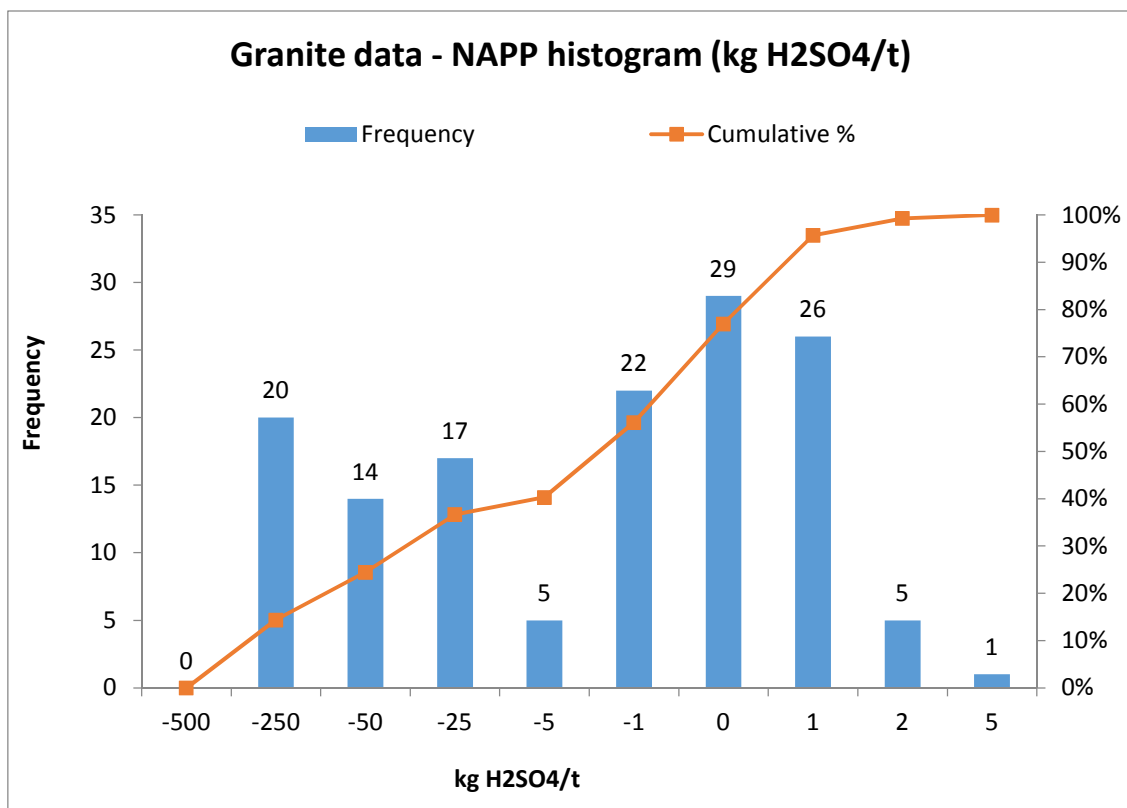
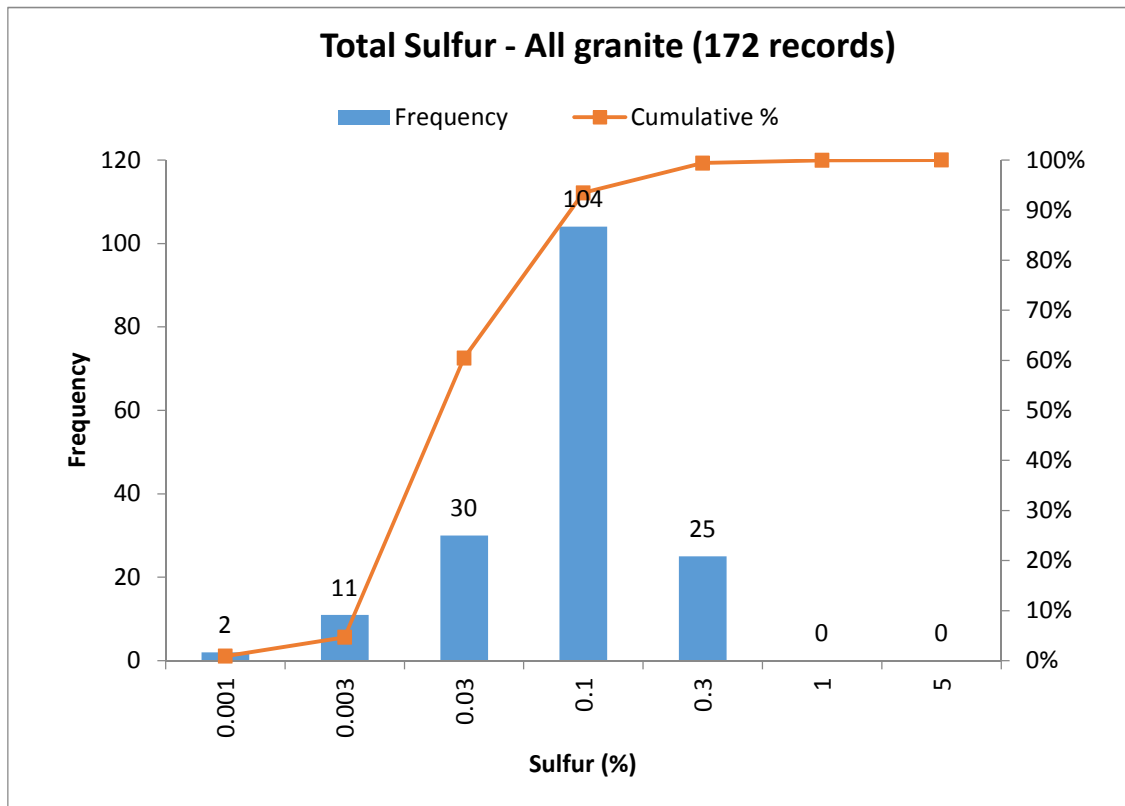
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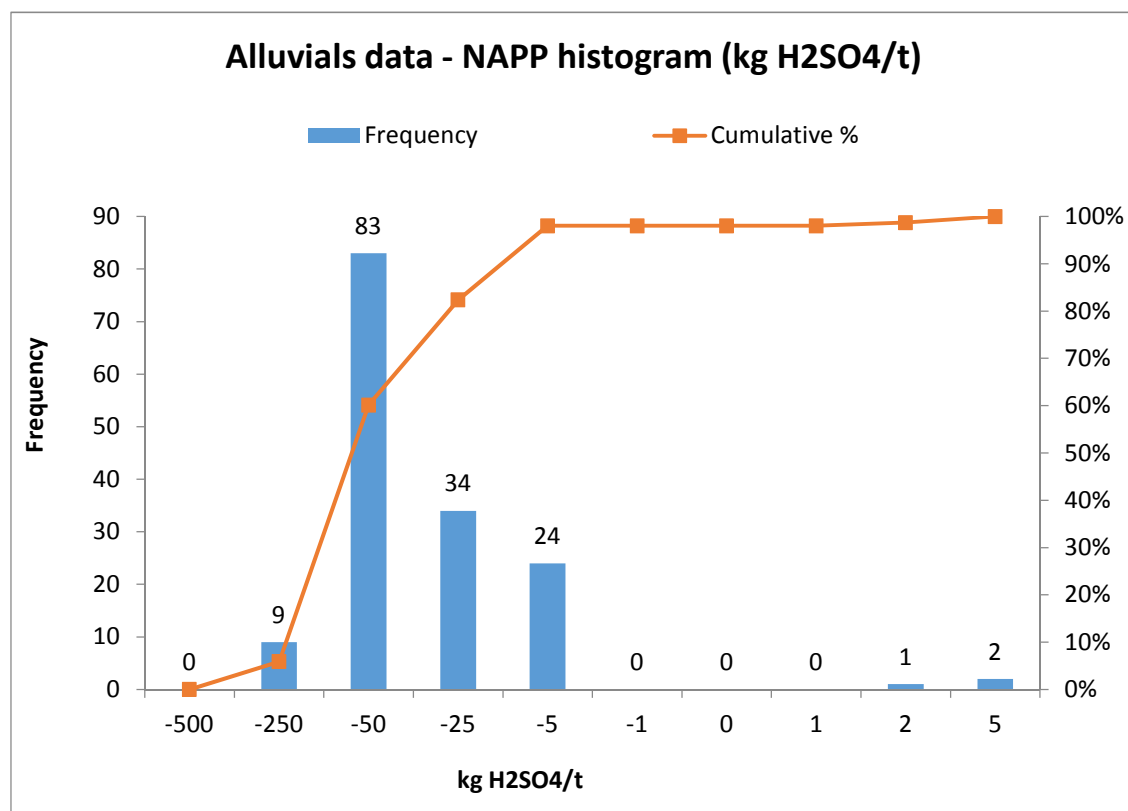
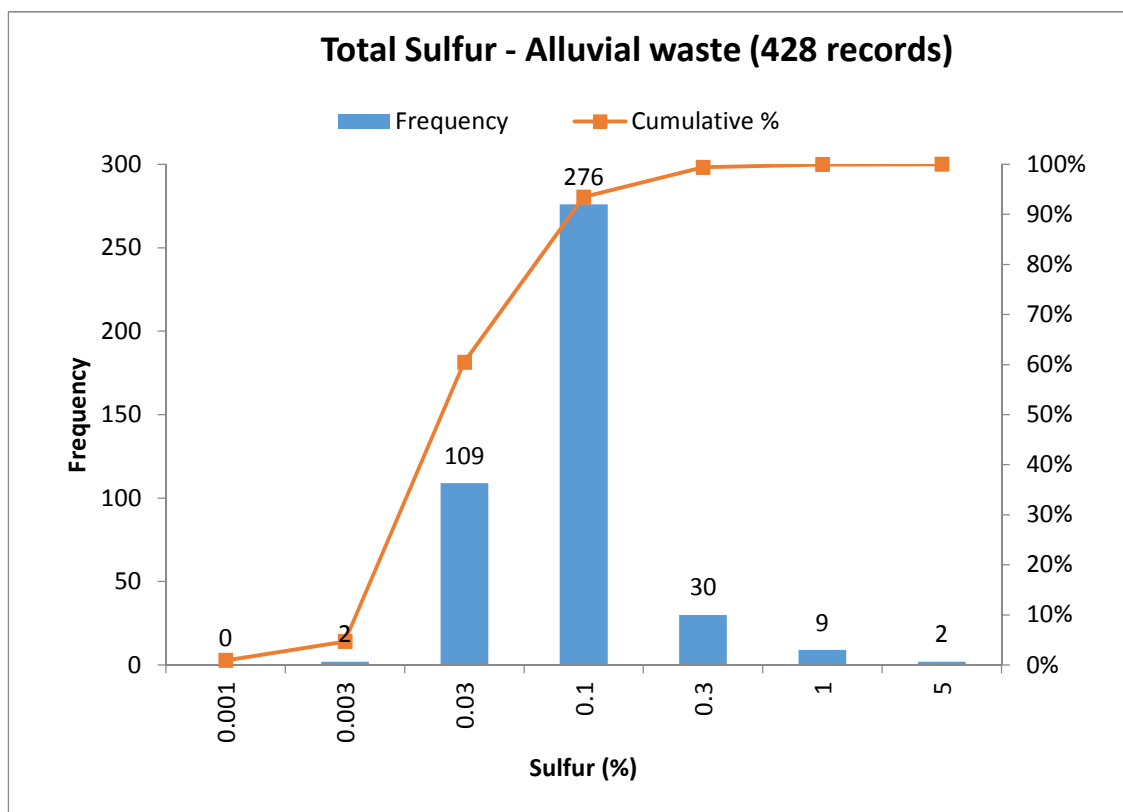
All gabbro waste data

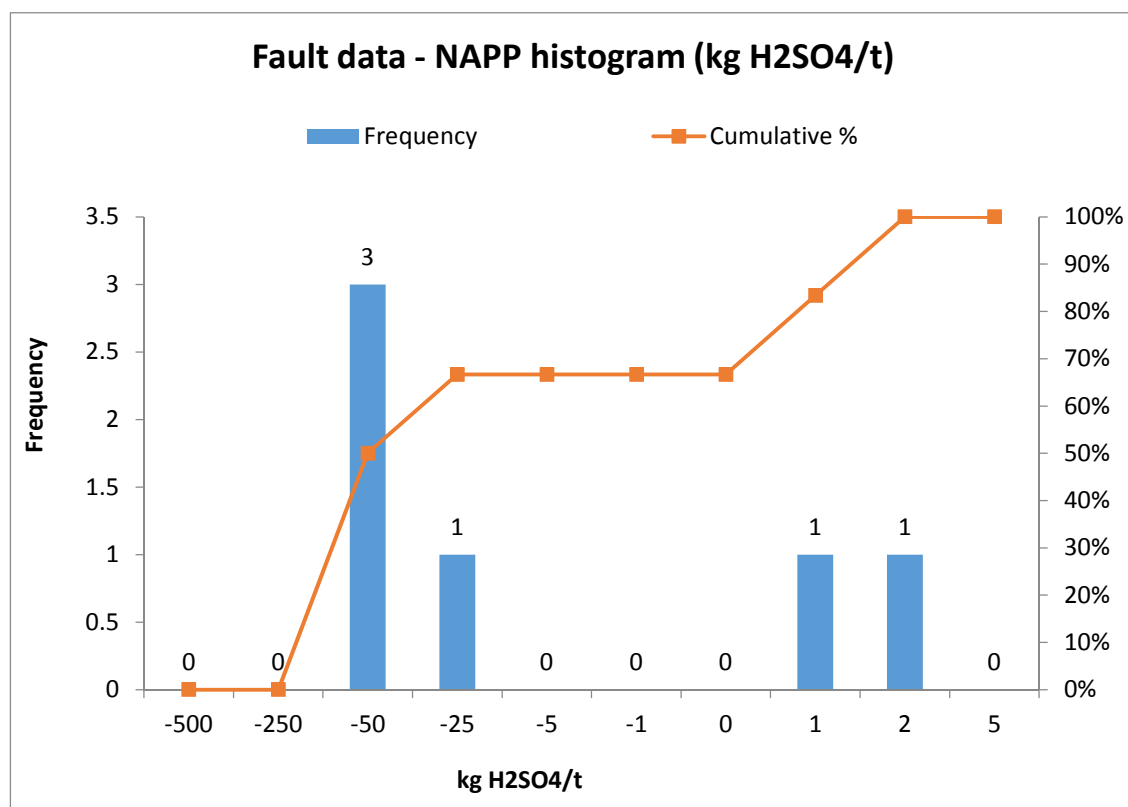
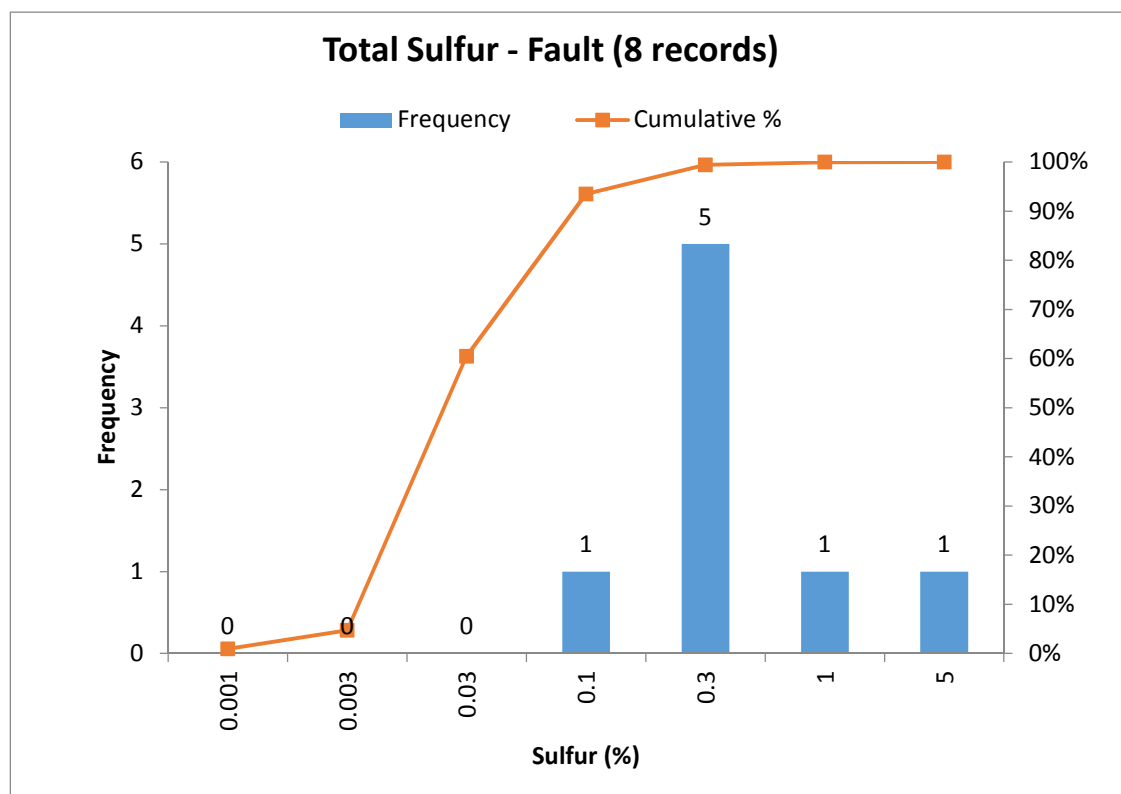


All granite waste data



All alluvial waste data



All fault waste data

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