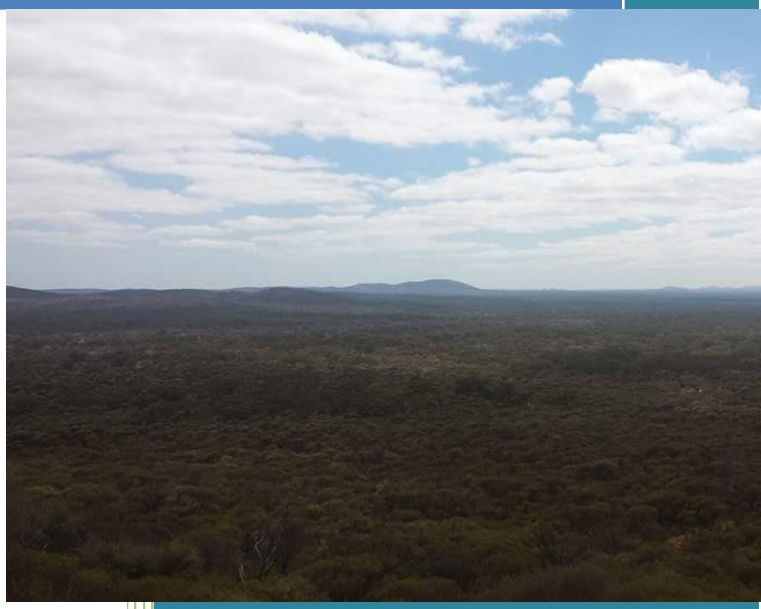
May

2017

ATTACHMENT 1
MT MULGINE PROJECT
EPA REFERRAL SUPPORTING DOCUMENT
VERSION 3
Rothsay, WA



Prepared on behalf of Tungsten Mining NL by:

Animal Plant Mineral Pty Ltd

Tenements M59/387 and M59/425

Completed by: Animal Plant Mineral Pty Ltd

ABN:	86 886 455 949
Tel:	(08) 6296 5155
Fax:	(08) 6296 5199
Address:	47 Caroline Retreat
	Henley Brook, Western Australia 6055
Website:	www.animalplantmineral.com.au

For further information on this report please contact:

	Ms Sharon Arena
Tel:	0419 934 461
Email:	sharon@animalplantmineral.com.au

Disclaimer

This document is protected by legal professional privilege. To ensure privilege is not waived, please keep this document confidential and in a safe and secure place. This document should not be distributed to, nor any reference to it made to any person or organization not directly involved in making decisions upon the subject matter of this document. If this document is requested by a third party, legal advice should be immediately obtained prior to that person viewing or taking the document to ensure that any necessary disclosure occurs in an appropriate manner.

EXECUTIVE SUMMARY

The Mt Mulgine Project is located in the Murchison region of Western Australia approximately 330 km northeast of Perth near Rothsay. The Mt Mulgine Project will host open pits, a processing plant, office, water storage facilities, run-of-mine pad, waste rock landforms, mineralised oxide landform and a tailings storage facility.

Minjar Gold Pty Ltd is the holder of all tenements associated with the Mt Mulgine Project. In December 2015 Mid-West Tungsten Pty Ltd, a wholly owned subsidiary of Tungsten Mining NL acquired the Australian tungsten exploration assets of Hazelwood Resources Limited. Mid-West Tungsten Pty Ltd now holds 100 percent of the tungsten and molybdenum rights for a contiguous group of tenements which include the Mulgine Hill and Mulgine Trench deposits. Mid-West Tungsten Pty Ltd propose to develop the Mulgine Hill deposit. This referral relates to tenements M59/425 and M59/387.

Mid-West Tungsten Pty Ltd aims to have commenced mining within one year from the date of this referral. The resource identified within Mulgine Hill is sufficient to undertake open pit mining for a duration of approximately 15 years.

Activities proposed to occur include:

- clearing of soil and vegetation over relevant areas, and storage of this material in segregated stockpiles;
- open pit mining of the Mulgine Hill deposit;
- transport of waste rock from open pits to constructed surface WRL's and other surface infrastructure;
- backfilling or partial backfilling of available open pits in the latter stages of the Project where possible;
- construction of office, workshop and modular processing plant facilities;
- establishment of a nominal 2.0 megawatt diesel power generation plant;
- establishment of the ROM pad;
- construction and operation of a 375,000 tonne per annum processing facility comprising a crushing circuit, x-ray ore sorting, gravity circuit and potentially a flotation circuit. Associated process water ponds and concentrate storage facilities will also be incorporated into the processing facility.
- fine tailings deposition into an above ground tailings storage facility; and
- construction of diversion structures where required to intercept and redirect surface water flows around constructed landforms.

It is proposed that approximately 146.21 hectares of land will be disturbed within a development envelope of 301 hectares.

Key impacts of the Mt Mulgine Project are expected to include impacts to:

Flora and vegetation

Localised clearing will be undertaken. Management strategies for the Mt Mulgine Project consider all 37 conservation significant flora species that have the potential to occur in the Project area. A vegetation survey undertaken in 2016 identified two Priority flora species. Additional seasonal survey work is proposed following significant rainfall in 2017 to confirm the presence or absence of conservation significant flora that may occur in the Project area. With the implementation of

comprehensive mitigation measures, impacts to conservation significant flora are expected to be negligible.

Terrestrial fauna

The location of waste rock and mineralised oxide landforms has been changed to avoid impacts to Western Spiny-tailed Skink and Shield-backed Trapdoor Spider habitat. The identification and protection to this habitat will ensure that the impact on conservation significant fauna distribution will be negligible.

Terrestrial environmental quality

Disruption of potentially acid forming material will occur. However, impacts are expected to be negligible as there is sufficient non-acid forming material and previously mined oxide material from the adjacent Minjar Gold operation, to contain and buffer potentially acid forming material. The potentially acid forming material will be managed on site through a potentially acid forming material management plan.

Potential pollution of the terrestrial environment by hydrocarbons, dangerous goods and domestic waste will be mitigated through effective management.

Hydrological processes

Minor local disruption to surface water and groundwater flow will occur within the Mt Mulgine Project area. Appropriate placement of diversion structures will ensure surface water flows are diverted around mining landforms and back into natural drainage lines. Interception of groundwater is not expected, however, if groundwater is intersected levels are anticipated to recover to natural levels post-mining.

Inland waters environmental quality

There is potential for contamination of inland waters by hydrocarbons, chemicals and Acid Mine Drainage. The potential for impact will be mitigated through strict management and a water quality monitoring program to ensure groundwater quality is maintained to an acceptable standard. Water quality monitoring will be concentrated around the TSF and other key infrastructure.

Social surroundings – Indigenous heritage

Activities proposed to occur will not impact the heritage sites identified in the Mt Mulgine Project area.

This revised document has been prepared to support the referral in accordance with the *Environmental Impact Assessment (Part IV Divisions 1 and 2) Procedures Manual 2016, Statement of Environmental Principles, Factors and Objectives* and with consideration for the Notice Requiring Further Information under s38A(1) of the *Environmental Protection Act 1986* (dated 24th April 2017). This document is intended to inform and assist in determining the appropriate environmental assessment and approval pathway for the proposed Mt Mulgine Project under Part IV of the *Environmental Protection Act 1986*.

CONTENTS

LIST OF APPENDICES

LIST OF FIGURES

LIST OF TABLES

PROJECT TERMS

Abbreviation	Meaning
MGP	Minjar Gold Project
Minjar	Minjar Gold Pty Ltd
MMP	Mt Mulgine Project
TGN	Mid-West Tungsten Pty Ltd and Tungsten Mining NL
the Project	TGN's Mt Mulgine Project including tenements M59/387 and M59/425

UNITS OF MEASURE

Unit	Measure
%	Percent
°	Degree
°C	Degrees Celsius
cm	Centimetres
ha	Hectare
kg	Kilogram
kg/t	Kilograms per tonne
Kl/d	Kilolitres per day
km	Kilometre
l	litre
m	metre
m^3	Metres cubed
m^3/d	Metres cubed per day
mAHD	Metres Australian Height Datum
Mbcm	Million bank cubic metres
mg/L	Milligrams per litre
Mm^3	Million metres cubed
mRL	Metres Relative Level
mm	Millimetre
Mt	Million tonnes
MW	Megawatt
t	Tonne
tpa	Tonnes per annum
V	Volt
w/w	Weight per weight (weight fraction)

LIST OF ABBREVIATIONS

Abbreviation	Meaning
AC	Alternating current
AMD	Acid Mine Drainage
APM	Animal Plant Mineral Pty Ltd
ARI	Average Recurrence Interval
AS/NZS	Australian Standard/New Zealand Standard
ASX	Australian Securities Exchange
BoM	Bureau of Meteorology
BIF	Banded Ironstone Formation
DPaW	Department of Parks and Wildlife
EP Act	*Environmental Protection Act 1986*
EPA	Environmental Protection Authority
DAA	Department of Aboriginal Affairs
DoW	Department of Water
EPA	Environmental Protection Authority
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cth)
FIFO	Fly in fly out
GDP	Ground Disturbance Permit
GHG	Greenhouse Gas
Golden Grove	Golden Grove Project
Hazelwood	Hazelwood Resources Limited
IBCs	Intermediate Bulk Containers
MCP	Mine Closure Plan
MGP	Minjar Gold Project
MineGeoTech	MineGeoTech Pty Ltd
MMP	Mt Mulgine Project
MOC	Mine Operations Centre
MP	Mining Proposal
NAF	Non-acid forming
NGER Act	*National Greenhouse and Energy Reporting Act 2007*
PAF	Potentially acid forming
PDWS	Public Drinking Water Source
PEC	Priority Ecological Communities
PMP	Project Management Plan
PMST	Protected Matters Search Tool
RIWI Act	*Rights in Water and Irrigation Act 1914*
Rockwater	Rockwater Pty Ltd
ROM	Run-of-Mine
sp.	Species – singular

Abbreviation	Meaning
spp.	Species - plural
SWC	Soil Water Consultants
TDS	Total Dissolved Solids
TEC	Threatened Ecological Communities
Terra Rosa	Terra Rosa Cultural Resource Management Pty Ltd
Terratree	Terratree Pty Ltd
TSF	Tailings Storage Facility
WRL	Waste Rock Landform
WA	Western Australia
Woodman	Woodman Consulting Pty Ltd

LIST OF ELEMENTS

Element/Compound	Meaning
Al_2O_3	Aluminium Oxide
S	Sulphur
SO_2	Silicon Dioxide
WO_3	Tungsten Trioxide

1 INTRODUCTION

1.1 BACKGROUND

The Mt Mulgine Project (MMP) (the Project) is situated approximately 330 kilometres (km) north east of Perth and 15 km north east of Rothsay. The Project is located within Mining Leases M59/387 and M59/425, which are held by Minjar Gold Pty Ltd (Minjar). In December 2015, Mid-West Tungsten Pty Ltd (referred to herein as TGN), a wholly owned subsidiary of Tungsten Mining NL (code TGN on the Australian Securities Exchange (ASX)) acquired the Australian tungsten exploration assets of Hazelwood Resources Limited (Hazelwood). TGN now holds 100 percent (%) of the tungsten and molybdenum rights for a contiguous group of tenements which include the Mulgine Hill and Mulgine Trench deposits (Appendix 1).

TGN is currently in the feasibility stage of the MMP and is proposing to commence construction by Quarter 1-2018. The scope of this Environmental Protection Authority (EPA) referral includes:

- Open pit mining of the Mulgine Hill deposit;
- Construction of processing facilities;
- Construction of Waste Rock Landforms (WRLs) and Run-of-Mine (ROM) pad;
- Construction of a Tailings Storage Facility (TSF); and
- Construction of support facilities (offices, workshops, access roads).

1.2 PROPONENT DETAILS AND LAND TENURE

The Project tenements are 100 % owned by Minjar. The tenements to which this referral relates specifically are provided in Table 1-1, with company details provided below.

Project Owner/Operator: Mid-West Tungsten Pty Ltd

Physical Address: 97 Outram Street, West Perth, WA 6005

Postal Address 1: PO Box 517, West Perth, WA 6872

Table 1-1: Tenements of the Mt Mulgine Project

Tenement	Commenced	Expiry	Area (ha[1])
M59/425	17/10/2003	16/10/2024	939
M59/387	20/12/1995	19/12/2037	886

[1] Hectares

The key proponent contact for the referral is:

Leigh Wardell-Johnson

Manager, Technical Development – Tungsten Mining NL

Ph: (08) 9486 8492

Email: leigh@tungstenmining.com

The key consultant contact for the referral is:

Sharon Arena

Principal Environmental Adviser - Animal Plant Mineral Pty Ltd

Ph: 0419 934 461

Email: sharon@animalplantmineral.com.au

1.3 LOCATION

The Project is located in the Murchison region of Western Australia (WA) approximately 330 km north east of Perth (see Figure 1-1). The MMP is situated within the Shire of Perenjori and can be accessed from the Warriedar Copper Mine Road and the Minjar haul road. The MMP tenements are partially located within the former Warriedar pastoral station, which is now managed by the Department of Parks and Wildlife (DPaW). Access to the Project area will be by agreement with Minjar.

Document Name: 20170217_TUN_Fig1-1_EPA Referral

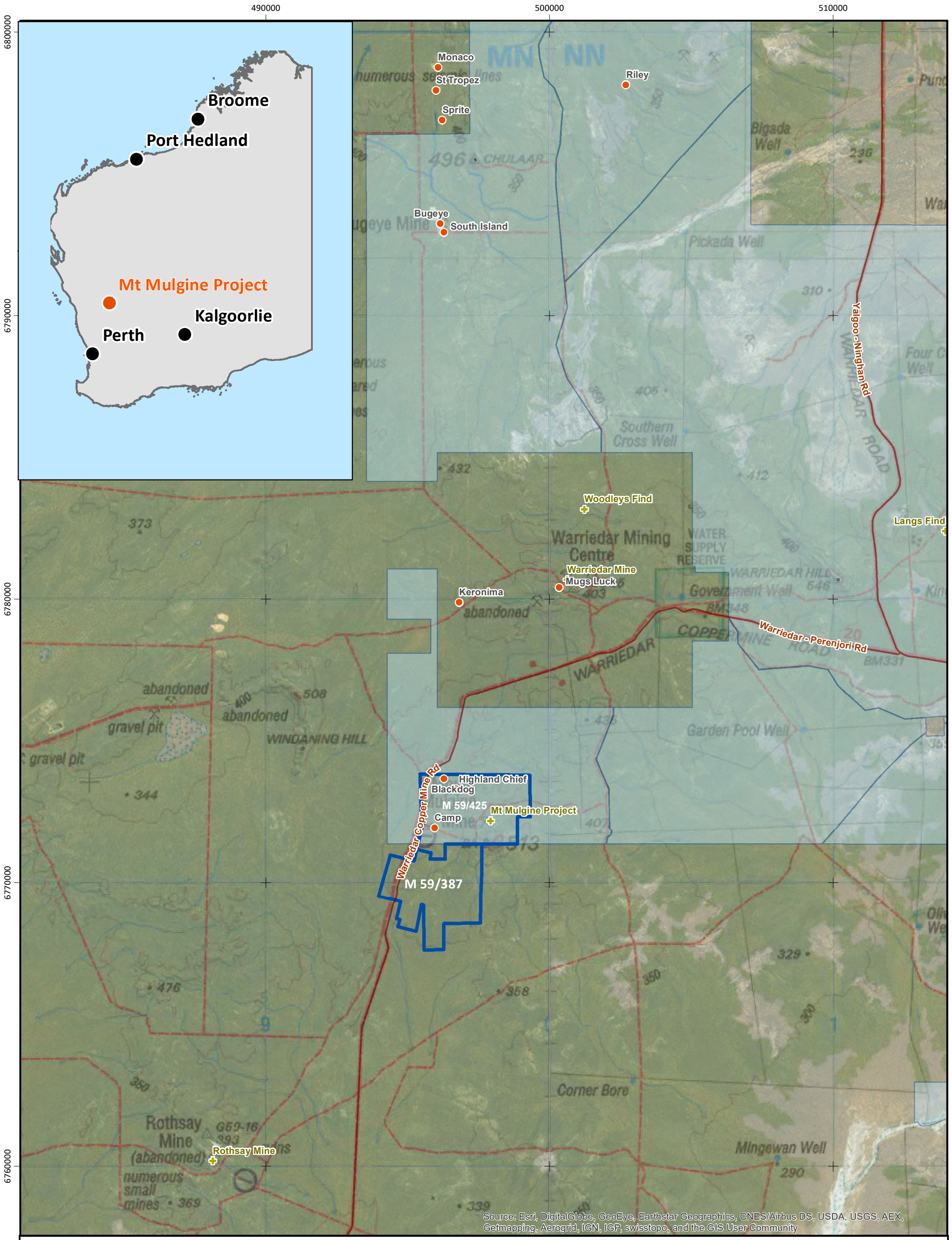


Figure 1-1: Mt Mulgine Project Location Plan

Legend

- Mines (Historic and/or Active)
- Roads
- *Tenements*
- *Warriedar pastoral lease*

1:120,000

GDA 1994 MGA Zone 50

17/02/2017

0 3 6

Kilometers

ems@animalplantmineral.com.au / (08) 6296 5155

\\MAINSERVER-PC\server storage\APM GIS and Mapping\03_Client\MIN\02_ArcGIS Maps\20170217_TUN_Fig1-1_EPA Referral.mxd

1.4 IMPLEMENTATION SCHEDULE

TGN aims to commence mining within approximately one year from the date of this referral. The resource identified within Mulgine Hill is sufficient to undertake open pit mining for a duration of approximately 15 years. Table 1-2 outlines the implementation schedule for the MMP.

Table 1-2: Mt Mulgine Project Implementation Schedule

Task	2016	2017				2018		
	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sep
Scoping study								
Feasibility study								
Final investment decision								
Construction								
Operations								

2 THE PROPOSAL

2.1 KEY PROPOSAL CHARACTERISTICS

The MMP will occur on Mining Leases M59/387 and M59/425. A summary of the proposal is provided in Table 2-1. Physical elements of the Project are provided in Table 2-2 and Figure 2-1.

Table 2-1: Summary of the Proposal

Proposal Title	Mt Mulgine Project
Proponent Name	Mid-West Tungsten Pty Ltd
Short Description	*Background* In December 2015 TGN acquired the Australian tungsten exploration assets of Hazelwood Resources Limited. As such, TGN has 100 % of the tungsten and molybdenum rights for a contiguous group of tenements which include the Mulgine Hill and Mulgine Trench deposits. Minjar is the registered holder and holds the gold and other mineral rights to these tenements. The MMP will host open pit mining, a processing plant, office and workshop facilities, magazine, ROM pad, turkey nest, WRLs and TSF. Some infrastructure from the existing Minjar Gold Mine may also be utilised for the Project. Total disturbance is anticipated to be approximately 146.21 ha. *Overview* Mining of ore will be by conventional open pit mining methods. Open pit mining will generate waste rock, which will be contained in the proposed WRLs adjacent to the deposit. Ore will be processed at the processing facility, with coarse waste product (nominal -40mm + 20mm) generated from x-ray ore sorting contained on a dry WRL and fine tailings (wet) being contained within a TSF. TGN proposes to develop the MMP processing plant on a disused airstrip situated on M59/425. DPaW has granted approval to undertake construction on the airstrip; a copy of the letter is provided in Appendix 2. Development will comprise the following: - clearing of soil and vegetation over relevant areas, and storage of this material in segregated stockpiles; - open pit mining of the Mulgine Hill deposit; - transport of waste rock from open pits to constructed surface WRL's and other surface infrastructure; - backfilling or partial backfilling of available open pits in the latter stages of the Project where possible; - construction of office, workshop and modular processing plant facilities; - establishment of a nominal 2.0 megawatt (MW) diesel power generation plant; - establishment of the ROM pad; - construction and operation of a 375,000 tonne per annum (tpa) processing facility comprising a crushing circuit, x-ray ore sorting, gravity circuit and potentially a flotation circuit. Associated process water ponds and concentrate storage facilities will also be incorporated into the processing facility. - fine tailings deposition into an above ground TSF; and - construction of diversion structures where required to intercept and redirect surface water flows around constructed landforms.

Table 2-2: Physical Elements of the Proposal

Element	Reference Name	Location	Proposed Extent
Open pit mine – 1	Pit1	Figure 2-1	Clearing of approximately 26.95 ha for proposed open pit mines. Pit 1 Approximately 785 m long, 495 m wide and 50 m deep. Pit 2 Approximately 340 m long, 130 m wide and 50 m deep. Pit 3 Approximately 85 m long, 50 m wide and 30 m deep.
Open pit mine – 2	Pit2	Figure 2-1	
Open pit mine - 3	Pit3	Figure 2-1	
Abandonment bunds	Bund	Figure 2-1	Clearing of approximately 1.65 ha.
Process Plant	Proc	Figure 2-1	Clearing of approximately 3.78 ha. Ore processing - 375,000 tpa.
Mineralised oxide landform	MOL	Figure 2-1	Clearing of approximately 10.60 ha.
WRL – east	WRLE	Figure 2-1	Clearing of approximately 35.30 ha. Mining waste - 7.71 million metres cubed (Mm^3).
WRL – south	WRLS	Figure 2-1	
TSF	TSF	Figure 2-1	Clearing of approximately 30.31 ha. Ore processing waste (wet tailings) - Total storage capacity of 3.3 Mm^3.
Low grade stockpile	Lowg	Figure 2-1	Clearing of approximately 1.30 ha.
Rejects stockpile	Rej	Figure 2-1	Clearing of approximately 6.31 ha.
Topsoil stockpile	Top	Figure 2-1	Clearing of approximately 4.6 ha.
ROM pad	ROM	Figure 2-1	Clearing of approximately 7.80 ha.
Parking	Work	Figure 2-1	Clearing of approximately 1.80 ha.
Offices	Off	Figure 2-1	Clearing of approximately 1.03 ha.
Mining operations centre	MOC	Figure 2-1	Clearing of approximately 1.00 ha.
Magazine	Mag	Figure 2-1	Clearing of approximately 0.53 ha.

Element	Reference Name	Location	Proposed Extent
Core farm	Core	Figure 2-1	Clearing of approximately 1.78 ha.
Haul/Internal roads	Road	Figure 2-1	Clearing of approximately 11.47 ha.
TOTAL CLEARING			**146.21 ha within the 301 ha development envelope.**

Document Name: 20170217_TUN_Fig2-1_EPA Referral

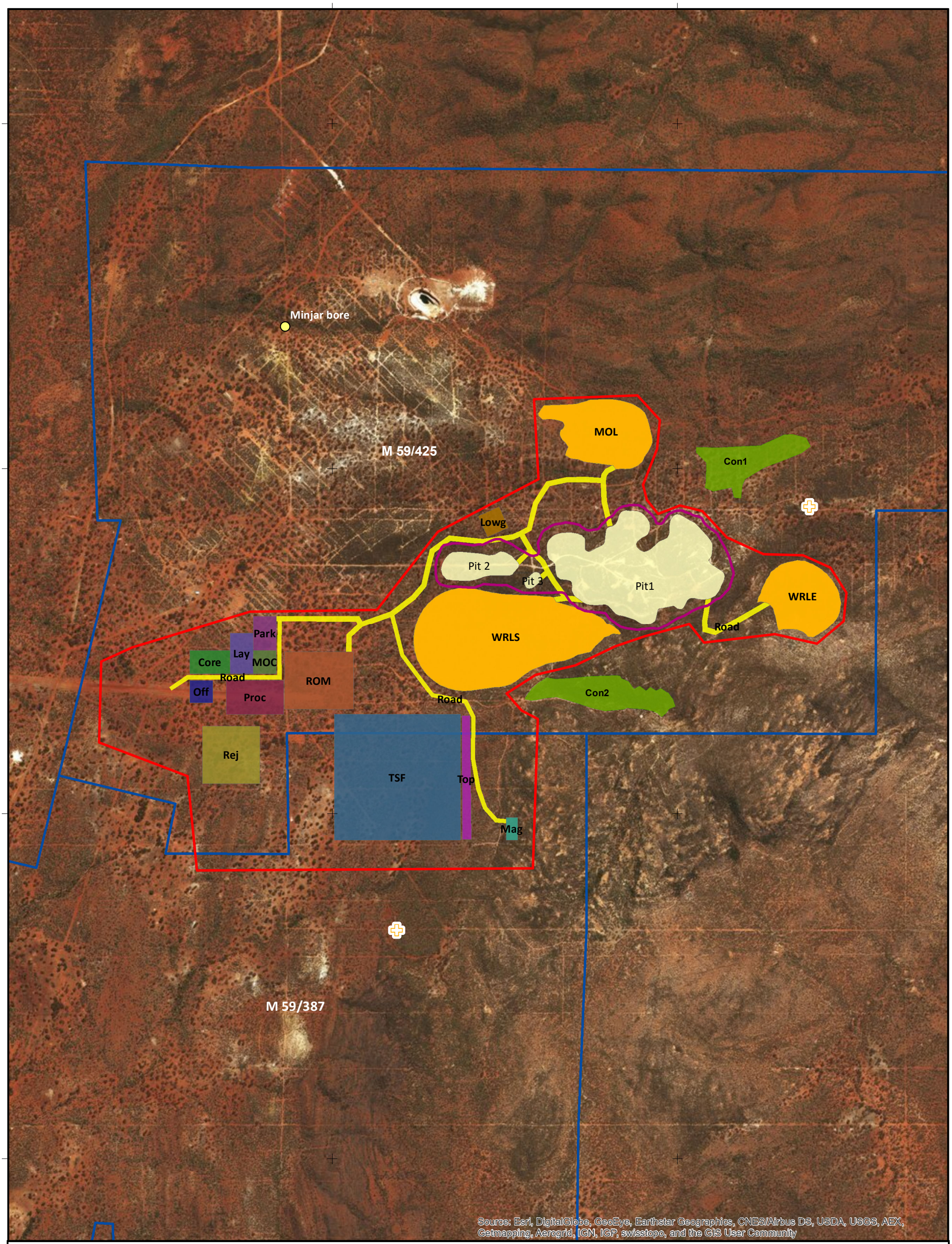


Figure 2-1: Mt Mulgine Project Proposed Physical Elements

Legend

- Bore
- Development Envelope
- Abandonment bund
- Heritage sie
- Pits
- Low grade stockpile
- Waste Rock Landforms
- Administration
- Core farm
- Laydown
- Magazine
- Mine Operations Centre
- Parking
- Plant
- ROM pad
- Rejects
- TSF
- Topsoil stockpile
- Roads
- Tenements
- Fauna Conservation Zones

0 0.5 1 2 3 4 Kilometers

1:15,000

17/02/2017

ems@animalplantmineral.com.au / (08) 6296 5155

\\MAINSERVER-PC\server storage\APM GIS and Mapping\03_Client\TUN\02_GIS Maps\20170217_TUN_Fig2-1_EPA Referral.mxd

Each component of the Project may be regulated through approvals, licenses, permits and management plans administered by various Regulators. Regulation of the key components of the Project is outlined in Table 2-3 below.

Table 2-3: Regulation of Project Components

Component	Regulator	Management Tool
Clearing native vegetation	Department of Mines and Petroleum (DMP), in consultation with DPaW	• Native Vegetation Clearing Permit
Construction and operation of the processing plant	Department of Environment Regulation (DER)	• Works Approval • Operating License
Construction and operation of the TSF	DMP	• Mining Proposal (MP) • Project Management Plan (PMP)
	DER	• Works Approval • Prescribed Premises Licence
Potentially Acid Forming (PAF) material management	DMP	• MP • PAF Management Plan
Open pit construction and operation	DMP	• MP • PMP
Dewatering Activities (if required)	DER	• Works Approval • Prescribed Premises Licence
	Department of Water (DoW)	• Section 5C licence to take water
Storage and handling of explosives	DMP	• Dangerous goods license • PMP
Air quality	DMP	• MP
Closure and rehabilitation	DMP, in consultation with DPaW.	• Mine Closure Plan (MCP)

2.3 PROJECT OVERVIEW

2.3.1 History

The Yalgoo-Singleton Greenstone belt is approximately 190 km, stretching from approximately 30 km north of Yalgoo in the north to Mt Gibson in the south.

Mining commenced in the broader area around the late 1890's at Rothsay gold mine, which operated irregularly until 1939. Gold mining at Paynes Find occurred from the early 1900's and the prospect is still currently being explored. Today, Minjar, MMG Limited and Gindalbie Metals Ltd have iron ore, gold and base metal mining operations in the surrounding area.

Ownership of the MMP leases has changed many times. The Project area was first explored by Minefields Exploration NL and Australian and New Zealand Exploration Company (ANZECO). Further gold exploration was undertaken from the early 1980's to 2006 by numerous companies. The Highland Chief mine was established in the early 1900's. In more recent times the Bobby McGee, Camp and Black Dog deposits within the western part of M59/425 have all been mined.

Gindalbie Gold Ltd (now Gindalbie Metals Ltd) purchased the leases in December 1999 and began gold mining operations. In 2005 Gindalbie and Vital Metals Limited entered into the Mt Mulgine Joint Venture and Farm-in Agreement in relation to the tungsten and molybdenum mineral rights for the Mt Mulgine tenements. In 2010 Vital Metals Limited assigned their 70 % interest in the tungsten and molybdenum rights to Hazelwood. In 2013 Hazelwood acquired Gindalbie's minority interest in the Mt Mulgine Tungsten Project, giving them 100 % of the tungsten and molybdenum rights. Through a sale agreement with Hazelwood dated December 2015, TGN acquired the entire tungsten and molybdenum rights for the Mt Mulgine tenements. Gold mining persists under Minjar's stewardship whom holds the gold rights to the tenements, although there is currently no active mining within the MMP area.

2.3.2 Mining

The tungsten-molybdenum mineralisation at Mt Mulgine is associated with 2 km stock of high-level leucogranite, Mulgine Granite, which has intruded the Mulgine anticline.

Mineralisation at Mulgine Hill is associated with the sub-horizontal upper contact of a mafic schist unit and overlying quartz-muscovite greisen. Tungsten occurs as scheelite in coarse disseminations within the greisen or within numerous quartz and greisen veins in both the mafic schists and the quartz-muscovite greisen.

Tungsten mineralisation at Mulgine Trench is hosted by quartz-scheelite veins in mafic and ultramafic volcanics in a 100 to 250 metres (m) thick zone that extends over 1.5 km of strike. Mineralisation is associated with foliation parallel quartz veins generally less than 10 centimetres (cm) in width. Stronger tungsten mineralisation occurs where quartz veining averages greater than 15 % of the total rock volume.

TGN proposes to commence mining in 2018. There is sufficient resource identified at Mulgine Hill to undertake open pit mining for a duration of approximately 15 years.

Mining will occur via conventional drill and blast open pit methods from three open pits. Ore will be trucked to the ROM Pad at the processing facility.

2.3.3 Waste Rock Landform Design/Location

MineGeoTech Pty Ltd (MineGeoTech) has prepared a concept design for the construction of the proposed WRLs within the MMP (see Appendix 3).

The scoping study by MineGeoTech provides a concept for the design and location of the two proposed WRLs to manage waste rock and one mineralised oxide stockpile for future treatment through the processing plant. The following criteria were considered when selecting a suitable location.

- Waste and mineralised oxide landforms must be placed within the Project area (i.e. within M59/425)
- Overall angle of rehabilitated shape to be 18 degrees (°);
- Maximum height of WRLs to be 40 m;
- WRL to blend in with the natural hill sides;
- Minimise transport distance from the pit crest;
- Ensure toe of WRLs are not within the abandonment bund (zone of instability);
- Approximate setback from identified *Egernia stokesii badia* habitat is to be minimum 50 m;
- Approximate setback from identified *Idiosoma nigrum* habitat is to be minimum 50 m; and
- Approximate setback from identified Aboriginal heritage site is to be minimum 50 m.

Given these constraints MineGeoTech recommended the WRLs be established to the south-west and east of the Mulgine Hill deposit and the mineralised oxide landform to the north (see Figure 2-2).

The proposed WRLs and mineralised oxide landform will together have an estimated disturbance footprint of 45.85 ha. The mineralised oxide landform will have a maximum height of 20 metres relative level (m RL), the eastern WRL a maximum height of 25 m RL and south-west WRL a maximum height of 40 m RL.

Document Name: 20170217_TUN_Fig2-2_EPA Referral

496500

498000

6774000

6772500

6771000

6769500

MOL

M 59/425

Lowg

WRLE

WRLS

Road

Road

Road

M 59/387

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Figure 2-2: Proposed Waste Rock and Mineralised Oxide Landform Locations

Legend

- Development Envelope
- Low grade stockpile
- Waste Rock Landforms

1:15,000

17/02/2017

GDA 1994 MGA Zone 50

0 0.5 1 2 3 4 Kilometers

ems@animalplantmineral.com.au / (08) 6296 5155

\\MAINSERVER-PC\server storage\APM GIS and Mapping\03_Client\TUN\02_GIS Maps\20170217_TUN_Fig2-2_EPA Referral.mxd

2.3.5 Ore Processing

The processing facility will process ore from the Mulgine Hill deposit, treating 5.3 million tonnes (Mt) at 0.23 % Tungsten trioxide (WO_3). The facility will include the processing plant, control room, tankage, concentrate storage shed, mine operations centre (MOC) and process water tank(s).

The processing plant will treat ore at a nominal throughput of 375,000 tpa using x-ray ore sorting as a pre-concentration stage, gravity concentration and/or froth flotation.

A total of 2,250 tpa of dry concentrate will be produced. The final product will be packed in 1 t bulker bags and placed in shipping containers for transport. It is likely the product will be transported to Fremantle via the Great Northern Highway where it will be shipped out of the container port.

2.3.5.1 Gravity Circuit / Gravity and Flotation Circuit

TGN is currently considering options for processing of ores including x-ray ore sorting, gravity concentration and/or froth flotation. Indicative process flowsheets are presented in Figure 2-3 and Figure 2-4.

Gravity

ROM ore is crushed in a primary jaw crusher and conveyed to a double deck vibrating screen with a top deck aperture of 40 millimetres (mm) and a bottom deck aperture of 20 mm. Screen oversize (+40mm) is conveyed to a cone crusher in closed circuit with the vibrating double deck screen. The 40mm+20mm material in conveyed to the x-ray ore sorter and the -20mm material is conveyed to the primary rod mill.

X-ray ore sorting “accepts” combine with the -20mm material to become primary rod mill feed; the “rejects” are conveyed to a coarse ore waste stockpile.

Rod Mill product is classified using a Derrick screen to produce:

- oversize that recirculates back to the rod mill;
- -1.2mm+0.5mm coarse product;
- -0.5mm+0.1mm medium product; and
- -0.1mm fine product.

The coarse and medium products report to coarse and medium spirals and tabling circuits respectively. The -0.1mm material reports to a falcon concentrator. Concentrate from the coarse, medium and fine gravity circuits are dewatered in a concentrate thickener, filtered and bagged.

Middlings and tailings from the coarse and medium circuits are reground in a ball mill to -0.1mm and fed to the falcon concentrator.

Wet tailings will be thickened for maximum water recovery before being pumped to the TSF.

Gravity and flotation

The gravity and flotation plant uses the same process as the gravity only plant, except that the -0.1mm material is fed to a flotation circuit rather than a falcon concentrator. Ongoing metallurgical test work will aim to prove the most economic extraction route.

2.3.5.2 Reagents

Reagents proposed to be used in processing are described below:

Flocculant – *settling agent for thickening*

Will be delivered to site in 750 kilogram (kg) bags. It will be mixed as a 0.05% w/w solution for use in the process.

Oleic Acid – *fatty acid used as a scheelite collector in flotation*

Will be delivered to site in 200 litre (l) steel drums. It will be mixed at a rate of 2 kilograms per tonne (kg/t) for use in the flotation circuit.

Sodium Ethyl Xanthate – *flotation reagent for sulphide minerals*

Will be delivered to site in 850 kg bags. It will be mixed as a 5-20 % w/w solution for use in the flotation circuit.

MIBC Frother – *frothing agent*

Will be delivered to site in 100 kg bags. It will be mixed as a 0.005 – 0.01 % w/w solution for use in the flotation circuit.

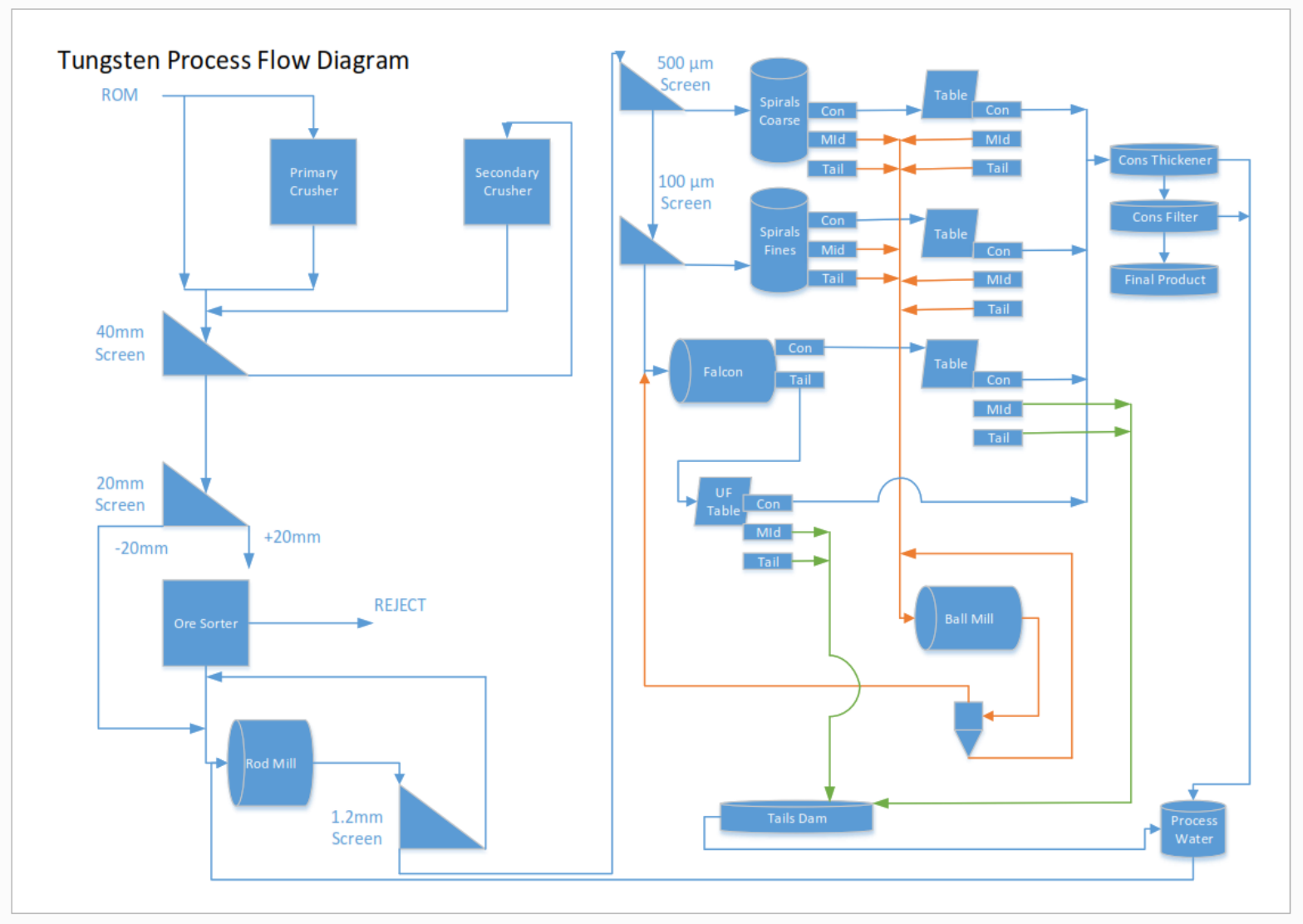


Figure 2-3: Mt Mulgine Project Gravity Process Flow Diagram

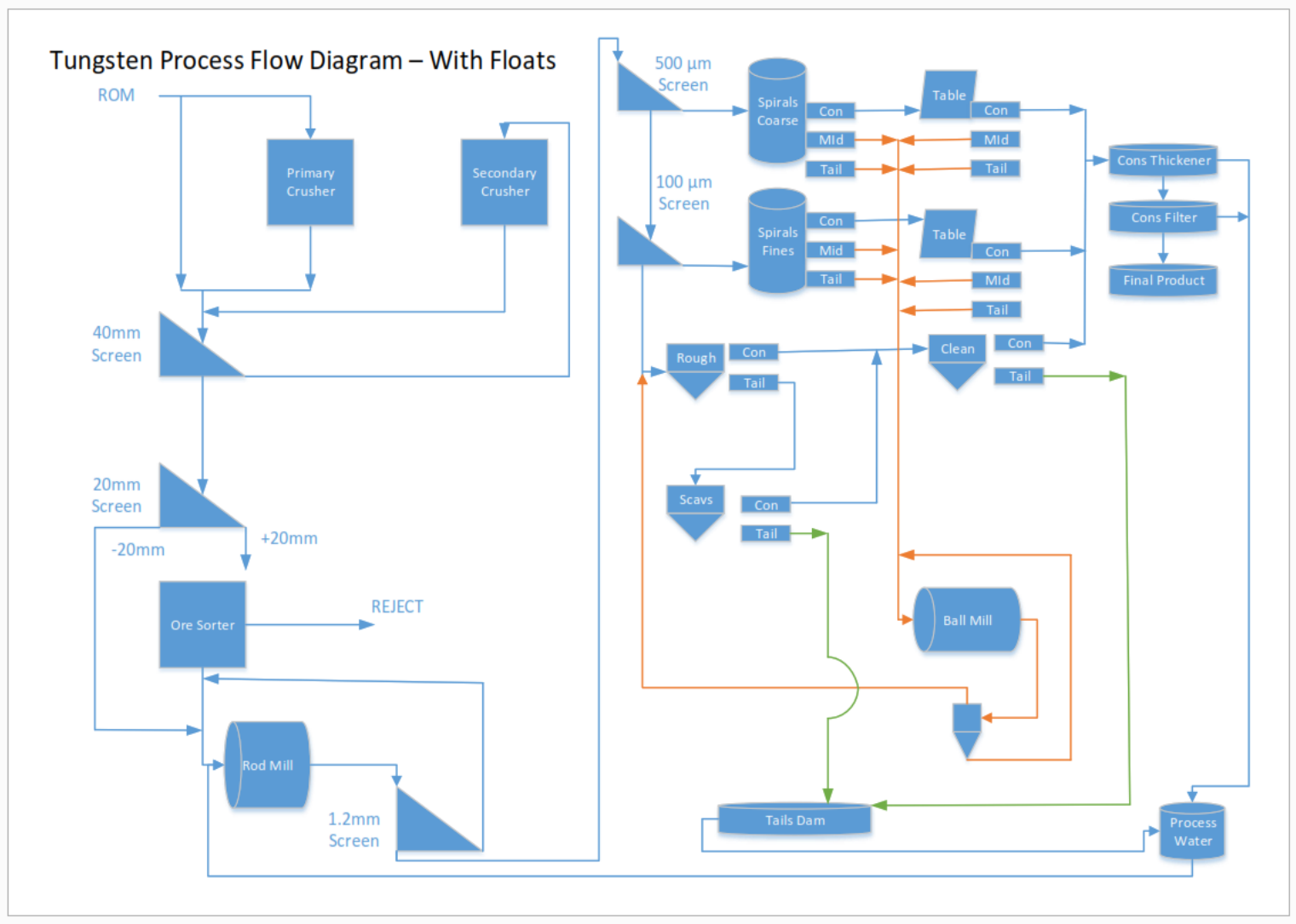


Figure 2-4: Mt Mulgine Project Gravity and Float Process Flow Diagram

2.3.6 Tailings Storage Facility

A paddock style TSF will be constructed for deposition of fine wet tailings from ore processing. The TSF will provide storage capacity for 3.3 Mm^3 of fine tailings waste. Approximately 220,000 m^3 of fine tailings will be deposited per annum. The proposed TSF design is shown in Figure 2-5 below.

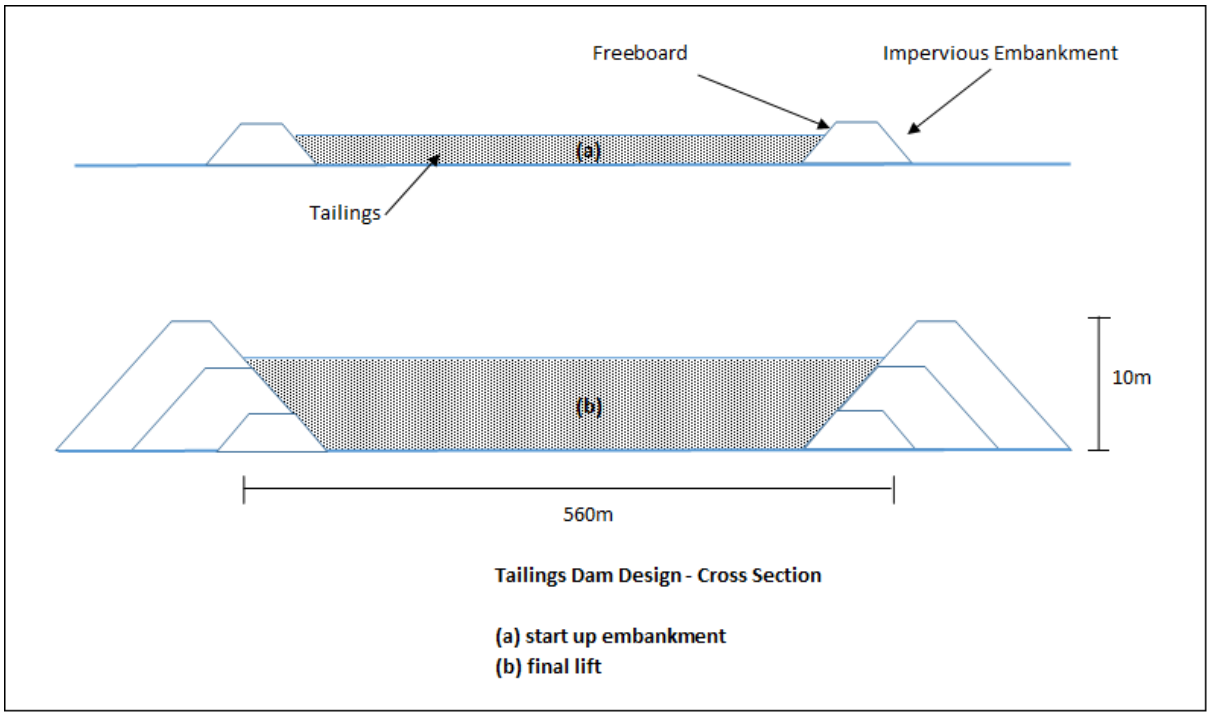


Figure 2-5: Cross Section of Paddock Tailings Storage Facility

2.4 PROPOSED LAND DISTURBANCE

Estimated total land disturbance required for the development of the MMP is approximately 146.21 ha. Indicative disturbance for key components of the Project are provided in Table 2-4.

Table 2-4: Estimated Disturbance for Key Project Components

Project Component	Estimated Disturbance Area (ha)
Open pit mines – 1, 2 and 3	26.95
Abandonment bunds	1.65
Process Plant*	3.78
Mineralised oxide landform	10.60
WRLs	35.30
TSF	30.31
Low grade stockpile	1.30
Rejects stockpile	6.31
Topsoil stockpile	4.60
ROM pad	7.80
Parking	1.80
Offices	1.03
Mine operations centre	1.00
Magazine	0.53
Core farm	1.78
Haul/Internal site roads	11.47
Total	**146.21**

*Tungsten has been given approval by DPaW to construct the Processing Plant on the airstrip situated on M59/425 (Appendix 2).

2.5 SUPPORT FACILITIES

2.5.1 Mine Water Disposal

Resource drilling undertaken by TGN encountered no intersection with groundwater except one drill hole located in the vicinity of Pit 3. It is not anticipated that mining will occur below the water table however additional drill holes adjacent to this anomaly will be required as part of future drill programs to verify the presence/absence of groundwater and to determine whether or not water containment facilities will be need to be considered as part of the project design.

Should dewatering be required, in-pit sumps will be utilised and potential mine dewater will be preferentially used in processing and dust suppression. A designated water storage facility will be constructed where mine dewater can be temporarily stored until needed.

2.5.2 Offices and Workshop Facilities

Support infrastructure at the MMP will include the following:

- Offices, crib room, ablutions and hardstand area;
- Workshops with associated hydrocarbon management systems and wash down area;
- Laydown and storage areas;
- Diesel storage and refuelling area;
- Explosives magazine for the storage of explosive in compliance with the *Explosives and Dangerous Goods Act*, the *Dangerous Goods Safety (Explosives) Regulations 2007* and Australian Standard *AS 2187.1:1998, Explosives – Storage, transport and use, Part 1;* and
- Water storage (existing turkeys nest) and bore infrastructure.

Bioremediation of contaminated soil will be undertaken within intermediate bulk containers (IBCs).

The existing Minjar accommodation camp will be utilised for site personnel. Personnel will travel to the Minjar accommodation camp on a fly in fly out (FIFO) basis using the Golden Grove Project airstrip, located approximately 7 km from the Minjar camp. Transport to the Mt Mulgine Mine site will be undertaken via light vehicle on Minjar access roads.

2.6 POWER SUPPLY

Diesel generators will likely be used to supply power for the proposed operations. The power station will generate up to 2 MW of power. Power from generators will be reticulated to buildings or plant as per *Australian Standard/New Zealand Standard (AS/NZS) 3000-2007: Electrical Installations*, with all installations meeting the required standard.

Solar power generation will be considered during feasibility as an alternate/supplemental power source.

2.7 WATER SUPPLY

A turkey nest and single bore are already established on site (Figure 2-1). TGN has legal access to this infrastructure and will utilise it for processing (up to 381 kilolitres per day (KL/d)), dust suppression and ablutions.

Additional abstraction locations will be considered if dewatering of mining areas is required.

2.8 WORKFORCE REQUIREMENTS

TNG will require approximately 165 workers to fulfil the operational requirements of MMP. The workers will be rostered on a FIFO basis comprising the positions outlined in Table 2-5 below.

Table 2-5: Workforce requirements for the Mt Mulgine Project

Senior Staff	Number
General Manager Operations	1
Manager Mining	1
Mill Manager	1
Finance and Administration Manager	1
Secretary/Receptionist	1
Fleet Maintenance Superintendent	1
Mill Maintenance Superintendent	1
Senior Metallurgist	0
Mining Production	
Mine Foreman	1
Senior Surveyor	1
Senior Mine Geologist	1
Snr Planning Engineer	1
Mine Geologists	1
Surveyor	1
Shift Mining Supervisor	3
Data Clerk	1
Junior Engineer	1
Junior Geologist	1
Samplers/Spotters	6
Survey Assistants	3
Pump Crew	3
Excavator Ops	4
Truck Drivers	12
Dozer Ops	6
Charge Crews	6
Drillers	6
Grader Ops	6
Road Train Ops	3
Loader Ops	3
Pump Crew	3
Mining Fleet Maintenance	
Foreman	2
Fitters	3
Boiler Makers	2
Auto Electrician	2
Servicemen	6
Maintenance Planner/Stock Controller	2
Processing	
Processing Operations	
Plant Metallurgist	1
Day Shift Supervisor	1

Day Crew	**3**
Shift Supervisors	**3**
Crusher Ops	**3**
Mill Ops	**8**
Chemist	**3**
Laboratory Assistants	**3**
Processing Maintenance	
Maintenance Foreman/Planner	**1**
Fitter	**4**
Boilermaker	**2**
Electrician	**2**
TA's	**3**
Mine Administration	
Camp	
Camp Admin Manager	**1**
Chef	**3**
Kitchen Hands	**6**
Cleaners	**6**
Laundry	**3**
Accounts	
Book Keepers	**2**
HSE	
HSE Supervisor	**1**
Environmental Officer	**1**
Paramedics	**2**
Safety Officer	**2**
Purchasing	
Chief Purchasing Officer	**1**
Storemen/Stock Controllers	**3**
Exploration	**20**
Total	**165**

2.9 ACCESS ROADS

Established site roads will be utilised for the Project, with roads to be widened and upgraded where necessary. Some additional roads may also be required to access site infrastructure.

Existing access to the MMP is via the Warriedar Copper Mine Road (Figure 1-1).

Ore mined from the deposits will be transported directly to the ROM pad adjacent to the processing plant located on site.

2.10 CLOSURE AND REHABILITATION

A MCP will be developed for the Project. It is the intention of TGN to re-establish pastoralism as the post mining land use within Mining Lease M59/387 and the areas of M59/425 where the underlying tenure is Pastoral Lease (PL N049416 - Wanarra). Within the remainder of the Project area on M59/425 the underlying tenure is Conservation Pastoral Lease (CPL 0000046 – Warriedar). It is the intention of TGN to re-establish the post mining land use as conservation in these locations.

Key landforms of the MMP to be closed and rehabilitated include:

- Open Pits;
- WRLs; and
- TSF.

Open pits will be preferentially backfilled where possible to reduce the long term legacy. Prior to closure, suitable waste rock will be used to construct abandonment bunds outside the zone of instability of open pits that have not been backfilled.

Landforms associated with the TSF and WRLs will remain after closure, however other areas such as processing plant site, laydown areas and access roads will be rehabilitated and not form long term features within the landscape.

Landforms of the MMP will be progressively rehabilitated where possible, with final closure and rehabilitation occurring upon cessation of mining activities. During rehabilitation the battered WRL faces will be re-contoured, ripped, topsoil replace where available and seeded with local provenance species. This will ensure these landforms are continuous with the surrounding environment as much as practicable.

Contours and rock mulching may be used to slow the flow of surface water across rehabilitated landforms and improve infiltration of water into the upper soil profile where it can be taken up by vegetation. Using local provenance species will contribute to slope stability, rainfall infiltration and nutrient cycling. The depth of rocky topsoils used to rehabilitate landforms will be maximised as much as possible, but will be dependent upon availability of such materials.

All final landforms will be geo-technically and geo-chemically stable, designed with appropriate batters. Completion criteria for the Project have been considered and are provided in Table 2-6. TGN recognises the criteria are at a preliminary stage and will be further developed throughout the approvals process. It is proposed the criteria be refined in consultation with key stakeholders and incorporated into the MCP submission.

Table 2-6: Preliminary Completion Criteria for the Mt Mulgine Project

Aspect	Objectives	Completion Criteria	Measurable Standards to Meet Completion Criteria
Safety and Public Health	• Site closure activities undertaken safely. • Public access to closed areas deterred.	• All excavations backfilled or have a perimeter safety bund • Signage where appropriate • Roads no longer required will be rehabilitated • Ensure areas are left in a safe manner	• Site inspected by independent auditor and completion report produced.
Final Landforms	• All constructed landforms are non-polluting and are stable with a low risk of erosion	• Constructed waste rock and TSF landforms to have final batters as described in Mining Proposals • Erosion levels on constructed landforms stabilised • Waste materials are appropriately placed in landforms so as to be non-polluting • TSF to have an effective 'store and release' cover system.	• Audit to confirm compliance with closure design specifications, including placement of waste materials. Rehabilitated landforms surveyed at completion of rehabilitation earthworks to ensure landform design completion criteria are met. • Annual inspection and monitoring for AER data sheets to collect erosion data on waste rock and TSF landforms. • Geotechnical review of landforms within 12 months of closure.
Infrastructure	• Assets are disposed or retained in accordance with agreements with stakeholders and regulatory agencies.	• Infrastructure removed unless retention is agreed upon during discussions with stakeholders and regulatory agencies. • Any remaining buried infrastructure to be defined and markers maintained if required. • A transfer agreement is in place for all residual assets. • Residual assets are functional at handover. • Maintenance and operational procedures provided to new owner.	• No infrastructure remaining at closure unless transfer agreement in place; to be confirmed by post closure inspection.
Soils	• Contaminated soils do not remain in-situ at levels above those acceptable for the agreed post-closure land use.	• If contaminated sites are identified, ensure the contaminated sites classification does not impact on suitability of the Project area for proposed post-mining	• Independent compliance report.

Aspect	Objectives	Completion Criteria	Measurable Standards to Meet Completion Criteria
		land use in accordance with the *Contaminated Sites Act 2003* (WA).	
Groundwater	• Alteration to groundwater from the Project (from extraction or contamination) not affecting existing or future users.	• Ground water quality within target parameters. • Groundwater levels within 15% of baseline groundwater level data.	• Post mining groundwater quality on a positive trajectory towards baseline data for three consecutive monitoring periods. • Groundwater levels within 15% of baseline data in three consecutive monitoring periods.
Surface Water	• Controlled surface water flows on rehabilitated landforms. • Surrounding surface water flows are not interrupted.	• At a catchment level surface water drainage flow functionality is reinstated. • Surface water diversion infrastructure, where retained by agreement with stakeholders, to be functional and effective.	• Audit of surface drainage infrastructure upon closure.
Revegetation	• Establish self-sustaining, resilient and stable vegetation.	• Final landform to include representative local endemic flora that contributes to slope stability, rainfall infiltration/run-off and nutrient cycling. • Weed taxa are not dominant in rehabilitation areas. • All available topsoil is respread over disturbance areas.	• Site inspection after rehabilitation works to survey previous soil stockpile locations. • Area of weed infestation recorded post closure is less than or equal to infestation levels at November 2016, for three consecutive monitoring periods.
Waste	• All non-mineral waste is appropriately disposed or removed from site.	• No visible waste remains at site upon closure.	• Completion report.

3 EXISTING ENVIRONMENT

3.1 SURVEYS AND INVESTIGATIONS

A number of surveys and investigations have been previously undertaken in and near the Project area. A summary of relevant surveys is provided in Table 3-1 below.

Table 3-1: Existing Surveys and Investigations of the Mt Mulgine Project Area and Surrounds

Aspect	Survey	Consultant	Year	Purpose
Flora and Vegetation	Vegetation survey	APM	2016	Level 2 vegetation survey for mining approvals.
	Flora and vegetation survey and mapping potential habitat for the Threatened (Declared Rare) species *Stylidium scintillans.*	Terratree Pty Ltd (Terratree)	2013	Level 1 and 2 flora and vegetation survey and habitat mapping for *Stylidium scintillans.*
	Flora and vegetation survey and targeted search for flora of conservation significance.	APM	2012	Level 1 flora and vegetation survey.
	Flora and vegetation survey.	APM (Animal Plant Mineral Pty Ltd)	2011	Level 2 flora and vegetation survey.
	Flora and vegetation survey.	Woodman	2007	Level 2 flora and vegetation survey for exploration activity.
	Flora and vegetation survey and targeted flora survey.	Woodman	2004	Level 1 flora and vegetation survey and targeted flora survey.
	Flora and vegetation survey.	Woodman Consulting Pty Ltd (Woodman)	2003	Level 2 flora and vegetation survey for the expansion of mining operations.
Terrestrial Fauna	Fauna survey.	APM	2016	Targeted survey for mining approvals.
	Fauna survey.	APM	2012	Level 1 biological assessment survey for the expansion of mining operations.
Geotechnical	Waste rock landform geotechnical scoping study	MineGeoTech	2017	Study to determine suitable WRL locations and shapes.
Soil and Landform	Soil characterisation	Soil Water Consultants (SWC)	2013	Characterisation of soils at the Black Dog deposit
	Soil characterisation	Soil Water Consultants	2013	Characterisation of soils at the Camp deposit
	Soil characterisation	Soil Water Consultants	2013	Characterisation of soils at the Trench deposit
Water	Hydrogeological assessment.	Rockwater Pty Ltd	2013	Hydrogeological assessment.

Aspect	Survey	Consultant	Year	Purpose
	Hydrogeological assessment.	Rockwater Pty Ltd	2012	Hydrogeological assessment.
	Regional surface water assessment.	Soil Water Consultants	2012	Surface water assessment of proposed mine and infrastructure areas.
Heritage	Aboriginal heritage survey.	Terra Rosa	2012	Archaeological and ethnographic survey.
	Aboriginal heritage survey.	Yamatji Communications	2008	Ethnographic survey.
	Aboriginal heritage survey.	Australian Interaction Consultants	2007	Archaeological and ethnographic survey.

3.2 CLIMATE

The MMP is located in the Murchison region of WA which experiences hot dry summers and cold winters.

The nearest Bureau of Meteorology (BoM) weather station is at Paynes Find (BoM Site Number: 007139), approximately 70 km east of the Project area. The Paynes Find station has been recording rainfall since 1919 and temperature since 1975. Average monthly and annual rainfall and temperature is presented in Table 3-2.

Table 3-2: Rainfall and Temperature Averages for Paynes Find Weather Station (007139)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean Rainfall (mm)	19.8	23.4	25.5	26.1	37.3	41.0	35.4	27.0	14.3	10.5	10.8	12.6
Mean Max Temp (°C)	37.3	36.5	32.9	28.4	23.1	19.3	18.5	20.1	23.8	27.8	31.7	35.0
Mean Min Temp (°C)	21.0	21.2	18.1	14.3	9.5	6.7	5.5	6.0	8.0	11.5	15.4	18.4

Source: BoM, 2016

Recorded data suggests that the MMP area is likely to receive close to 289 mm of rain on an annual basis and experience temperatures ranging between 5.5 degrees Celsius (°C) and 37.3°C (the lowest and highest monthly averages recorded) (BoM, 2016). January is the hottest month with a mean maximum temperature of 37.3 °C and mean minimum of 21°C. July is the coolest month with a mean maximum temperature of 18.5 °C and mean minimum of 5.5°C (BoM, 2016) (Table 3-2). Figure 3-1 illustrates the Project area is subject to climate typical of the region, with hot summers and wet winters.

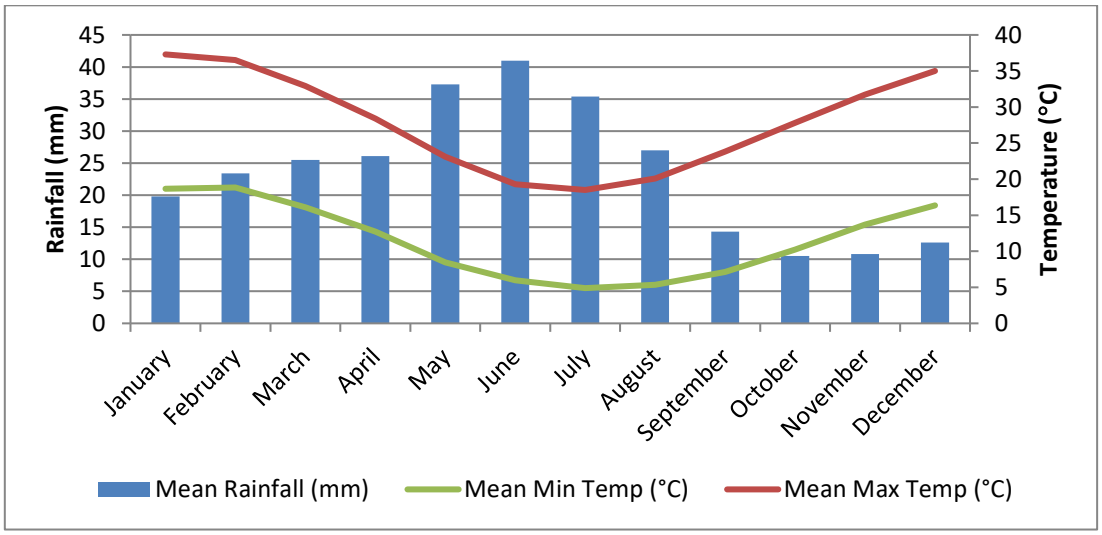


Figure 3-1: Paynes Find Weather Station Meteorological Data (007139)

3.3 AMENITY

Local and regional environmental values

There are no natural landforms occurring within the Project site that provide enhanced amenity to the area. The MMP is predominately located within the former Warriedar pastoral station, which is now managed by DPaW.

Current status

The MMP area contains the remnants of historical mining and exploration activities, including numerous access tracks and old mine shafts. However, these are not visible from the Warriedar Copper Mine Road and do not impact on the visual amenity of the site. Elements of the Project remaining post closure will include open pits and abandonment bunds, the TSF landform and WRLs. Visual impacts of the Project post mining will be minimised by removing infrastructure and rehabilitating with local provenance native species.

3.4 FLORA AND VEGETATION

Local and regional environmental values

The MMP is situated approximately 6 km south east of the Blue Hills Range, a banded ironstone formation (BIF) which is of conservation value. No BIF occurs within the proposed disturbance footprint.

As mentioned, the MMP tenements are partially within the former Warriedar pastoral lease. As part of its management DPaW aims to conserve the natural environment by undertaking activities such as condition monitoring, research and biological surveys.

Current status

The Project area has been subject to mining and exploration since the early 1900's. Numerous access tracks and legacy workings such as mine shafts and previous drilling can be found across the MMP area.

Desktop Assessment

Flora and vegetation reports were assessed to determine flora present or previously recorded in the area and any changes in the status of those flora since survey work commenced in 2003.

A desktop search of the *Environment Protection and Biodiversity Conservation Act 1999* (*EPBC Act)* Protected Matters Search Tool (PMST) and NatureMap database was undertaken in December 2016.

The PMST returned 12 species protected under the *EPBC Act* recorded within 10 km of the Project area. The NatureMap and DPaW database searches listed 31 Priority taxa and four threatened species recorded within 10 km of the Project area.

A request was also made for a search of the (DPaW) databases for Threatened and Priority flora and the presence of Threatened Ecological Communities (TEC) or Priority Ecological Communities (PEC) within 30 km of the MMP area.

Searches of the *EPBC* PMST and DPaW database identified the following TECs and PECs within the 30km radius:

- 'Blue Hills (Mount Karara/Mungada Ridge/Blue Hills) vegetation complexes (banded ironstone formation)' (Priority 1 PEC *Wildlife Conservation Act 1950* (*WC Act)*);
- 'Minjar and Chulaar Hills vegetation complexes (banded ironstone formation) (Priority 1 PEC – *WC Act*);
- 'Mount Gibson Range vegetation complexes (banded ironstone formation)' (Priority 1 PEC – *WC Act*);
- 'Ninghan calcrete groundwater assemblage type on Moore palaeodrainage on Ninghan Station' (Priority 1 PEC – *WC Act*); and
- 'Warriedar Hill/Pinyalling vegetation complexes' (banded ironstone formation) (Priority 1 PEC – *WC Act*).

Table 3-3 outlines the conservation significant flora identified in the MMP area by previous surveys and conservation significant flora identified by desktop searches which may occur in the MMP area.

Table 3-3: Conservation Significant Flora Potentially Occurring in the Mt Mulgine Project Area

Species	Description & Habitat	Likelihood of Detection if Present	Identified by Desktop Search	Previously Recorded on Site	Previous Conservation Status (State)	Current Conservation Status	
						Cth	State
Acacia acanthoclada subsp. *glaucescens*	Shrub. Flowers are yellow from July to September. Gravelly/stony loam, red sand, clay. Flats, slopes, breakaways.	Moderate - long lived perennial structures can be used for identification.	Y	Woodman, 2003; Woodman, 2004	P3		NT[1]
Acacia diallaga	Shrub. Skeletal red, silty loam on slopes and occasionally crests. Occurs with *Allocasuarina acutivalvis* and *Grevillea scabrida*.	Moderate - long lived perennial structures can be used for identification.	Y	APM, 2011; APM, 2012; Terratree, 2013	P2	-	P1
Acacia karina	Shrub. Red-brown silty clay loam with ironstone pebbles, banded ironstone, shalestone. Rocky slopes.	Moderate - long lived perennial structures can be used for identification.	Y	Woodman, 2007; APM, 2012; Terratree, 2013	P2	-	P1
Acacia subsessilis	Shrub. Flowers are yellow from July to August. Red sand or stony gravel over ironstone. Rocky hills.	Moderate - long lived perennial structures can be used for identification.	N	APM, 2012	P3		P3
Acacia sulcaticaulis	Shrub, rarely trees. Locally abundant in the vicinity of Mt Mulgine. Occurs with *Allocasuarina acutivalvis* on skeletal, red silty loam, on steep slopes, ridges and along rocky creek courses.	Moderate - long lived perennial structures can be used for identification.	Y	APM, 2012	P1	-	P1
Acacia woodmaniorum	Shrub. Skeletal red silt, red-brown soil, banded ironstone, laterite. Slopes, sides of hills, crests of ridges, ranges, disturbed overburden of mine sites.	Moderate - long lived perennial structures can be used for identification.	Y	-	-	-	T
Allocasuarina tessellata	Shrub or tree. Loam, sand. Greenstone and dolerite boulders.	Moderate - long lived perennial structures can be used for identification.	Y	Terratree, 2013	P1	-	P1

Species	Description & Habitat	Likelihood of Detection if Present	Identified by Desktop Search	Previously Recorded on Site	Previous Conservation Status (State)	Current Conservation Status	
						Cth	State
Austrostipa blackii	Grass-like or herb. Flowers September to November.	High, flowering in November.	Y	-	-	-	P3
Bossiaea sp. Jackson Range (G. Cockerton & S. McNee LCS 13614)	Shrub. Red sandy loam, laterite/duricrust breakaways.	Moderate - long lived perennial structures can be used for identification.	Y	-	-	-	P3
Calandrinia kalanniensis	Perennial herb. Flowers are pink-white from November to December or January. Shallow brown clay, often gritty, derived from eroded granite. Rock outcrops, herbfields.	High, flowering in summer.	Y	-	-	-	P2
Calandrinia sp. Warriedar (F. Obbens 04/09)	Annual herb. Red brown clay-loamy soils on low slopes.	Low.	Y	-	-	-	P2
Calotis sp. Perrinvale Station (R.J. Cranfield 7096)	Prostrate annual herb. Red clayey soils.	Low.	Y	-	-	-	P3
Chamelaucium sp. Warriedar (A.P. Brown & S. Patrick APB 1100)	Shrub. Flat or rocky slopes along drainage lines, red clay-loam soils; occurs with *Allocasuarina dielsiana*.	Moderate - long lived perennial structures can be used for identification.	Y	Terratree, 2013	P1	-	P1
Chamelaucium sp. Yalgoo (Y. Chadwick 1816)	Shrub. Granite outcrops.	Moderate - long lived perennial structures can be used for identification.	Y	APM, 2012	P1	-	P1
Cyanicula fragrans	Perennial herb. Flowers are blue from August to September. Red loam. Flat granite outcrops.	Low.	Y	-	-	-	P3
Dicrastylis linearifolia	Shrub. Flowers are white from November to December. Red sand. Sandplain.	High, flowering in summer.	Y	-	-	-	P3

Species	Description & Habitat	Likelihood of Detection if Present	Identified by Desktop Search	Previously Recorded on Site	Previous Conservation Status (State)	Current Conservation Status	
						Cth	State
Dodonaea amplisemina	Shrub. Red-brown sandy clay on basalt and gabbro and banded ironstone or on dolerite and quartzite. Rocky hills.	Moderate - long lived perennial structures can be used for identification.	Y	Terratree, 2013	P4	-	P4
Drummondita fulva	Shrub. Skeletal, shallow, acidic soils of orange-red or red-brown sandy loams and clayey silts. Footslopes, lower to upper slopes and hillcrests.	Moderate - long lived perennial structures can be used for identification.	Y	APM, 2012	P3	-	P3
Eremophila oldfieldii subsp. Karara (D. Coultas s.n. PERTH 07341717)	Small woody tree. Lower-mid slopes, silty red clay-loam soils	Moderate - long lived perennial structures can be used for identification.	Y	-	-	-	P1
Eremophila sp. Rothsay (D. Coultas & J. Kelt s.n. PERTH 08200440)	Shrub. Slow rise with red-brown silty clay loam.	Moderate - long lived perennial structures can be used for identification.	Y	-	-	-	P1
Eremophila viscida	Shrub. Flowers are green-white-yellow from September to November. Grinitic soils, sandy loam. Stony gullies, sandplains.	High – flowering in November	Y	-	-	EN	T
Grevillea globosa	Shrub. Flowers are cream and white and green/red-brown in January or June or November. Red loam, yellow sand.	Moderate - long lived perennial structures can be used for identification.	Y	-	-	-	P3
Grevillea scabrida	Shrub. Flowers are green-white/green-yellow/white in July. Red clay loam, stony loam.	Moderate - long lived perennial structures can be used for identification.	Y	Woodman, 2003; Woodman, 2007; APM, 2012; Terratree, 2013	P3	-	P1
Grevillea subtiliflora	Shrub. Flowers are white in April or July to September. Red-brown loam.	Moderate - long lived perennial structures can be used for identification.	Y	Woodman, 2003; APM, 2011; APM, 2012; Terratree, 2013	P1 (2003); P3 (2011, 2012, 2013)	-	P3
Gunniopsis divisa	Herb. Flowers are white in August. Loam, quartz. Roadsides.	Low.	Y	-	-	-	P3

Species	Description & Habitat	Likelihood of Detection if Present	Identified by Desktop Search	Previously Recorded on Site	Previous Conservation Status (State)	Current Conservation Status	
						Cth	State
Hybanthus cymulosus	Perennial herb. Flowers are blue-purple from May to July. Clay, rocky loam clay.	Moderate - long lived perennial structures can be used for identification.	Y	-	-	CR	T
Hydrocotyle sp. Warriedar (P.G. Wilson 12267)	Annual herb. Flowers in September. Red loam.	Low.	Y	Woodman, 2003; Terratree, 2013	P1	-	P1
Lepidosperma sp. Blue Hills (A. Markey & S. Dillon 3468)	Perennial sedge. Flat red-clay-loam soils along creeklines.	Low.	Y	-	-	-	P1
Micromyrtus acuta	Shrub. Grey-tain silty fine to coarse sand, laterite, granite. Rock outcrops.	Moderate - long lived perennial structures can be used for identification.	Y	-	-	-	P3
Micromyrtus trudgenii	Shrub. Red-brown loamy clay, yellow-brown soils, gravel, siltstone, quartz, basalt, banded ironstone, dolerite. Tops and slopes of hills and ridges.	Moderate - long lived perennial structures can be used for identification.	Y	APM, 2012	P3	-	P3
Millotia dimorpha	Annual herb. Flowers are yellow-white in September. Red loamy soils.	Low.	Y	-	-	-	P1
Persoonia pentasticha	Shrub. Flowers are yellow from August to November. Sand, loam. Base of granite outcrops.	High, flowering in November.	Y	Woodman, 2003; Woodman, 2007; APM, 2012; Terratree, 2013	P2 (2003); P3 (2007, 2012, 2013)	-	P3
Polianthion collinum	Shrub. Flowers are white-cream from May to July. Red clay loam between blocks of banded ironstone. Low hills and slopes.	Low – geology does not match the site	Y	-	-	-	P3
Prostanthera sp. Karara (D. Coultas & K. Greenacre Opp 8)	Shrub. Low to mid-slopes on red silty clay soils.	Moderate - long lived perennial structures can be used for identification.	Y	-	-	-	P1

Species	Description & Habitat	Likelihood of Detection if Present	Identified by Desktop Search	Previously Recorded on Site	Previous Conservation Status (State)	Current Conservation Status	
						Cth	State
Rhodanthe collina	Annual herb. Flowers are white and yellow from August to October. Loam. Rocky hills.	Low.	Y	Woodman, 2003	P1	-	P3
Stenanthemum poicilum	Shrub. Flowers are white from May to June or September to November. Red clay or sandy clay, loam.	High, flowers in November and long lived perennial structures can be used for identification.	Y	-	-	-	P3
Stylidium scintillans	Annual herb. Flowers in winter. Confined to upper slopes and summits of low rises and breakaways composed of highly weathered granitic basement rock with weathered or colluvial ironstone rock and kaolinitic residue. Rocky, shallow, pale brown clay-loam soils, individuals sometimes grow out of rock fissures.	Low.	Y	*Not recorded, however suitable habitat was identified by Terratree (2013)	-	-	T

[1] Not threatened

Site Investigations

The most recent flora and vegetation survey of the MMP was undertaken by APM in 2016, the full report is included as Appendix 4.

The objective of the APM (2016) survey was to undertake a Level 2 vegetation assessment in accordance with Environmental Protection Authority (EPA) Guidance No. 51 *Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia*, 2004.[1]

The field survey was carried out over 5 days between the 08/11/2016 and 12/11/2016 and a total of 38 quadrats were established, each being 20 x 20 m in size. The survey recorded 117 flora taxa from 79 genus groups. This total does not represent a complete species inventory for the project as a small number of annual herbs and grasses were difficult to identify to species level. Additional seasonal survey work is proposed following significant rainfall in 2017. Nevertheless, the outcomes of the survey enabled the requisite analysis for the description and mapping of vegetation communities.

Analyses were undertaken on the data and included removal of outlying quadrats, OptimClass1 procedure in JUICE and canonical correspondence analysis.

Ten vegetation communities were identified within the development envelope. These are summarised in Table 3-4 and shown in Figure 3-2.

The vegetation communities determined via analysis do not reflect the species assemblages or structure of the PECs identified from the DPaW and PMST database searches.

[1] The survey was conducted just prior to the release of the revised *Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment* (December 2016).

Table 3-4: Vegetation Communities of the Mt Mulgine Project Area

Vegetation Community No.	Description
1	*Eucalyptus* sp. *A*[1], open woodland on mixed *Acacia andrewsii, Enchylaena tomentosa, Maireana georgei* and *Ptilotus obovatus* shrubland over *Austrostipa variabilis* grassland.
2	*Ptilotus obovatus* and *Scaevola spinescens* shrubland over *Austrostipa scabra* grassland.
3	*Eucalyptus* sp. *A*[1] and *Acacia ramulosa* woodland over *Maireana trichoptera*, *Rhagodia drummondii* and *Sclerolaena diacantha* shrubland over *Austrostipa elegantissima* grassland.
4	*Acacia ramulosa* and *A. assimilis* woodland over *A. tetragonophylla, Melaleuca eleuterostachya*, *M. stereophloia*, and *Allocasuarina dielsiana* shrubs.
5	Mixed shrubland of *Pimelea avonensis*, *Hybanthus floribundus* subsp. *curvifolius*, *Acacia acuminata*, *Eremophila granitica* and *Cryptandra imbricata*. *Acacia acuminata and Allocasuarina* not forming dominant (>25%) shrub layer.
6	Mixed shrublands with *Eremophila decipiens* subsp. *decipiens, Ptilotus helipteroides* and *Senna artemisioides* subsp. *filifolia* over *Eriachne pulchella grassland. Acacia* spp.[2] not forming dominant shrubland strata.
7	*Allocasuarina dielsiana* and *Acacia acuminata* open woodland over *Melaleuca eleuterostachya*, *Eremophila oldfieldii* and *Thyridolepis multiculmis* shrubland.
8	*Melaleuca stereophloia and Allocasuarina acutivalvis* subsp. *prinsepiana* open woodland over *Eremophila georgei, Grevillea didymobotrya* subsp. *didymobotrya* and *Acacia acuminata* shrubland.
9	*Acacia latior* dominated woodlands over *Gastrolobium laytonii, Calycopeplus paucifolius* and *Philotheca deserti* low open shrublands over *Eriachne benthamii* grass.
10	*Allocasuarina campestris* dominated woodlands over *Micromyrtus* sp. *A*[1], *Cryptandra* sp.[3] and *Calycopeplus paucifolius* low open shrubland over *Eriachne pulchella* low open grassland

[1] Species awaiting formal identification
[2] plural species
[3] singular species

As a function of the survey, two conservation significant flora taxa were identified within two quadrats:

- *Drummondita fulva* (Priority 1, *WC Act*); and
- *Grevillea scabrida* (Priority 3, *WC Act*).

These species are restricted to the local government areas of Perenjori and Yalgoo. DPaW records indicate they have been recorded outside the MMP area. *D. fulva* was recorded by APM in the western part of M59/425 in 2012. *G. scabrida* has been recorded in the MMP area by a number of surveys and was found by APM (2012) to be widespread within M59/425, particularly in the northern section of the tenement. These two taxa were identified as occurring within the designated survey quadrats. Follow-up survey work will be required to determine the distribution and density of these species across the site and will better enable the final selection of sites for mining infrastructure and overburden dumps.

Document Name: 20170217_Fig3-2_EPA Ref

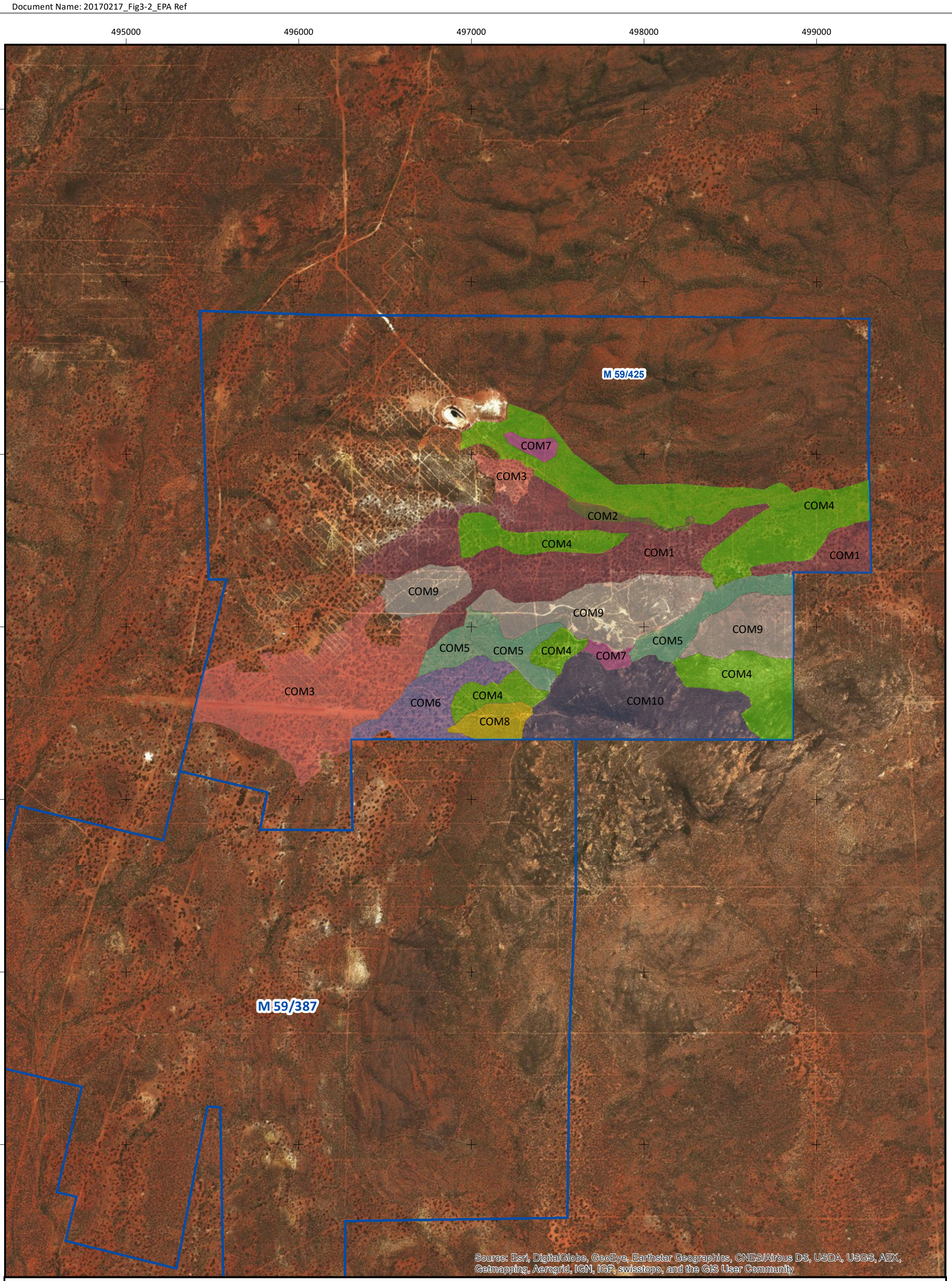


Figure 3-2: Vegetation Communities of the Mt Mulgine Project Area

Legend

- Community 1
- Community 2
- Community 3
- Community 4
- Community 5
- Community 6
- Community 7
- Community 8
- Community 9
- Community 10
- *Tenements*

N

0 0.5 1 2 3 4 Kilometers

17/02/2017

GDA 1994 MGA Zone 50 1:20,000 ems@animalplantmineral.com.au / (08) 6296 5155

\\MAINSERVER-PC\server storage\APM GIS and Mapping\03_Client\TUN\02_GIS Maps\20170217_Fig3-2_EPA Ref.mxd

3.5 FAUNA AND HABITAT

3.5.1 Terrestrial Fauna

Local and regional environmental values

The MMP is located east of the Blue Hills Range and is physiologically different. The site is not representative of BIF which is of conservation value. The former Warriedar pastoral lease is managed by DPaW who undertake activities such as feral animal and kangaroo control, research and biological surveys.

Current Status

Historic mining and exploration has altered the vegetation and landscape within the MMP area. However, native vegetation has re-established across the site and now provides suitable habitat for conservation significant Shield-backed Trapdoor Spider and Western Spiny-tailed Skink.

Surveys and Investigations

Desktop Assessment

A search of the *EPBC Act* list for MNES indicated 12 fauna species of conservation significance have the potential to occur in habitats that may be present within 10 km of the Project area. The 12 species comprise ten birds, one invertebrate and one reptile.

A search of NatureMap indicated up to 81 fauna species have the potential to occur, comprising of seven invertebrates, 13 reptiles, seven mammals (including three feral taxa), and 54 birds.

A search of DPaW's Threatened and Priority Fauna database identified eight conservation significant fauna previously recorded within a 35 km radius of the MMP area.

Site Investigations

The most recent fauna survey undertaken within the MMP area was carried out by APM in 2016, the full report is included as Appendix 4.

The field survey targeted conservation significant fauna having a high likelihood of occurrence based on the vegetation and habitats present. The survey was carried out over 6 days from 22/11/2016 to 27/11/2016. The survey identified one conservation significant fauna species listed under the *EPBC Act* and *WC Act*:

- *Idiosoma nigrum*, Shield-backed Trapdoor Spider (Vulnerable, *EPBC Act, Threatened, WC Act*).

Suitable habitat for the following conservation significant fauna taxa listed under the *EPBC Act* and *WC Act* was identified within the Project area:

- *Egernia stokesii badia*, Western Spiny-tailed Skink (Endangered, *EPBC Act, Vulnerable, WC Act*)

Two Malleefowl mounds recorded in 2012 were re-visited during the survey to confirm their presence. Both mounds were historic.

Conservation significant fauna habitat within the MMP is described as:

- *Eucalyptus* open woodland on mixed shrubland over *Austrostipa* grassland over sandy loam soil; and
- *Allocasuarina* woodlands over mixed low open shrubland over *Eriachne* low open grassland over sandy soils with exposed aggregate. The focal area of this conservation significant fauna habitat is the deep valley and south facing slope.

The location of Shield-backed Trapdoor Spider and Western Spiny-tailed Skink habitat is presented in Figure 3-3 and Figure 3-4 respectively.

3.5.2 Subterranean Fauna

Local and regional environmental values

A stygofauna survey was undertaken in July 2009 (Outback Ecology Services, 2009) along a 20 km strike of gold bearing horizon in the greater MGP area. In addition, two shallow pastoral wells and four deep water bores installed during the previous mining phases were also sampled. The deep bores (30 m depth), contained no Stygofauna. One shallow pastoral well intersecting the alluvial aquifer sampled positive for Stygofauna.

A survey of the Greater Karara Iron Ore Project west of the Project area had low to no stygofauna yields from fractured rock aquifers. Desktop studies have also concluded the area does not provide significant habitat for stygofauna.

Current Status

Given stygofauna were only recorded from the alluvial perched aquifer, stygofauna of the area may be confined to shallow alluvial aquifers. Impacts to stygofauna are not expected due to the lack of connectivity between the perched alluvial aquifer and the fractured rock aquifer.