

**MUNGANA GOLDMINES LTD**  
**Mungana Gold Open Pit Development**  
**Initial Advice Statement**  
**August 2009**







# **Mungana Goldmines Ltd**

## **Mungana Gold Open Pit Development Initial Advice Statement**

Mungana Goldmines Ltd  
August 2009



# Table of Contents

<b>1. Introduction</b>	<b>1</b>
1.1 Project Overview	1
1.2 Project Location	2
1.3 Project Tenements and Land Ownership	2
<b>2. Proposed Project Activities</b>	<b>9</b>
2.1 Current Development and Proposed Activities	9
2.2 Environmentally Relevant Activities	9
2.3 Land Disturbance and Topsoil Stripping	10
2.4 Mining and Haulage of the Deposits	10
2.5 Processing Activities	11
2.6 Transport	14
2.7 Waste Rock	14
2.8 Tailings Storage Facility (TSF)	15
2.9 Pit Geotechnical Stability	16
2.10 Water Requirements	16
2.11 Power Supply	16
2.12 Equipment, Staffing and Accommodation	16
2.13 General Infrastructure	17
<b>3. Description of the Existing Environment</b>	<b>19</b>
3.1 Environmentally Sensitive Areas	19
3.2 Regional Climate	20
3.3 Current Land Use	20
3.4 Geology	24
3.5 Hydrogeology and Groundwater	27
3.6 Surface Water and Drainage	28
3.7 Soils and Land Suitability	28
3.8 Terrestrial Flora and Fauna	31
3.8.1 Flora	31
3.8.2 Fauna	36
3.9 Vibration	40
3.10 Noise	41
3.11 Air	41
3.12 Cultural Heritage	42
3.12.1 Indigenous Cultural Heritage	42

3.12.2	Non Indigenous Cultural Heritage .....	42
3.13	Native Title .....	43
3.14	Community .....	43
<b>4.</b>	<b>Community Consultation.....</b>	<b>45</b>
4.1	Interested Persons .....	45
4.2	Affected Persons .....	45
4.3	Consultation Process .....	45
<b>5.</b>	<b>EIS Trigger Criteria.....</b>	<b>46</b>
<b>6.</b>	<b>References .....</b>	<b>48</b>

#### List of Tables

<b>Table 1:</b>	<b>Current Tenement Details .....</b>	<b>2</b>
<b>Table 2:</b>	<b>Environmentally Relevant Activities .....</b>	<b>9</b>
<b>Table 3:</b>	<b>Disturbance .....</b>	<b>10</b>
<b>Table 4:</b>	<b>Mungana Gold Open Pit Material Mining Schedule .....</b>	<b>11</b>
<b>Table 5:</b>	<b>Consumables used in processing plant.....</b>	<b>13</b>
<b>Table 6:</b>	<b>Regional Ecosystems Occurring Within the Current Lease Area .....</b>	<b>31</b>
<b>Table 7:</b>	<b>Flora of conservation significance and likelihood of occurrence within the development area .....</b>	<b>35</b>
<b>Table 8:</b>	<b>Fauna species of conservation significance and likelihood of occurrence within the development area.....</b>	<b>38</b>
<b>Table 9:</b>	<b>Cultural Heritage Significance.....</b>	<b>43</b>
<b>Table 10:</b>	<b>Interested Persons .....</b>	<b>45</b>
<b>Table 11:</b>	<b>Affected Persons .....</b>	<b>45</b>
<b>Table 12:</b>	<b>EIS Trigger Criteria.....</b>	<b>46</b>

#### List of Figures

<b>Figure 1:</b>	<b>Location.....</b>	<b>5</b>
<b>Figure 2:</b>	<b>General Arrangements .....</b>	<b>6</b>
<b>Figure 3:</b>	<b>Tenure Map .....</b>	<b>7</b>

<b>Figure 4: Sensitive Areas.....</b>	<b>21</b>
<b>Figure 5: Mean Monthly Rainfall – Chillagoe Atherton St Station (No. 030140) 1902 – present .....</b>	<b>23</b>
<b>Figure 6: Mean Monthly Temperature – Mareeba Airport Station (No. 030140) 2000 – present .....</b>	<b>23</b>
<b>Figure 7: Annual Wind Rose 2004–2005 for the Mungana Area (NMA 2007) .....</b>	<b>24</b>
<b>Figure 8: Mungana Geological Overview .....</b>	<b>25</b>
<b>Figure 9: Regional Ecosystems and Flora and Fauna Observations .....</b>	<b>29</b>
<b>Figure 10: Revised Regional Ecosystems and Flora and Fauna Observations .....</b>	<b>33</b>



# 1. Introduction

This Initial Advice Statement (IAS) has been prepared by Mungana Goldmines Ltd (MGM) (ACN 136 606 338), a wholly owned subsidiary of Kagara Ltd. As part of its Red Dome Project (located 15 km west of Chillagoe in north Queensland (**Figure 1**)), MGM is seeking to develop an open pit gold mine known as the Mungana Gold Open Pit Development (MGOPD).

A pre-lodgement meeting was held with the Department of Environment and Resource Management (DERM) on 7 July 2009 to discuss the proposed development and possible assessment pathway. MGM subsequently elected to prepare a voluntary Environmental Impact Statement (EIS).

MGM applied to the Chief Executive under Sections 70 and 71 of the *Environmental Protection Act 1994* (EP Act) for approval to prepare a voluntary EIS. This IAS provides supporting information for the EIS application.

## 1.1 Project Overview

The development would involve open pit mining of a gold resource at a rate of approximately 1.2 million tonnes a year, adjacent to polymetallic reserves currently being mined from underground at Mungana. The project would be situated primarily on the existing Red Dome Project leases and the project life would be approximately 3.5 years.

Red Dome Gold Mine operated from 1988 until 1997 and included open pit mining, production of gold ore and gold/copper concentrates via heap leaching, carbon-in-pulp (CIP), carbon-in-leach (CIL) and flotation processes. Rehabilitation of the site was carried out while the mine was operational and following the cessation of mining (**Figure 2**).

Kagara Ltd recommenced operations at the Red Dome leases in 2006 to bring several polymetallic lenses into production and currently operates an underground polymetallic mine on the leases (**Figure 2**). Current mining activities are carried out under the following approvals.

- Environmental Authority (EA) No. MIN100610207, dated 21 August 2008.
- Red Dome Project – Mungana Development Environmental Management Plan, August 2007 (Amendment 1, February 2008).
- Plan of Operations, 15 April 2008 – 15 April 2013.

The current EA allows for underground mining and the construction of associated infrastructure such as offices, workshops, power corridor, roads, and water impoundments. As at August 2009, a polymetallic processing plant has been constructed to 52% completion on site and a tailings storage facility (TSF) has been constructed to 95% completion.

The MGOPD would use the infrastructure originally intended for processing polymetallic minerals, with modifications for gold and copper recovery such as additional crushing and grinding, copper flotation filtration, CIL process, elution circuit, gold room and a cyanide treatment circuit.

The proposed pit would have a depth of about 250 m and an area of about 21.2 ha. Development would include construction of waste dumps (non acid forming (NAF) and potential acid forming (PAF)), extension of the Run of Mine (ROM) area, subsoil and topsoil stockpiles and additional accessways (**Figure 2**).

The Red Dome Project, including the development of an open pit, was referred to the then Department for Environment and Heritage under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) in 2006. On 3 April 2006, the Department for Environment and Heritage determined the project to be ‘Not a Controlled Action’ provided that it is undertaken in a ‘Particular Manner’ which the Commonwealth government specified in their decision notice.

## 1.2 Project Location

The MGOPT would be situated principally on the existing Red Dome Project leases, which lie 15 km west of Chillagoe, within the Tablelands Regional Shire (TRC) local government area (**Figure 1**). Chillagoe is 140 km west of Mareeba (the nearest TRC service centre) and approximately 210 km west of Cairns, the nearest regional city.

## 1.3 Project Tenements and Land Ownership

Details of relevant Red Dome Project Mining Leases (MLs) are shown in **Table 1**. The affected leases are ML 4928, ML 4977, ML 5176 and ML 5319 (**Figure 3**). An area potentially required for waste storage lies outside the existing MLs on EPM 15458 and an application for a mining lease over this area is in process.

**Table 1: Current Tenement Details**

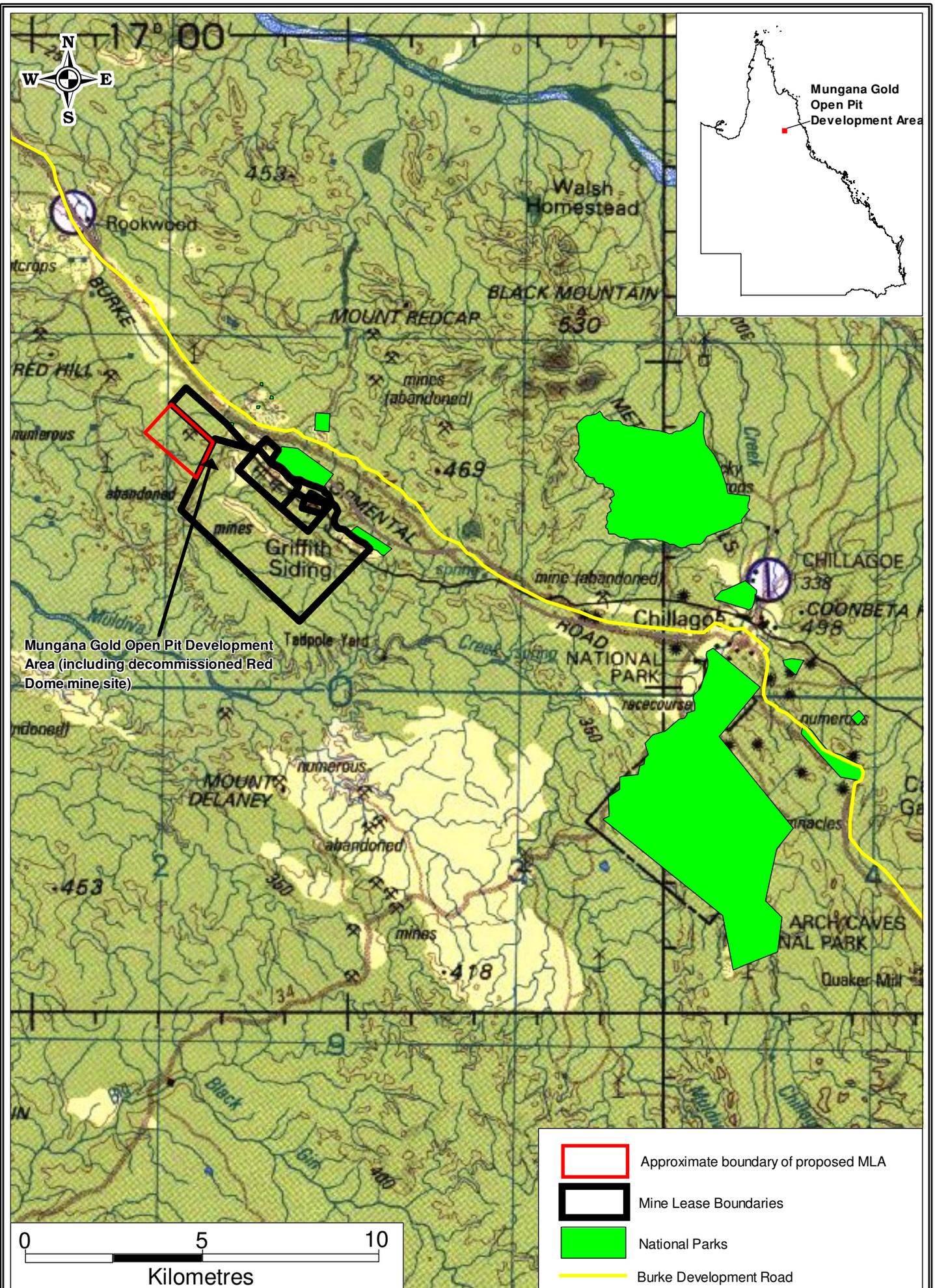
Lease #	Lease Area (ha)	Lease Term Expiry Date	Background Land Owner	Lot #	Plan #	Landowner's Address
4928	127.8	31/03/2011	Kagara Ltd	Lot 600	SP101788	Kagara Ltd, 2 <sup>nd</sup> Floor 24 Outram St, West Perth WA 6005
			DERM	Lot 1	MPH24857	DERM, PO Box 156 Mareeba QLD 4880
			DERM	Lot 12	USL22005	DERM, PO Box 156 Mareeba QLD 4880
			Queensland Rail	Lot 1271	SP102246	Queensland Rail Property Division, GPO Box 1429 Brisbane QLD 4001
4977	65.19	30/11/2019	Kagara Ltd	Lot 600	SP101788	Kagara Ltd, 2 <sup>nd</sup> Floor 24 Outram St, West Perth WA 6005
5176	1238	31/10/2006 (renewal application lodged prior to 30 April 2006)	Kagara Ltd	Lot 600	SP101788	Kagara Ltd, 2 <sup>nd</sup> Floor 24 Outram St, West Perth WA 6005
			DERM	Lot 12	USL22005	DERM, PO Box 156 Mareeba QLD 4880
			DERM	Lot 73	L215US64	DERM, PO Box 156 Mareeba QLD 4880
			DERM	Lot 74	USL21564	DERM, PO Box 156 Mareeba QLD 4880
			DERM	Lot 15	USL22005	DERM, PO Box 156 Mareeba QLD 4880
Kagara Ltd	Lot 3	SP139719	Kagara Ltd, 2 <sup>nd</sup> Floor 24 Outram St, West Perth WA 6005			

<b>Lease #</b>	<b>Lease Area (ha)</b>	<b>Lease Term Expiry Date</b>	<b>Background Land Owner</b>	<b>Lot #</b>	<b>Plan #</b>	<b>Landowner's Address</b>
5319	125.5	31/03/2011	TRC	45	CP851407	TRC, 65 Rankin Street Mareeba QLD 4880
			DERM	60	USL21564	DERM, PO Box 156 Mareeba QLD 4880
			DERM	12	USL22005	DERM, PO Box 156 Mareeba QLD 4880
			RG, RD, PL, IA and IM Ferguson	4	BW18	RG, RD, PL, IA and IM Ferguson c/- Rookwood Station Chillagoe QLD 4871

DERM – Department of Environment and Resource Management

TRC – Tableland Regional Council

This page left intentionally blank



PROJECT: Red Dome Project: Mungana Gold Open Pit Development  
 TITLE: Location

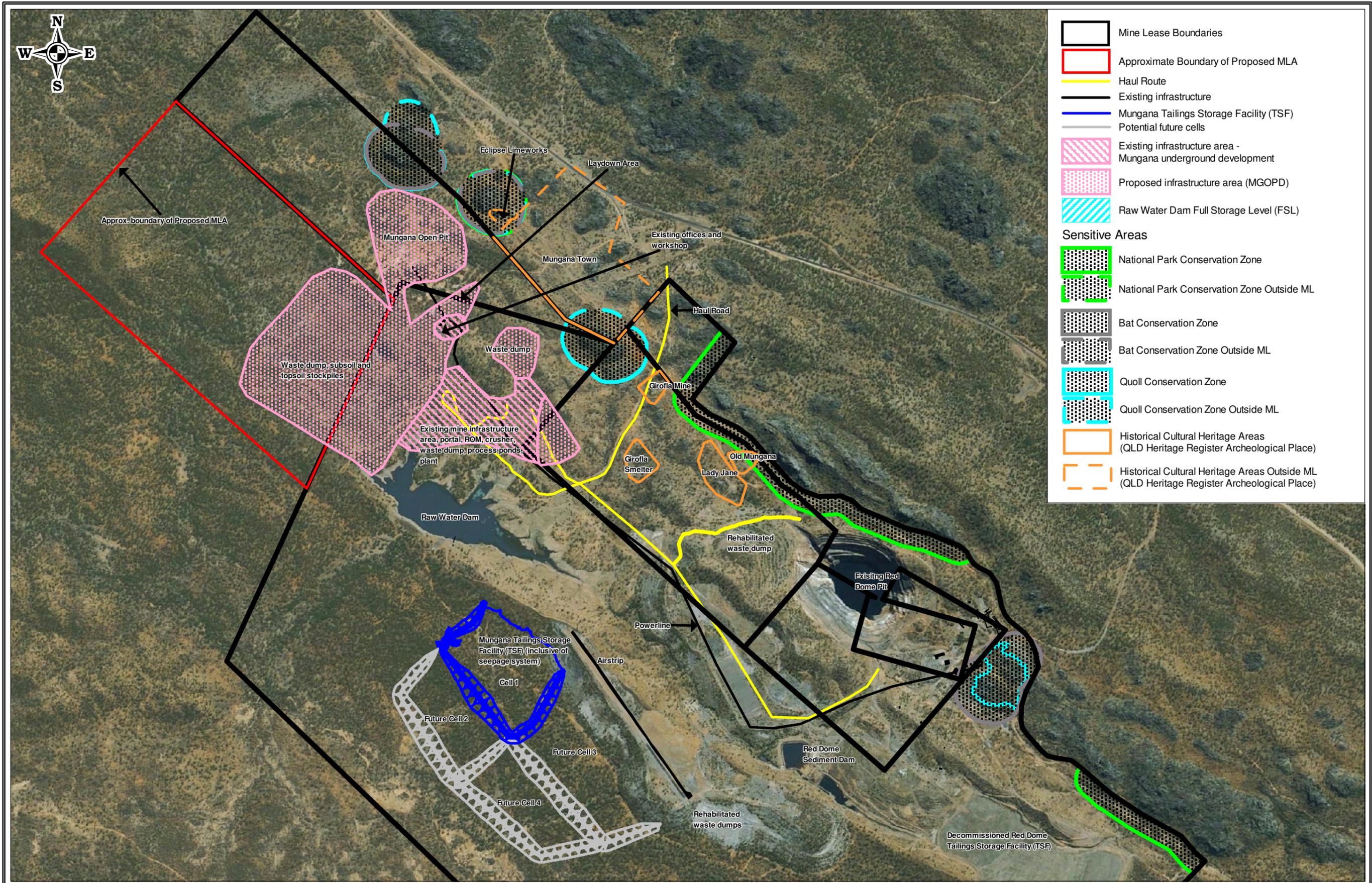
JOB NO: 2301000.02  
 DATE: August 2009  
 SOURCE: NRA, MGL

Natural Resource Assessments



ENVIRONMENTAL CONSULTANTS

Figure 1



-  Mine Lease Boundaries
  -  Approximate Boundary of Proposed MLA
  -  Haul Route
  -  Existing infrastructure
  -  Mungana Tailings Storage Facility (TSF)
  -  Potential future cells
  -  Existing infrastructure area - Mungana underground development
  -  Proposed infrastructure area (MGOPD)
  -  Raw Water Dam Full Storage Level (FSL)
- Sensitive Areas**
-  National Park Conservation Zone
  -  National Park Conservation Zone Outside ML
  -  Bat Conservation Zone
  -  Bat Conservation Zone Outside ML
  -  Quoll Conservation Zone
  -  Quoll Conservation Zone Outside ML
  -  Historical Cultural Heritage Areas (QLD Heritage Register Archeological Place)
  -  Historical Cultural Heritage Areas Outside ML (QLD Heritage Register Archeological Place)

0 500 1000  
Meters

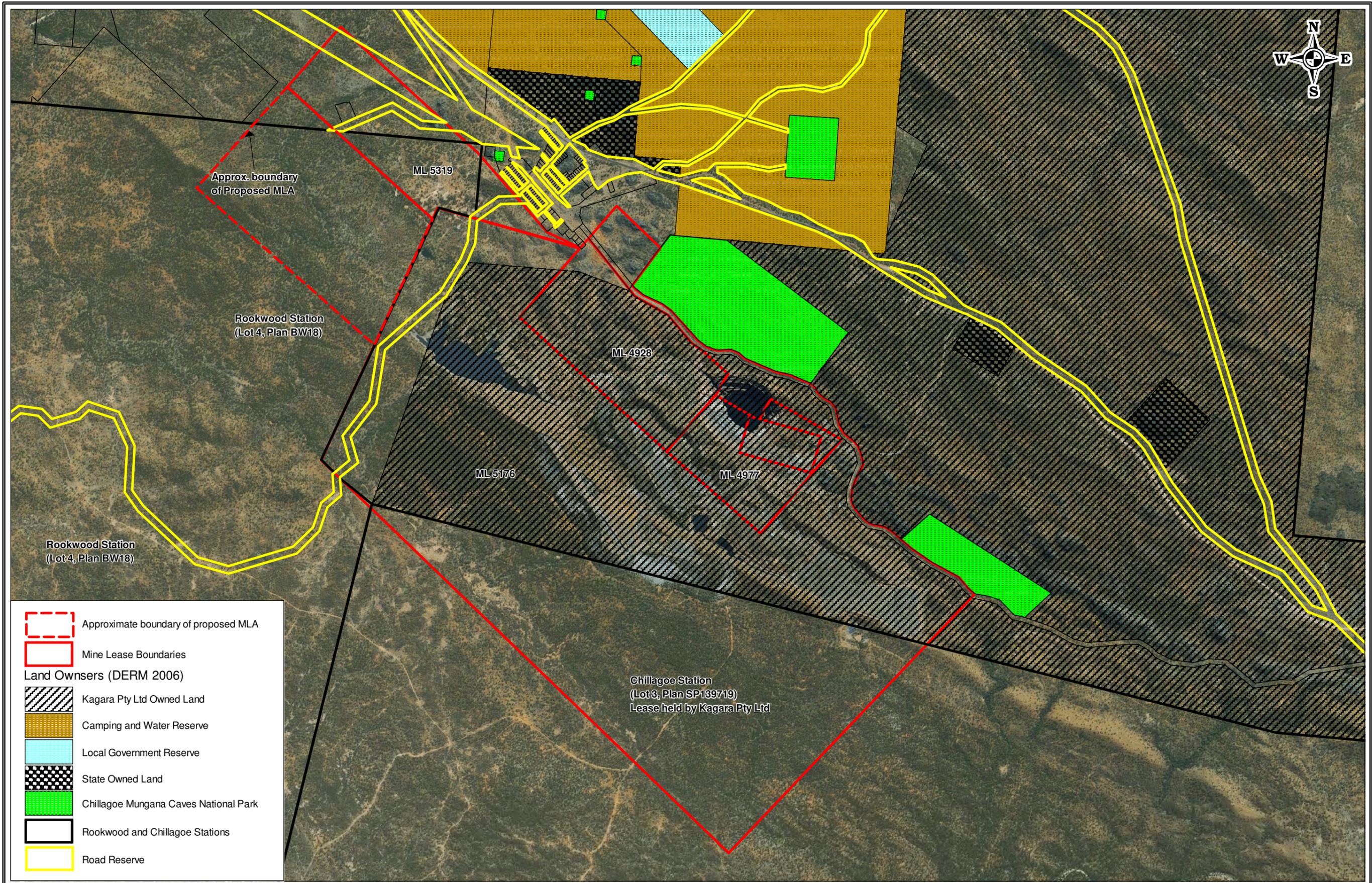
PROJECT: Red Dome Project: Mungana Gold Open Pit Development  
 TITLE: General Arrangements  
 T:\\_AAA\2301000\2301000\_02\2301000\_02\_Mungana Gold General Arrangements\_2009\_08\_13.wor

JOB NO: 2301000.02  
 DATE: August 2009  
 SOURCE: NRA, MGL, AWA

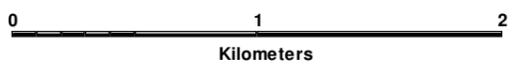


Figure 2

Recommended print size: A3



Approximate boundary of proposed MLA  
 Mine Lease Boundaries  
**Land Owners (DERM 2006)**  
 Kagara Pty Ltd Owned Land  
 Camping and Water Reserve  
 Local Government Reserve  
 State Owned Land  
 Chillagoe Mungana Caves National Park  
 Rookwood and Chillagoe Stations  
 Road Reserve



PROJECT: Red Dome Project: Mungana Gold Open Pit Development  
 TITLE: Tenure Map  
T:\AAA\230\WOR\2301000\_02\2301000.02\_Mungana Gold Tenure Map\_2009\_08\_13\WOR

JOB NO: 2301000.02  
 DATE: August 2009  
 SOURCE: NRA, MGL, DERM



Figure 3



## 2. Proposed Project Activities

Sections 2.1 to 2.14 describe the mining, processing and rehabilitation activities that are proposed for the project.

### 2.1 Current Development and Proposed Activities

The existing site arrangements are illustrated on **Figure 2**. The polymetallic processing plant was designed for treatment of up to 650,000 tonnes per annum of ore to produce predominantly copper, lead and zinc concentrates, with concentrates transported to Townsville for smelting/refining at Sun Metals Corporation in Townsville or shipped overseas.

The Mungana gold reserve is located above the Mungana base metal and porphyry lodes. The mineralisation is hosted by porphyry, breccias, skarns and sandstone rock units. The gold mineralisation extends from the surface (approximately 2330 mRL) to 1600 mRL (more than 730 m below surface). The proposed open pit would allow mining of the ore from surface to 2080 mRL, a vertical distance of 250 m. Associated with the gold reserve is the BMU zinc ore resource. This zone consists of transitional base metal ore.

It is proposed that material above the economic cut-off grade be mined by selective open pit mining methods to produce approximately 140,000 recoverable ounces of gold, with 4.7 million ounces of silver and approximately 55,000 tonnes of copper/gold concentrate. The current base metal plant will be modified with the addition of a CIL/CIP circuit, elution and gold room, to process approximately 3,100,000 tonnes of ore grading at 1.5 g/t of gold and 0.5 % copper over approximately a 3.5 year life.

### 2.2 Environmentally Relevant Activities

Environmentally Relevant Activities (ERAs) (as defined in the *Environmental Protection Regulation* 2008) that have been or will be conducted on site are summarised in **Table 2**.

**Table 2: Environmentally Relevant Activities**

ERA	Activity <sup>#</sup>
7	Chemical manufacturing, processing or mixing
8	Chemical storage (including petroleum storage)
16	Extracting rock or other material
17	Abrasive blasting
31	Mineral processing to produce mineral concentrates in works having a design capacity of more than 100,000 tonnes per year
43	Concrete batching
60	Waste disposal – disposal of general waste at a rate of more than 50 tonnes per annum.
61	Incinerating waste* (explosive packaging only)
63	Sewage treatment

<sup>#</sup> Mining (encompassing extraction, crushing and ultimate milling of rock for mineral recovery) is an ERA and authorised by MIN100610207.

\* Conducted in a fire training area on site.

## 2.3 Land Disturbance and Topsoil Stripping

Current disturbance within the Red Dome Project lease area comprises:

- 389 ha – rehabilitated or undergoing rehabilitation (disturbance associated with the Red Dome Gold Mine)
- 161 ha – disturbance area approved for the Mungana polymetallic underground mine (2008–2013 Plan of Operations).

The MGOPTD will result in a total of 139.4 hectares of additional disturbance. The components of the additional disturbance are shown in Table 3.

**Table 3: Disturbance**

Site	Disturbance (ha)
Pit	21.2
Pit Roads	2.7
Waste Dump 1	73.0
Waste Dump 2	4.6
Subsoil stockpiles	10.7
Topsoil stockpiles	12.9
ROM Extensions	4.5
WRD Dam (potential)	0
Site Access Road	3
Workshop	1.2
Fuel Facilities	0
Office	0
Truck Park	3.6
Magazine	1
Mill Extension	1
<b>Total Area</b>	<b>139.4</b>

## 2.4 Mining and Haulage of the Deposits

### Open Pit

The pit will produce 47.0 million tonnes of waste, 3.0 million tonnes of gold bearing ore and 0.2 million tonnes of polymetallic ore. It is currently proposed to mine the open pit in three stages to optimise the mill feed.

The operations will involve blast hole drilling, sampling, blasting, wall control, designation of material types, selectively excavating material into dump trucks, and creation of waste rock dump to specific designs. Material will be selectively stockpiled on the ROM pad, waste dumps, or utilised in the tailings dam wall construction. Downstream sediment control structures will be provided.

Given that a dewatering program has been in place for the underground mine (beneath the open pit location) since 2006, it is anticipated that pit dewatering activities will be limited to the removal of rainwater with only minor inflow of ground water.

## Mining Rate

The mining rate is determined by the milling requirements and the depth at which material is mined. **Table 4** provides the current mining schedule based upon 0.5 g/t gold as a cut-off grade. Pit development will commence in October 2010, to achieve mill feed in April 2011. The highest annual mining rate will be 22.5 million tonnes in the 2011–2012 financial year.

**Table 4: Mungana Gold Open Pit Material Mining Schedule**

Date	Mining Waste*	Gold Ore*	Polymetallic Ore*	Gold Milling*	Polymetallic Milling*
2010–11	15,820,874	379,107		316,134	
2011–12	25,181,573	1,082,067	72,052	1,217,133	70,000
2012–13	6,023,003	1,485,876	139,023	1,264,536	70,000
2013–14	0	35,750	0	311,296	71,075
<b>Total</b>	<b>47,025,451</b>	<b>2,982,799</b>	<b>211,075</b>	<b>3,109,099</b>	<b>211,075</b>

\* All figures are in tonnes and include rehandling.

## 2.5 Processing Activities

### Test Work Program

A test program will be carried out to determine plant design criteria required for optimum gold recovery. Test work will be carried out on composite samples reflecting the three main ore types which will be encountered (oxide, transitional and fresh) and will comprise:

1. Leaching tests at various grind sizes
2. Flotation tests to recover copper, then leaching of the flotation tailings.
3. Bond work index determinations of the major ore types.

Settling tests will also be carried out on the flotation tailings to determine thickener requirements.

### Processing Plant Design Parameters

The key processing plant design parameters to be determined are as follows.

- Grind size required for optimum copper and gold recovery in flotation and cyanide leaching.
- The relative hardness of each ore type and an estimate of the power required in the full-scale plant to achieve the throughput and grind size targets.
- Recoveries of copper, gold and silver to be expected in flotation as well as the reagents and pulp conditions required.
- Concentrate grades that can be achieved.
- Cyanide consumption in gold leaching of the flotation tailings.
- Gold and silver recovery in cyanide leaching.
- Time required for cyanide leaching.
- Flocculant and settling rate of the flotation and cyanide leach tailings.
- Reagent consumption and residence time required for the cyanide destruction process.

### Processing Plant Description

Construction of the Mungana polymetallic processing plant had reached 52% prior to work being halted due to the decline in commodities prices in 2008.

All earthworks, concrete, sheds and buildings, steelwork and fabrication were completed except for assembly of the Larox filter and associated conveyor. Outstanding construction work largely comprises plumbing, pipe work, cabling and instrumentation.

It is proposed that the crushing and grinding, a portion of the flotation circuit, and the wet plant (thickeners/concentrate storage/tailings pumps) polymetallic processing facilities be completed and utilised. The plant will be modified for gold production with the addition of a secondary crusher, flotation and tailings thickener, and a small CIL plant, elution circuit and gold smelting room. The modified plant will be contained within the existing disturbance footprint of the polymetallic processing plant.

### ***Crushing and Grinding***

The crusher and grinding circuit will be used as originally planned but a secondary crusher and sizing screen will be installed to treat the jaw crusher product. This will reduce the ore down to a size at which the existing SAG and ball milling circuit will have the capacity to treat up to 1,200,000 tpa. The grinding circuit will operate 24 hours a day, seven days a week.

### ***Copper Flotation and Filtration***

The presence of copper minerals in the ore will necessitate a flotation circuit which will consist of roughers and cleaners to produce a copper concentrate prior to the CIL process. Parts of the existing flotation circuit will be used to float then concentrate a copper product from the ore feed. Reagents used in flotation will essentially be similar to those planned for the Mungana base metals concentrator, with the additional requirement of a sulfur-adding reagent for the oxide material such as sodium sulfide or sodium hydrosulfide.

The flotation tailings will pass through a thickener to remove excess water prior to cyanide leaching. The supernatant water from the thickener will be re-used in the processing plant. Flotation concentrate will be dewatered on site using the pre-existing thickener and larox filtration circuit. All water from this area will be recycled to the process circuit.

### ***Carbon-in-leach process***

A typical CIL process will be utilised which uses cyanide to leach gold from the ground ore in agitated tanks and then activated carbon in the pulp to absorb the gold from the cyanide solution. The pregnant carbon containing the gold is then recovered from the pulp and undergoes treatment to recover the contained gold and silver in the gold plant.

The CIL circuit will consist of approximately eight agitated slurry tanks to give 24 hours' residence time. Cyanide will be added to the first tanks and air will be injected in the first four in sequence to improve leaching kinetics. Activated carbon will be present in the last six tanks to absorb the gold from the pulp. This carbon moves counter current to the slurry and is 1–3 mm in size, allowing it to be easily recovered from the pulps by screening. Once loaded with gold, the carbon is then recovered and transported to the elution circuit for treatment.

### ***Elution Circuit and Gold Room***

The activated carbon, which is loaded with gold, is treated in one to two tonne batches and is subjected to several processes in the elution circuit to recover the gold as bullion. First, the carbon is subjected to two washing processes to remove impurities, the first involving hydrochloric acid followed by another involving a cold cyanide solution. Once cleaned the carbon is then pumped into a stripping column where it is contacted with a hot cyanide solution to strip the gold. This pregnant gold solution is then sent to the gold room where the gold is recovered from solution using an electrowinning cell. The stripped, barren carbon is then cleaned and reactivated by passing it through an LPG-fired kiln at 400–600 °C, after which it is pumped back into the leach circuit.

The gold smelting room is a high security area containing both the electrowinning circuit and final smelting furnace for the processing of the gold into bullion.

#### **Cyanide Treatment Circuit and tailings deposition**

The CIL tail is passed over a final screen to recover any remaining carbon and is then pumped to a tailings thickener which will recover as much as possible of the pH buffered water containing cyanide in solution for re-use in the plant.

The thickened tailings will then be subjected to a cyanide treatment process to reduce cyanide levels to the required standard prior to disposal to the TSF.

#### **Consumables/Reagents**

**Table 5** outlines consumables which will be used in processing and their point of use. The consumption rates for each are based on estimates from previous test work as well as industry standards.

**Table 5: Consumables used in processing plant**

Reagent	Addition Points								Consumption			
	Crushing	Grinding	Flotation	Leaching	Concentrate Filtration	Elution + Gold Plant	Cyanide Reduction	Tailings	Process Water	Units	Annual Tonnes	
Mild Steel Balls										Kg/t	1.5-2.0	2100
Lime										Kg/t	2	2400
Sulphide collector										g/t	20	24
Oxide collector										g/t	100	120
Frother										g/t	20	24
Sodium Sulphide										kg/t	0.8	960
Activated Carbon										g/t	40	48
Cyanide										Kg/t	0.4-1.0	960
Metabisulphate										Kg/t	0.2-0.8	720
Flocculant										g/t	60	72
Antiscalant										g/t	10	12
LPG										l/t	0.5	600
Hydrochloric Acid										Kg/t	0.1	60

Additional cyanide storage and mixing facilities are required for the MGOPD and will be provided as a fully self-contained automated system which can be built and operated by the cyanide supplier. Cyanide will be delivered to site as a dry powder and immediately mixed to liquid as it is offloaded.

Investigations of processing requirements and transport arrangements indicate that dry cyanide will need to be stored on site over the wet season when access is limited.

## 2.6 Transport

Currently polymetallic ore from the Mungana underground base metals mine is hauled by road to Mt Garnet for processing. If economic, ore recovered from the BMU zinc resource as part of the MGOPTD will also be hauled to Mt Garnet for processing.

All ore haulage will be conducted using Type 2 configured roadtrains and will travel from Mungana to Mt Garnet via the Burke Development Road, Almaden–Gingerella-Sundown Road and the Kennedy Highway. It is expected that haulage activities will cease for the majority of the wet season.

All copper concentrate produced from the operation of the MGOPTD will also be hauled to Mt Garnet for blending then subsequent haulage to Townsville Port via existing routes for shipment overseas.

Concentrate haulage associated with the MGOPTD will comprise one extra roadtrain trip per day. The BMU Zinc ore will be hauled to Mt Garnet using the existing polymetallic ore haulage fleet. These combined activities trigger the notifiable road use criteria (*Mineral Resources and Other Legislation Amendment Act 2002*).

All freight during construction and operation of the MGOPTD will be transported to site either from Cairns via the Burke Development Road or from Townsville, or south via the ore haulage route. Gold doré will be transported from site by road or air under a security protocol.

## 2.7 Waste Rock

It is estimated that between 4.5 and 11.5 million tonnes of mined material will be PAF and between 35.5 and 42.5 million tonnes of the material will be NAF. A proportion of this NAF will have acid neutralising potential.

### Waste Rock Characterisation

Waste characterisation studies (waste rock, regolith and tailings geochemistry) were conducted on material associated with the Mungana polymetallic deposit. There is considerable overlap between this waste and that associated with the gold reserves.

Test work entailed the following.

- Acid-base chemistry – pH, EC, Total sulfur, sulfate-sulfur, acid neutralisation capacity, carbonate carbon and pH buffering properties, net acid producing potential (NAPP) and net acid generation (NAG).
- Multi-element analysis – geochemical abundance index (GAI)
- Mineralogy.

Test work was based on 25 waste bedrock samples from eight bedrock waste types. Selection intensity was based on the relative dominance of each and intensity varied from 1:1,800 tonnes to 1:116,000 tonnes. Samples were taken from drill cores which allowed definition of intervals of 1–2 m and so allowed assessment at the ‘metre-scale’.

Less detailed waste characterisation work was also conducted by Nuigini Mining as part of a proposal to mine the Mungana gold deposit in the 1990s.

Additional waste characterisation work will be undertaken during preparation of the EIS to provide data specific to the overburden, waste rock and tailings associated with the current open pit proposal. The data will be used in both the detailed pit design and in waste management planning.

## 2.8 Tailings Storage Facility (TSF)

The TSF (Cell 1) has been constructed (95% complete) for the Mungana polymetallic processing plant and will be suitable for the deposition of tailings from the gold plant.

The TSF is situated to the south of the Sentinel Range (**Figure 2**) in a site underlain by the Dargalong Metamorphics which consist of low primary porosity metamorphics which are not regarded as hydraulically conductive (AGE 2007). The TSF Design Concept Report and associated Groundwater Investigations Report prepared as part of the approval process for the Mungana polymetallic underground development will be reviewed, in the context of gold tailings geochemistry, as part of the EIS.

The TSF (Cell 1) was sized to accommodate all tailings produced by the 650,000 tpa polymetallic plant over five years of operation, as well as providing sufficient freeboard in accordance with regulatory requirements. As such there is sufficient capacity to accommodate all of the tailings produced by the proposed CIL circuit.

The TSF design includes the following components.

- Earth and rockfill embankment.
- Storage clay lining comprising conditioning and compaction of the *in situ* storage soils.
- Emergency spillway located on an abutment of the TSF and discharging to a tributary of Welcome Creek.
- Seepage collection system comprising an embankment underdrain, seepage collection sump and return water pump.
- Decant structure for the recovery of bleed tailings water and stormwater runoff from the beach areas.
- Tailings delivery line from the plant site to the TSF.
- Perimeter tailings deposition line with spigots.
- Return water line from the decant to the Process Pond.

TSF operation for the gold processing circuit is similar to that proposed for the base metals. The spigotting will be cycled to maximise air drying of the beaches. The recovery of water from the TSF will occur from a decant pond located on the northern perimeter of the TSF. The decant system will be operated such that the water volume within the decant area is generally kept to a minimum level. It is envisaged that a sled mounted recovery pump would be used to return water to the plant site.

A perimeter seepage collection system has been constructed for the TSF (Cell 1), and incorporates a subsurface drain downstream of the embankment grading to a collection sump to facilitate recovery of seepage and return to the TSF storage.

## 2.9 Pit Geotechnical Stability

The north and south walls of the proposed open pit are in fresh competent materials (sandstones and cherts), which will allow for high overall wall angles as per the existing Red Dome pit.

The Eclipse Cave Conservation Zone (100 m buffer from the base of the karst) is close to the crest of the proposed open pit in this area.

The eastern and western walls are affected by deep weathering and associated alteration and it is expected that any stability issues will be confined to this area.

Waste and geotechnical characterisation work will be used to optimise the pit design for stability and resource extraction. The mining of the final walls will involve smooth wall blasting and the firing of trim shot next to the pit wall. The main production blasts in the open pit will be managed via a Blast Management Plan, to achieve less than 140 dBL at the base of the limestone bluffs. It is anticipated that working bench heights will be 5 to 15 metres.

## 2.10 Water Requirements

The major changes to the existing water balance will be the collection of rainwater in the open pit and water consumption by the mill. In addition, sediment dam(s) may be constructed downstream of the development waste dump(s). It is expected that the project will have a positive water balance if the waste dump sediment dam(s) are not directly discharged. If water quality of the waste dump sediment dam(s) is such that discharge is permitted, then the overall water balance will be negative.

The existing Site Water Management Strategy will be reviewed as part of preparation of the EIS. This will include a risk assessment to determine the appropriate design criteria for any on site dams.

## 2.11 Power Supply

A new substation is required at Chillagoe to accommodate the energy needs of the processing facility. At the time of writing, construction is nearing completion, at a cost to Kagara of approximately \$1 million. The substation will provide electricity to the mine and a reliable supply to the local community.

## 2.12 Equipment, Staffing and Accommodation

The open pit will be developed using conventional mining equipment consisting of backhoe configured hydraulic excavators, off highway dump trucks, bulldozers, blast hole hydraulic drill rigs, water carts and road graders.

Machinery will be serviced on site in a purpose-built workshop with suitable concrete jacking pads. The refuelling bay will be configured for large dump trucks.

Approximately 140 personnel (including technical personnel) will make up the workforce for the open pit. A construction crew of about 40 will be required. All the personnel for the project will be accommodated at Chillagoe Camp, located on the outskirts of the Chillagoe township. This facility was constructed in 2007 and can accommodate 240 people.

## 2.13 General Infrastructure

The open pit will require the relocation of some existing surface infrastructure associated with the underground mine, including the exhaust fan and return air rise.

A gazetted road passes through the development footprint (**Figure 3**). The road will be closed (by application for road closure).

Telephone communications have already been established by the extension of the Telstra network a further 3 km along the Burke Development Road from Red Dome. There is mobile phone service available in the area although there is currently no reception in the plant area. UHF bandwidth radio communication at the plant site will be utilised.

Fire protection will be provided by:

- strategically located hydrants and reels connected to the process water distribution system
- a diesel-driven fire water pump for emergency use, located adjacent to the process water pumps at the process water dam
- portable fire extinguishers in high risk areas and site vehicles
- smoke detectors and alarms
- designated fire drill, practice and training area
- fire breaks (and associated maintenance thereof) around the project area.

The existing Post Mine Land Use Plan (PMLUP) documents the planned rehabilitation process, rehabilitation targets and measurable success criteria. The rehabilitation strategy and post mine land use targets nominated are based on the largely successful rehabilitation of the post mining landform at Red Dome Gold Mine. The PMLUP is designed to achieve the following broad outcomes.

- Where possible, areas disturbed during mining are progressively rehabilitated as soon as practicable following disturbance.
- Rehabilitation to establish stable landforms with land quality consistent with rehabilitation targets related to agricultural potential, but that do not compromise the establishment of vegetation communities that reflect the surrounding landscape.
- All infrastructure on site (including process water impoundments) will be decommissioned, removed and rehabilitated post mining, unless the written approval of the landowner and relevant regulatory authority is obtained.
- At mine closure, contaminated land will be investigated and remedied to a standard consistent with proposed post mine land use.

Note that the existing PMLUP incorporates measures to protect and rehabilitate habitat of listed flora and fauna species as required in the 'Not a Controlled Action – Particular Manner' decision by the Department of Environment, Water, Heritage and the Arts (DEWHA).

The PMLUP will be reviewed to include the disturbance areas and final landforms associated with the MGOPD. The general approach to rehabilitation of these areas and landforms is:

- Pit – to remain with catchment controls to ensure no discharge under prevailing climatic conditions. No post mine beneficial land use is envisaged.
- Waste dumps – potential acid forming material will be encapsulated with non acid forming or neutralising material to a design specification. On all dumps surface drainage and slope chutes will be provided to promote runoff. Maximum slope gradient and length will be specified to reduce erosion risk. Post mine land use will be low intensity grazing.
- Tailings Storage Facility – decommissioning of the TSF will be in accordance with a specific design report prepared in accordance with the Code of Environmental Compliance for Authorities for High Hazard Dams Containing Hazardous Waste (EPA *undated*). Decommissioning objectives are as follows.
  - Contaminated water no longer stored in the facility.
  - Containment embankment and its contents are structurally stable and resistant to erosion.
  - Seepage or other emissions from the facility will not cause environmental harm.
  - Capping of the TSF will comprise:
    - surface stabilisation layer – comprising a rock mattress
    - sealing layer – constructed using clay fill material
    - surface protection layer – constructed using selected waste rock.
- Plant and infrastructure – the process plant and other infrastructure (workshops, offices) will be dismantled and removed upon cessation of mining. Land contamination assessments and (if necessary) remediation works will be undertaken before areas are surfaced profiled, ripped and seeded.
- Roads – access roads required by the landholder will be retained (with written consent). Other access roads will be profiled, ripped and seeded.

## 3. Description of the Existing Environment

A number of environmental studies have been conducted at the project site. Environmental studies already completed or being undertaken include:

- General Environmental Studies – Red Dome EIS (Lewis Environmental Consultants 1983, 1985).
- North-west Mungana development studies (NRA 1995a, b, c).
- Terrestrial fauna surveys (ERMMM 1999; NRA 1995c; NRA 2007a, EPBC Referral 2006/2639).
- Surface water quality and ecology studies (John Lewis & Associates 1984; Lewis Environmental Consultants 1986; C&B 2001, 2002; NRA 2005a, b, c, d, e; NRA 2006a, b, c, d, e, NRA 2007c, d; NRA 2008; NRA 2009a, b, c).
- Groundwater studies (AGE 2006, 2007a).
- Contaminated land studies (IT Environment 1999; NRA 1995a).
- Vegetation and soil management (NRA 1995b).
- Rehabilitation studies (NRA 2004a).
- Archaeological and European cultural heritage studies (McNiven, 1988; Grimwade 1991a, b, 1992, 1993, 1994, 1995; NRA 2004b, Gordon Grimwade & Associates 2007).
- Noise, Vibration and Air Quality Assessment (NMA 2007).
- Ongoing consultation with stakeholders.

Additional studies will be undertaken in accordance with the Terms of Reference for the development.

### 3.1 Environmentally Sensitive Areas

A search of the DERM Ecomaps website (<http://www.epa.qld.gov.au/ecoaccess/ecomaps>) identified the following environmentally sensitive areas (**Figure 4**).

- Registered Heritage Places on the Queensland Heritage Register. The proponent nominated these areas for inclusion on the Register in 2007. The values of these sites are discussed further in **Section 3.12** of this IAS.
- Chillagoe-Mungana Caves National Park.

The proponent has nominated a 100 m conservation zone around national parks adjoining the MLs and around limestone karsts in or adjoining the MLs that provide potential habitat for listed fauna and flora species. Activities that can be carried out within the conservation zones are defined in the Referral approved under the EPBC Act.

Similarly, management of areas on the Queensland Heritage Register is carried out according to the Cultural Heritage Management Plan, which is provided in the current Plan of Operations.

## 3.2 Regional Climate

The climate of the area is monsoonal, with high rainfall in summer and early autumn, and relatively dry winters. **Figure 5** shows the mean annual rainfall for Chillagoe is 864.2 mm, with the highest monthly rainfall occurring in January (223.6 mm) and the lowest in July and August (4 mm). The greatest rainfall occurs in the wet season months from November to March inclusive (782.5 mm or 91%). The mean monthly maximum temperature for the area (**Figure 6**) ranges from 25.5 °C in July to 33.9 °C in December; the mean monthly minimum temperature ranges from 11.2 °C in July to 21 °C in February.

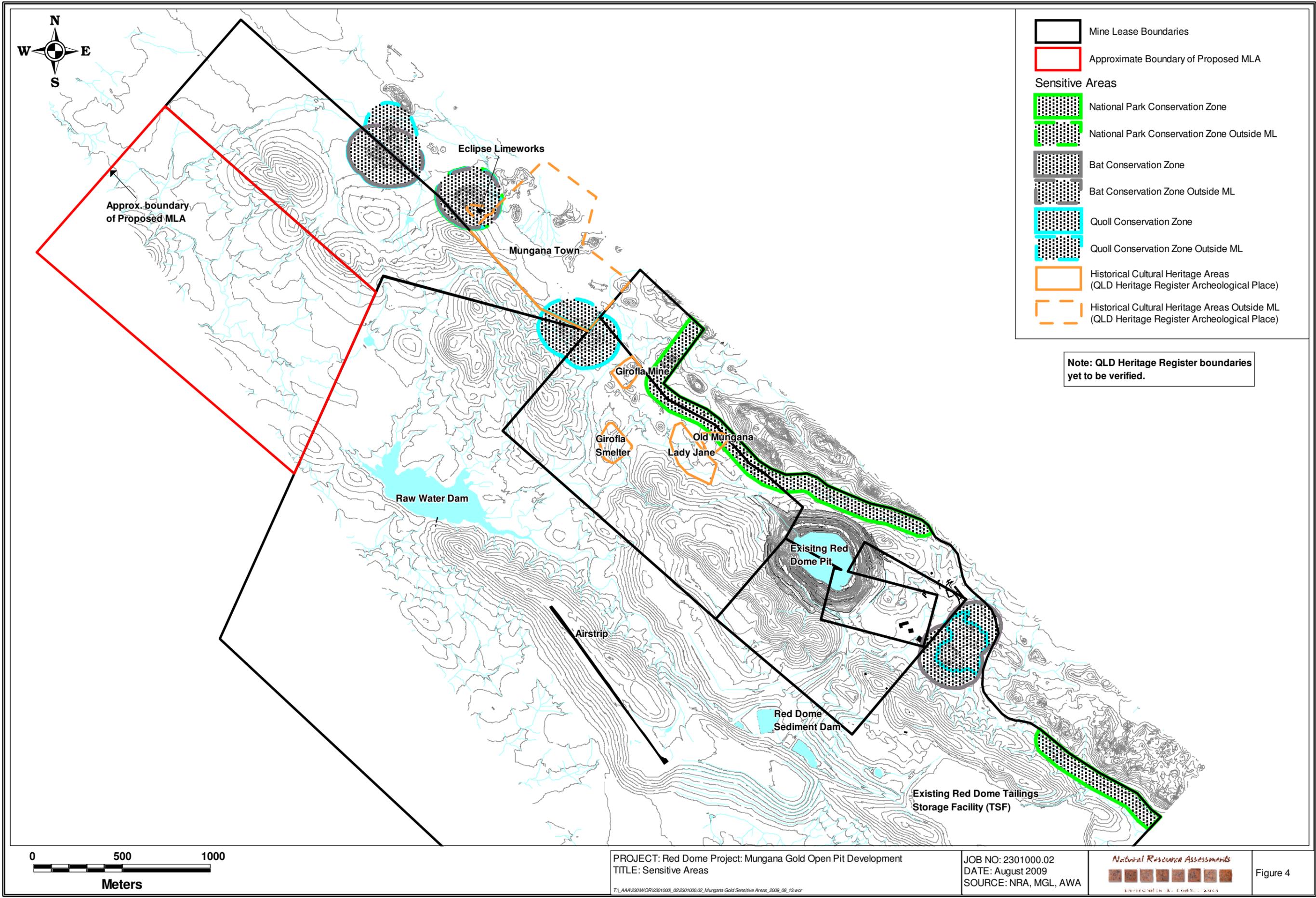
Meteorological conditions on site have been modelled using CSIRO's TAPM V3 model data from 2004 and 2005 (NMA 2007). Wind roses generated with the model show that the predominant wind direction during the year is easterly. Wind speed was generally between 5 and 9 knots (**Figure 7**).

## 3.3 Current Land Use

The pre-mining (contemporary) land use within the leases was low intensity grazing following historic mining activities from about 1898 to 1946. There is no history of large-scale cultivation in the area, but small market gardens may have operated at the time of historical mining activities.

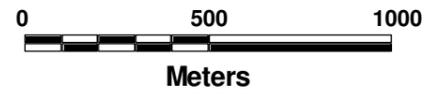
Large portions of the lease area (approximately 60% of the south-eastern lease area) were disturbed during the mining activities associated with the Red Dome Gold Mine (1986 to 1997). Rehabilitation was carried out progressively during operations and continued during closure and decommissioning.

Kagara Ltd currently mines a polymetallic resource (using underground mining) adjacent to the proposed open pit. Associated infrastructure such as stockpile, water impoundments, offices and workshops are in place and a polymetallic processing plant and TSF have been constructed to 52% and 95% completion respectively.



	Mine Lease Boundaries
	Approximate Boundary of Proposed MLA
<b>Sensitive Areas</b>	
	National Park Conservation Zone
	National Park Conservation Zone Outside ML
	Bat Conservation Zone
	Bat Conservation Zone Outside ML
	Quoll Conservation Zone
	Quoll Conservation Zone Outside ML
	Historical Cultural Heritage Areas (QLD Heritage Register Archeological Place)
	Historical Cultural Heritage Areas Outside ML (QLD Heritage Register Archeological Place)

Note: QLD Heritage Register boundaries yet to be verified.



PROJECT: Red Dome Project: Mungana Gold Open Pit Development  
 TITLE: Sensitive Areas

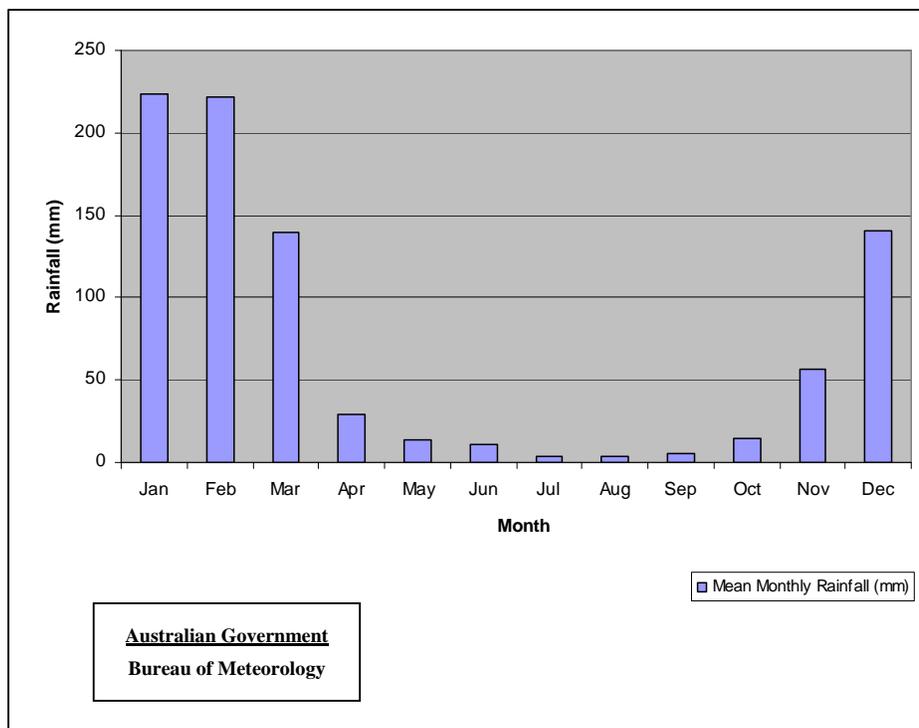
JOB NO: 2301000.02  
 DATE: August 2009  
 SOURCE: NRA, MGL, AWA



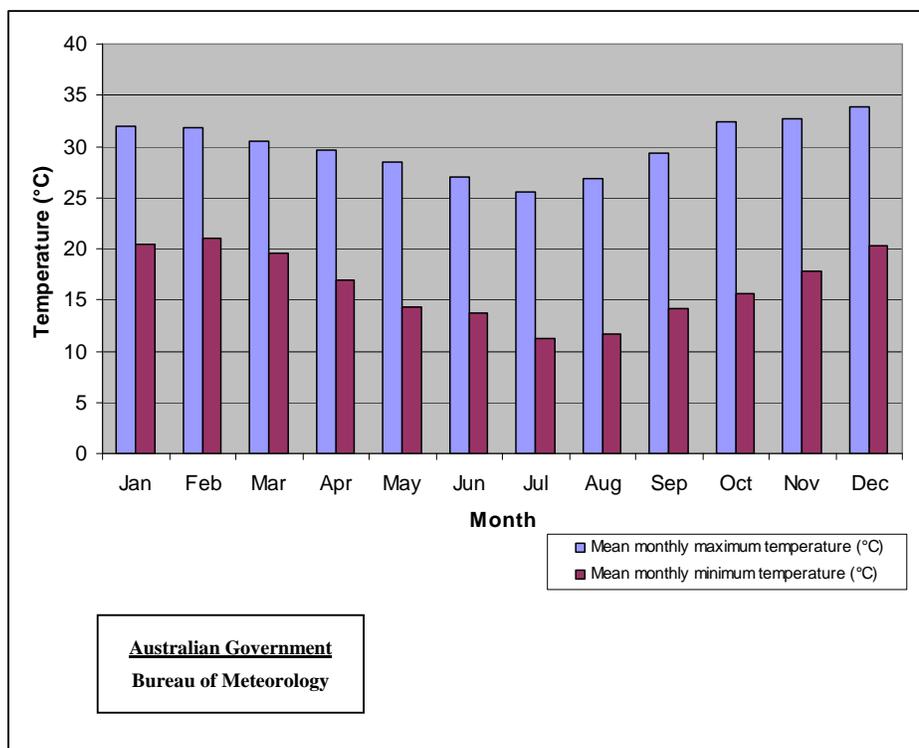
Figure 4

T:\\_AAA\2301\WOR\2301000\_02\2301000.02\_Mungana Gold Sensitive Areas\_2009\_08\_13.wor

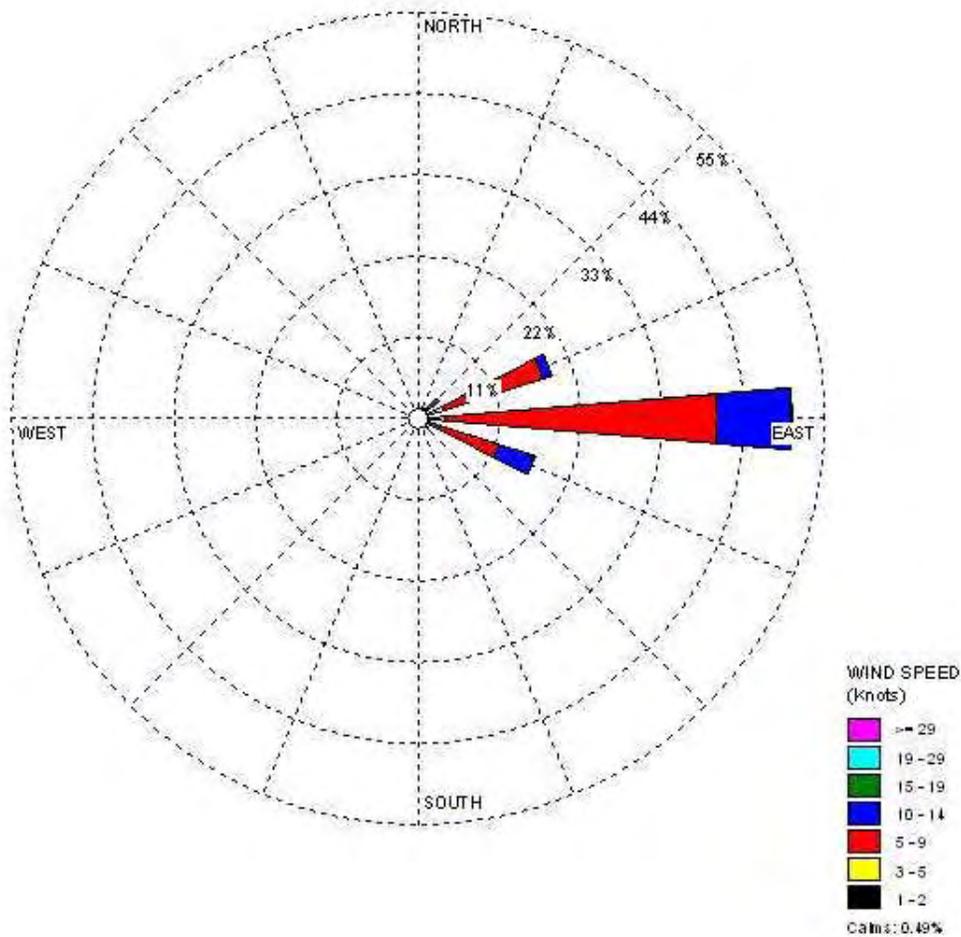




**Figure 5: Mean Monthly Rainfall – Chillagee Atherton St Station (No. 030140)  
1902 – present**



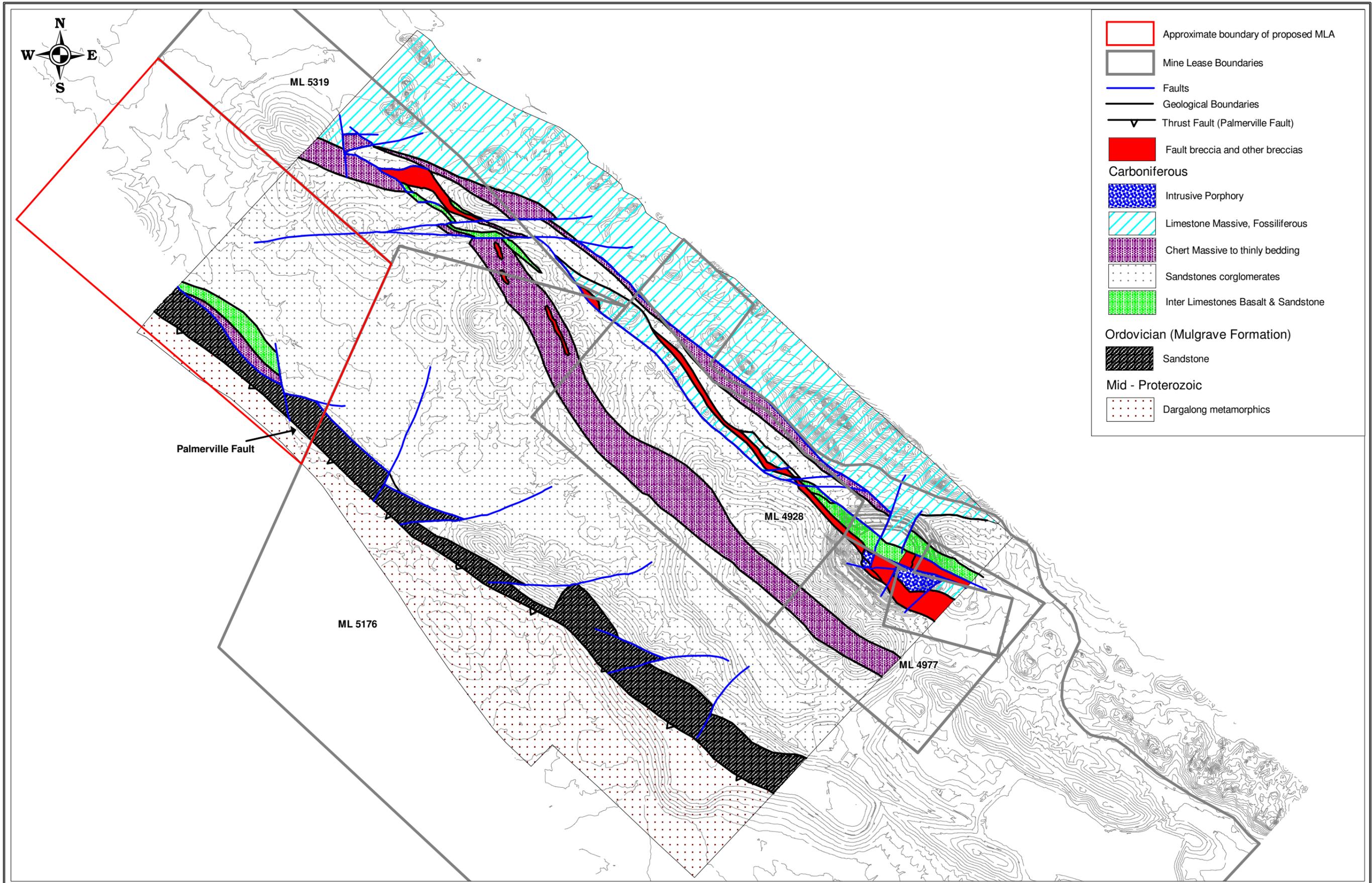
**Figure 6: Mean Monthly Temperature – Mareeba Airport Station (No. 030140)  
2000 – present**



**Figure 7: Annual Wind Rose 2004–2005 for the Mungana Area (NMA 2007)**

### 3.4 Geology

The Mungana polymetallic and gold deposit lies within the same north-west trending structural ‘corridor’ as the former Red Dome Gold Mine but three kilometres to the west-north-west. The corridor contains a sequence of Siluro-Devonian sediments known as the Chillagoe Formation and comprises a range of clastic sediments, mostly sandstones and cherts, interbedded with marbleized limestones. Subsequent tectonic events have severely disrupted the original sedimentary sequence and resulted in a complex of imbricate thrust slices overlying the Palmerville Fault which lies just south-west of the Mungana deposit and forms the south-western edge of the corridor. The Chillagoe Formation is also intruded by a number of granitic bodies and later mineralised porphyries such as those worked at Red Dome. Roughly synchronous with the porphyries were a number of episodes of mineralisation with the deposition of significant gold, copper, lead and zinc ore bodies. **Figure 8** provides a geological overview of the area.



- Approximate boundary of proposed MLA
- Mine Lease Boundaries
- Faults
- Geological Boundaries
- Thrust Fault (Palmerville Fault)
- Fault breccia and other breccias
- Carboniferous**
- Intrusive Porphyry
- Limestone Massive, Fossiliferous
- Chert Massive to thinly bedding
- Sandstones conglomerates
- Inter Limestones Basalt & Sandstone
- Ordovician (Mulgrave Formation)**
- Sandstone
- Mid - Proterozoic**
- Dargalong metamorphics

0 500 1000  
Meters

PROJECT: Red Dome Project: Mungana Gold Open Pit Development  
TITLE: Mungana Geological Overview

T:\\_AAA\2301000\WOP\2301000\_02\2301000\_02\_Mungana Gold Geology Map\_2009\_08\_13.WOP

JOB NO: 2301000.02  
DATE: August 2009  
SOURCE: NRA, MGL



Figure 8



### 3.5 Hydrogeology and Groundwater

There are three hydrogeological regimes in the Mungana area:

- limestone aquifers of the Chillagoe Formation
- fractured sandstone aquifers, also of the Chillagoe Formation
- fractured aquifers of the Dargalong Metamorphics.

The MGOPD is associated with the skarn type deposits of the Chillagoe Formation. The main aquifer lithology in the Chillagoe Formation is limestone.

A less permeable and lower yielding fractured sandstone subsidiary aquifer also occurs within the Chillagoe Formation. This aquifer lithology underlies the Red Dome pit area. The limestone and sandstone aquifers of the Chillagoe Formation have a high bulk permeability.

The groundwater quality data collected prior to development of the Red Dome Mine (Lewis Environmental Consultants 1985) showed uniform water composition. Groundwater was calcium bicarbonate rich, which is consistent with a limestone aquifer.

Extensive groundwater monitoring was carried out during the Red Dome operation and detected:

- groundwater contamination emanating from the heap leach pad area and flowing towards Opera Creek (AGE 2006)
- contamination from the Red Dome TSF eastwards (AGE 2006).

Pump back bores were installed down gradient of the Red Dome TSF and were operated until bore conditions stabilised. Given that the aquifers are highly confined in the area, no significant long-term impacts related to the Red Dome TSF are expected (NRA 2005e, wherein the results of independent hydrology studies are cited).

Groundwater use in the area comprises:

- groundwater taken from bore WB 14 for potable use on the Mungana site (water quality exceeds *Australian Drinking Water Guidelines* (2004) for *E. coli* and hardness, and is treated prior to use)
- Welcome Creek bore located on Rookwood Station about 5 km west of Mungana (in lithic sandstone aquifer) – probably used for stock watering
- Mungana Railway Yards bore located 1 km north-east of the Mungana portal (in limestone aquifer) – used for stock watering.

Dewatering in the fractured sandstone aquifer which surrounds the Mungana underground commenced in November 2006. Drawdown is monitored in a bore array surrounding the underground including bores in the footprint of the proposed open pit and bores in the Chillagoe limestone aquifer (associated with the karst and cave system) (**Figure 9**). Two years after commencement of dewatering RLA (2008) reported that:

- there had been a groundwater drawdown of 200m in the fractured sandstone aquifer of the dewatering area (vicinity of the underground)
- there had been a recession of 5.2m in the limestone aquifer 2km north of the dewatering area.

RLA (2008) concluded that the recession in the limestone aquifer could be reasonably accounted for by seasonal water level decline and groundwater use (water is drawn from the bore for potable use) and that there did not seem to be any impact on the caves in the adjoining Chillagoe-Mungana Caves National Park due to dewatering. The report recommended the

addition of two further bores in the limestone aquifer to confirm this relationship and these were subsequently added to the site monitoring program. This data will be reviewed and additional groundwater investigations will be carried out (including installation of additional bores) as part of the project EIS to further qualify potential impacts of pit dewatering on adjacent limestone karst formations and any karst wetlands that may occur therein. Post mine void hydrology will also be investigated.

### 3.6 Surface Water and Drainage

The Red Dome mining leases fall within the catchments of four creek systems (shown on **Figure 9**):

- Lily Creek
- Opera Creek
- Welcome Creek
- One Mile Creek.

All catchments discharge to the Walsh River (a tributary of the Mitchell River).

Water quality monitoring in the area commenced prior to the development of the Red Dome project in 1985 and indicated that receiving water quality was affected by high suspended solids and mobilised metals (copper and zinc) related to historical workings in the area. During the Red Dome operation there was an increase in mobilisation of sediments and metals on site, however the construction of the raw water dam served to improve water quality downstream by capturing sediments and entrained contaminants. The Red Dome operation was managed to achieve stock water standards in receiving waters.

In accordance with EA conditions, monthly water quality monitoring occurs across the site (**Figure 9**) using an analyte suite based on site geochemistry. Wet and dry season aquatic ecology programs including all four local catchments have been carried out since 2004. Additional surface studies have been carried out in connection with historical TSF seepage, seepage from the southern waste dump and discharge from the raw water dam. Investigations have shown there has been no discernible negative impact on the receiving environment (NRA 2005a, b; NRA 2008; NRA 2009d).

Additional surface water investigations will be carried out as part of the EIS to identify reference sites for the new disturbance areas, provide additional monitoring data and confirm environmental values of surface water.

Site hydrological modelling and the Site Water Management Strategy will also be reviewed.

### 3.7 Soils and Land Suitability

The pre-mining soils of the project area have been described in Lewis Environmental Consultants (1985) and NRA (1995b). The survey intensity and mapping scale used in previous reports is considered adequate to characterise soil and land resources on the project area in the context of the proposed scale of operations and background land use.

Except for the small areas associated with the limestone karsts, the soils of the project area are generally not of high quality and are typical of arid regions of northern Queensland. Nevertheless, most soils, especially those near the surface, contain a moderate nutrient content with the exception of readily available nitrogen. None of the pre-mining soil quality data reviewed indicated soil salinity that would restrict rehabilitation.



Note: Where monitoring sites required for compliance monitoring or environmental management purposes are lost due to the open pit development, alternative sites will be identified during the EIS process.

Water storage monitoring includes the Mungana Process Pond and Mungana Plant Site Sediment Dam

Note: Two ground water bores to be established 50m and 250m downgradient from the Mungana TSF.

-  Approximate boundary of proposed MLA
-  Mine Lease Boundaries
-  Drainage
-  EA Water Storage Monitoring Sites
-  EA Receiving Water Monitoring Site
-  EA Receiving Sediment Monitoring Sites
-  EA Ground Water Monitoring Sites
-  Other Surface Water Monitoring Sites
-  Other Ground Water Monitoring Sites
-  Tailings Storage Facility (TSF)



PROJECT: Red Dome Project: Mungana Gold Open Pit Development  
 TITLE: Mungana EA Water Quality Monitoring Sites 2009

JOB NO: 2301000.02  
 DATE: August 2009  
 SOURCE: NRA, MGL



Figure 9



No significant sodicity was identified in previous reports although some of the Dermosols (present in areas now largely disturbed) were reported to have low calcium-magnesium ratios and as such may be structurally unstable. All soils, with the exception of some of the more recent soils formed on limestone, are moderately acidic, although pH (1:5 in water) is not expected to be less than 5.5.

Additional soil investigations will be carried out as part of the EIS to extend soils mapping over new disturbance areas related to the development.

## 3.8 Terrestrial Flora and Fauna

### 3.8.1 Flora

#### Landscape Overview

There are several distinct vegetation types in the project area. The majority of the site is described as low rolling hills and flats dominated by Sclerophyll Woodlands and dry open Eucalypt Forests. Dissecting this landscape are ephemeral waterways with narrow borders of riparian vegetation, although this is not always distinct or continuous. There are also artificial permanent water sources (dams) within the project area and in the surrounding countryside. Limestone karsts are present along the north-eastern boundary of the project area (and further to the north). Vegetation on and around these karsts is dominated by dry Semi-evergreen Vine Thicket. Some species in this vegetation community are restricted to these outcrops due to soil associations, but others maintain their distribution around the limestone karsts as a protective mechanism from fire.

#### Current Conditions

The project area supports a mosaic of remnant and non-remnant vegetation. Non-remnant areas generally correspond to large portions of the site that were extensively disturbed during the mining activities associated with the Red Dome Gold Mine that operated from 1986 to 1997.

The lease area supports a number of regional ecosystems (REs). Areas dominated by Mixed Woodland (RE 9.11.25, RE 9.11.3a, RE 9.3.13) and Ironbark Woodland (RE 9.11.3a) are present over the majority of the lease area. Scattered areas of Semi-deciduous Vine Thicket on limestone rock karsts (RE 9.11.8a) are present along the north-eastern boundary of the site (**Figure 10**).

REs, their conservation status and area occupied within the current lease area are described in **Table 6**.

**Table 6: Regional Ecosystems Occurring Within the Current Lease Area**

RE Number	RE Description	VM Act 1999 <sup>1</sup>	DERM Biodiversity <sup>2</sup>	Area (ha)
9.11.3a	Ironbark Woodland: <i>Eucalyptus cullenii</i> ± <i>Corymbia erythrophloia</i> ± <i>C. dallachiana</i> ± <i>C. clarksoniana</i> woodland to open woodland with mixed species on skeletal soils on metamorphic hills.	Not of Concern	No Concern at Present	749.7 (48%)
9.11.25, 9.11.3a, 9.3.13	Mixed Woodland: the area along the south-western border was not visited in the field. DERM RE mapping indicates RE 9.11.25 may be present, as well as RE 9.11.3a and RE 9.3.13 (very minor component along creek lines). RE 9.11.25 is described as <i>Eucalyptus tardecidens</i> ± <i>Corymbia</i> spp. low woodland on	Not of Concern	RE 9.11.25 & RE 9.11.3a Not of Concern RE 9.3.13 Of Concern	381.4 (24%)

RE Number	RE Description	VM Act 1999 <sup>1</sup>	DERM Biodiversity <sup>2</sup>	Area (ha)
	steep to rolling metamorphic hills ( <i>Not of Concern/No Concern at Present</i> ).			
Non-remnant	Cleared and not revegetated.	-	-	238.6 (15%)
Not determined	Revegetated.	-	-	59.9 (4%)
9.5.9a	Clarkson's Bloodwood Woodland: <i>Corymbia clarksoniana</i> ± <i>Eucalyptus cullenii</i> ± <i>E. platyphylla</i> ± <i>E. leptophleba</i> woodland on Tertiary remnant surfaces.	Not of Concern	No Concern at Present	56.6 (4%)
Water	Waterbodies	-	-	31.7 (2 %)
9.11.8	Semi-evergreen Vine Thicket: occurs on limestone karst. <i>Of Concern</i> biodiversity status due to mining affecting some areas and Rubber Vine ( <i>Cryptostegia grandiflora</i> ) degrading others.	Not of Concern	Of Concern	28.9 (2%)
9.3.13	Melaleuca Woodland: <i>Melaleuca fluviatilis</i> and/ or <i>M. argentea</i> ± <i>Eucalyptus camaldulensis</i> fringing woodland on channels and levees. Generally on western flowing rivers. <i>Of Concern</i> biodiversity status due to Rubber Vine ( <i>Cryptostegia grandiflora</i> ) infestation, high grazing pressure and alluvial mining leading to degradation.	Not of Concern	Of Concern	15.1 (1%)

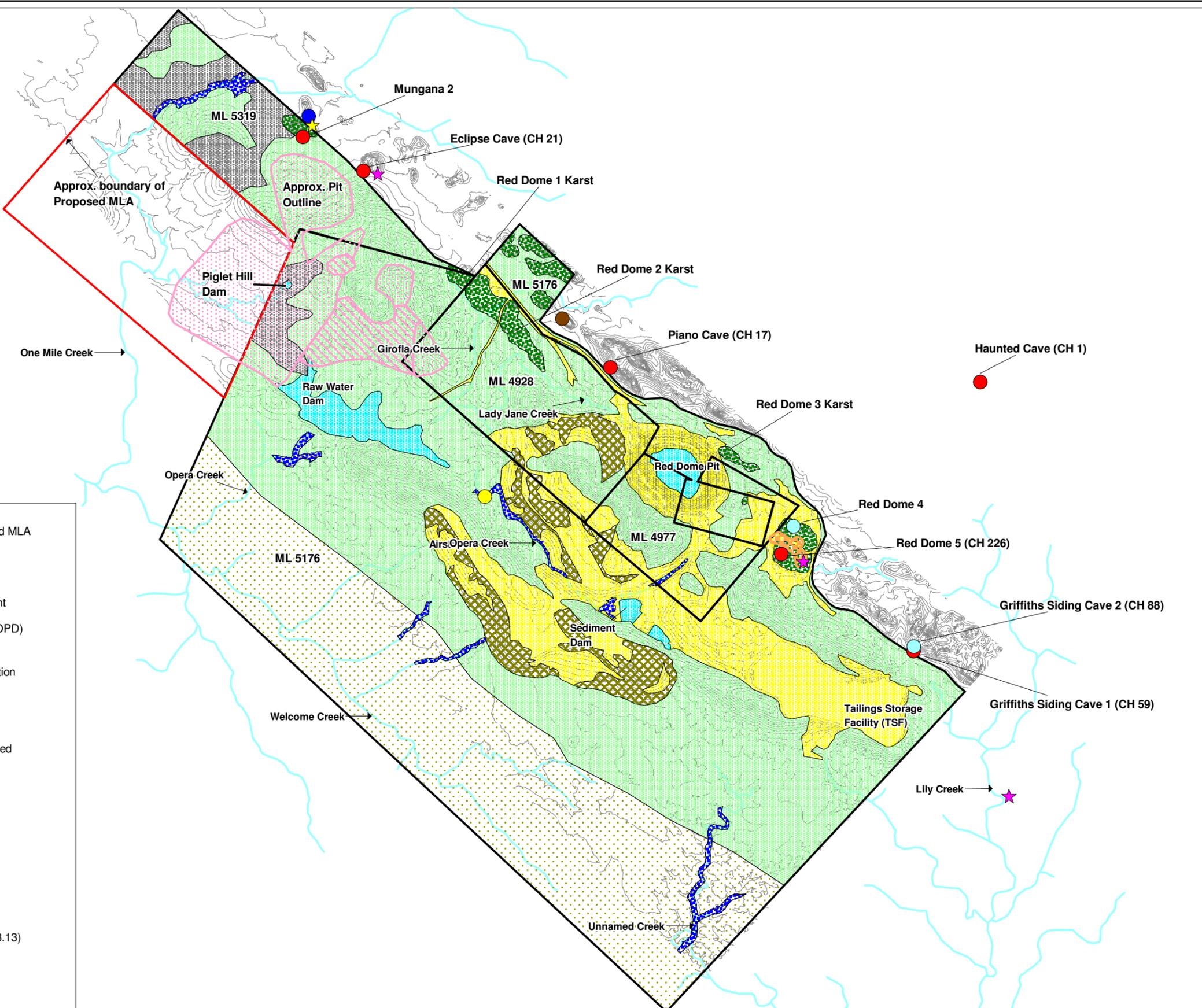
<sup>1</sup> The Queensland *Vegetation Management Act 1999* (VM Act) provides a legislative framework for the management and assessment of clearing on certain tenures based on the remaining extent of the RE in the bioregion and the existing land use.

<sup>2</sup> The DERM biodiversity status is based not only on the extent of the REs in the bioregion but also on the condition of remaining examples, and the presence of threatening processes. These categories are not recognised by legislation but are utilised in a best practice approach.

All the REs are listed as *Not of Concern* under the *Queensland Vegetation Management Act 1999* (VM Act), however the riparian associated Melaleuca Woodland (RE 9.3.13) and the Semi-evergreen Vine Thicket (RE 9.11.8a) associated with karsts are defined as *Of Concern* under DERM biodiversity mapping. Neither is extensive in the MGOPD disturbance area.

### Plant Species of Conservation Significance

Protected plant species are those species listed under the EPBC Act and the Queensland *Nature Conservation Act 1992* (NC Act).



- Approximate Boundary of Proposed MLA
  - Mine Lease Boundaries
  - Existing infrastructure area - Mungana underground development
  - Proposed infrastructure area (MGOPD)
  - Drainage
  - Macropteranthes montana observation
  - Greater Large-eared Horseshoe Bat
  - Panicum chillagoanum observation
  - Greater Large-eared Horseshoe Bat and Diadem Leaf-nosed Bat recorded
  - Diadem Leaf-nosed Bat recorded
  - ★ White-rumped Swiflet
  - Mareeba Rock Wallaby
  - ★ Northern Quoll scat
- Revised Regional Ecosystems**
- Ironbark Woodland (RE 9.11.3a)
  - Semi-evergreen Vine Thicket (RE 9.11.8)
  - Melaleuca Woodland (9.3.13)
  - Clarkson's Bloodwood Woodland (9.5.9a)
  - Mixed Woodland (REs 9.11.25, 9.11.3a, 9.3.13)
  - Non-remnant
  - Revegetated
  - Waterbodies



PROJECT: Red Dome Project: Mungana Gold Open Pit Development  
 TITLE: Revised Regional Ecosystems and Flora and Fauna Observations  
T:\\_AAA\2301000\2301000\_02\2301000\_02\_Revised RES\_F&F Survey Results\_2009\_08\_13.WOR

JOB NO: 2301000.02  
 DATE: August 2009  
 SOURCE: NRA, MGL



Figure 10



EPBC database and Queensland Herbarium HERBRECS database search results listed several species of conservation significance under the EPBC Act and/or the NC Act. **Table 7** provides a list of the plant species of conservation significance considered to have a high likelihood of occurrence, or that were documented within the project area during previous survey work (Kagara Pty Ltd 2007).

**Table 7: Flora of conservation significance and likelihood of occurrence within the development area**

Species	Growth Form	Occurrence or Potential Habitat on Site	NC Act Status	EPBC Status	Likelihood of Occurrence <sup>1</sup>
<i>Alectryon tropicus</i>	Shrub/ small tree	Identified adjacent to the Red Dome 1, 2, 3, 4 & 5, Mungana 2 and Eclipse Tower limestone karsts.	R	-	High
<i>Atalaya calcicola</i>	Shrub/ small tree	Occurs in NEQ in monsoon forests and vine thickets, usually on limestone.	R	-	High
<i>Chamaesyce carissoides</i>	Shrub	West of Mungana in low laterised sandstone cliffines (300 m alt.). Likely persistent in fire refugia. Potential to occur in rocky areas adjacent to all limestone karsts within the project area.	V	V	Moderate – High
<i>Graptophyllum excelsum</i>	Shrub	Observed flowering at the Mungana 2, Red Dome 1 and Red Dome 2 karsts. Also occurs in open Ironbark Woodland.	R	-	Present
<i>Lepturus</i> sp. (Chillagoe M.Godwin C2576)	Grass	Low grass on shallow, well drained terra rossa soil amongst boulders near limestone karst.	V	-	High
<i>Lepturus xerophilus</i>	Grass	Endemic and very sporadic. Uncommon, growing on limestone in partial shade.	R	-	High
<i>Macropteranthes montana</i>	Tree	Approximately 31 individuals observed near limestone karsts at Red Dome 4 and 5 in the south-eastern portion of the lease area. The species is restricted to areas adjacent to these sites.	V	V	Present
<i>Panicum chillagoanum</i>	Grass	Individuals observed high on slopes adjacent to the Mungana 2 karst.	R	-	Present
<i>Stictocardia queenslandica</i>	Vine	Restricted to monsoonal forests on limestone karsts.	R	-	High
<i>Tephrosia savannicola</i>	Shrub	A common local shrub found on steep rocky hillsides in open forest communities. A single individual was recorded in ML 5319, north-west of One Mile Creek.	R	-	Present

<sup>1</sup> Likelihood of occurrence is based on published habitat requirements, presence of habitat past search effort (as reflected in the number of herbarium records), consultation with Queensland Herbarium staff and survey results.

With the exception of *Tephrosia savannicola*, all significant plant species listed in the table above are known or are likely to be associated with the limestone karsts associated habitats in the area.

A 100 m buffer has been nominated around limestone karsts and national parks in the mining lease area. These areas are managed as conservation zones. Activities that can be carried out within the conservation zones are defined in the Referral approved under the EPBC Act

### **Weed Species**

The most significant weed species occurring in the lease area are Rubbervine (*Cryptostegia grandiflora*) and Chinese Apple (*Ziziphus mauritiana*). Both are Class 2 pest species under the Queensland *Land Protection (Stock Route and Pest Management) Act 2002* (LP Act) and are listed in the Tablelands Regional Council Pest Management Plan 2008–2012. Under the LP Act, the land manager is responsible for control of Class 2 pest species with the aim of keeping the land free of these pests. A strategic approach to weed control has been adopted on site and an annual weed control program is maintained.

## **3.8.2 Fauna**

### **Fauna Habitat**

The following habitats are found on site.

#### **Open Woodland**

This habitat corresponds to Ironbark Woodland (RE 9.11.3a), Mixed Woodland (REs 9.11.25, 9.11.3a, and 9.3.13) and Clarkson's Bloodwood Woodland (RE 9.5.9a). Combined, these woodland types cover approximately 76% of the lease area. Habitat condition is low to moderate in most areas. Ground layer condition is predominantly poor due to sustained cattle grazing. Fauna microhabitats in this habitat type include grassy/herbaceous understorey areas, leaf litter, fallen logs and branches, exfoliated bark, and low-relief rock outcrop areas of limited spatial extent.

#### **Riparian Woodland**

This habitat type corresponds to Melaleuca Woodland (RE 9.3.13) and is found on gentle gradient streams throughout the project area. The creeks that support this woodland are ephemeral and provide essential water, cover, foraging, and breeding resources to the fauna species of the area.

#### **Vine Thicket**

This habitat type matches Semi-evergreen Vine Thicket (RE 9.11.8a). It is restricted to areas adjacent to limestone karsts and may occur on either steep scree covered slopes or flat areas. It provides core habitat to the Northern Quoll. Macropods including the Mareeba Rock Wallaby (*Petrogale mareeba*), Common Wallaroo (*Macropus robustus*), Antilopine Wallaroo (*Macropus antilopinus*), and Eastern Grey Kangaroo (*Macropus giganteus*) also use this habitat type for shelter and cover.

#### **Limestone Karsts**

Limestone karsts occur adjacent to and along the north-eastern boundaries of the project area (**Figure 10**). Karsts within or adjacent to the project area are:

- Mungana 2
- Eclipse Tower (Chillago-Mungana Caves National Park)
- Red Dome 1
- Red Dome 2

- Piano Tower (Chillagoe-Mungana Caves National Park)
- Red Dome 3
- Red Dome 4
- Red Dome 5
- Spring Tower (Griffiths Siding caves in Chillagoe-Mungana Caves National Park).

The Northern Quoll and Mareeba Rock Wallaby use limestone karsts as core habitat. Caves within the limestone karsts provide core habitat for cave-dwelling bat species including the Greater Large-eared Horseshoe Bat (large form) (*Rhinolophus philippinensis maros*), Diadem Leaf-nosed Bat (*Hipposideros diadema reginae*), and Common Sheath-tail Bat (*Taphozous georgianus*). Limestone caves also provide nesting habitat for the White-rumped Swiftlet (*Collocalia spodiopygius*).

#### Ponds and Dams

The raw water dam is the largest waterbody (aerial extent) within the project area. It was constructed as part of the Red Dome Gold Mine (1986–1997) processing circuit. The raw water dam is currently the most important perennial surface water source for much of the fauna occurring in and adjacent to the project area. A smaller stock dam, Piglet Hill Dam, is located north-west of the raw water dam (**Figure 10**).

#### Creeks

Ephemeral creeks occur throughout the area.

### Fauna Species of Conservation Significance

Fauna species of conservation significance are those listed under the EPBC Act and the NC Act as endangered, rare, vulnerable, threatened or migratory.

**Table 8** lists fauna species of conservation significance recorded in, or that have a high potential to occur in, the project area.

Additional flora and fauna investigations will be carried out as part of the EIS, to include new disturbance areas and increase survey intensity.

**Table 8: Fauna species of conservation significance and likelihood of occurrence within the development area**

Common Name	Scientific Name	Status		Occurrence or Potential Habitat on Site	Likelihood of Occurrence
		NC Act	EPBC Act		
<b>Reptiles</b>					
	<i>Carlia rococo</i>	R	-	High potential to occur at all limestone karsts and low-relief limestone outcrops (eg adjacent to Red Dome 1 and Red Dome 2 karsts).	High <sup>1,2</sup>
	<i>Lerista storri</i>	R	-	High potential to occur at base limestone outcrops within the project area.	High <sup>2</sup>
<b>Birds</b>					
Black-necked Stork	<i>Ephippiorhynchus asiaticus</i>	R	-	Individuals observed within the project area in 1995 (NRA 1995d). The species feeds in shallow water to 0.5 m depth and is most likely to occur at the raw water dam.	High <sup>3</sup>
Glossy Ibis	<i>Plegadis falcinellus</i>	-	M	Mainly occurs in areas of shallow water and mudflats. Nests in trees. Common over northern and eastern Australia.	High <sup>3</sup>
Great Egret	<i>Ardea alba</i>	-	M	Variety of wetlands and areas with shallow water. Nests in trees. Occurs across Australia.	High <sup>2,3,4</sup>
Cattle Egret	<i>Ardea ibis</i>	-	M	Variety of wetlands and areas with shallow water. Coastal to inland areas of eastern, northern, and western Australia. Nests in trees.	Recorded <sup>4</sup>
Cotton Pygmy-goose	<i>Nettapus coromandelianus</i>	R	M	Most likely to occur at the raw water dam during wet season (summer) periods.	High <sup>2,4</sup>
White-bellied Sea-Eagle	<i>Haliaeetus leucogaster</i>	-	M	Coastal and subcoastal areas, reservoirs, rivers and lakes.	Recorded <sup>4,5</sup>
Square-tailed Kite	<i>Lophoictinia isura</i>	R	-	High potential to occur in the open woodland and shrubby habitats in the project area.	High
Grey Falcon	<i>Falco hypoleucos</i>	R	-	Observed hunting Little Friarbirds ( <i>Philemon citreogularis</i> ) as they drank at Piglet Hill Dam on 5 November 1995 (NRA 1995d).	High <sup>3,5</sup>
Rainbow Bee-eater	<i>Merops ornatus</i>	-	M	Commonly occurs in woodlands and timbered plains across Australia.	Recorded <sup>2,4,5</sup>
White-rumped Swiftlet	<i>Collocalia spodiopygius</i>	R	-	Observed above the Red Dome 4 and Red Dome 5 limestone karsts. The Red Dome 5 karst contains numerous linked caves and it is likely that the species roosts at that location.	Recorded <sup>2,3,4,5</sup>

Common Name	Scientific Name	Status		Occurrence or Potential Habitat on Site	Likelihood of Occurrence
		NC Act	EPBC Act		
<b>Mammals</b>					
Mareeba Rock-wallaby	<i>Petrogale mareeba</i>	R	-	Likely to occur at the larger limestone karsts ( <i>ie</i> Mungana 2, Red Dome 1, Red Dome 4, and Red Dome 5 karsts) and rocky habitat areas in the project area. Has been observed in rocky habitat immediately outside the north-central boundary of the project area (EPBC Referral 2006/2639).	Recorded <sup>2,5</sup>
Northern Quoll	<i>Dasyurus hallucatus</i>	-	E	Inhabits eucalypt woodlands in broken rocky country. Successful reproduction generally associated with creeklines and rocky areas. Dens in hollow trees. It is highly probable that a scat found at the Mungana 2 limestone karst is that of a Northern Quoll. The distribution of the species within the area is likely to be centred and largely confined to the limestone karsts.	Recorded <sup>2,5</sup>
Diadem Leaf-nosed Bat	<i>Hipposideros diadema reginae</i>	R	-	Reported from several caves in the Chillagoe area. Hunts in a variety of habitats. The species was recorded at 15 sites across the Chillagoe karst system (EPBC Referral 2006/2639), indicating that it is widely distributed in the Chillagoe-Mungana Caves National Park and Chillagoe region.	Recorded <sup>1,2,5</sup>
Greater Large-eared Horseshoe Bat	<i>Rhinolophus philippinensis maros</i>	R	E	Most commonly found roosting in caves and disused mines but also evidence to suggest it roosts in dense vegetation and tree hollows in humid localities. Dense vegetation is preferred as foraging habitat. The species has been detected at all caves surveyed within or directly adjacent to the project area and individuals of the species are known to intermittently use numerous roost sites.	Recorded <sup>2,5</sup>

EPBC Act: Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.

NC Act: Queensland *Nature Conservation Act 1992*.

Status: E = Endangered; V = Vulnerable; R = Rare; M = Migratory.

<sup>1</sup> Species identified from Queensland Museum database search.

<sup>2</sup> Species identified from WildNet database search.

<sup>3</sup> Species recorded during NRA 1995 survey.

<sup>4</sup> Species identified from Birds Australia database search.

<sup>5</sup> Species recorded during NRA 2005–2006 surveys.

### 3.9 Vibration

Blasting will be required for the mine development and operation. Blasting will be designed to meet relevant standards and guidelines in relation to noise and vibration including minimising disturbance to the local community.

The limestone caves are potentially sensitive locations with respect to blasting, both from a structural perspective and due to the fact that they provide habitat for species of conservation significance.

During the Red Dome operation blasting occurred in the open pit within 100 m of the Chillagoe-Mungana Caves National Park and the caves therein.

Lewis Environmental Consultants (1985) carried out eight blasts as part of the EIS for the Red Dome Project. These were located between 405 and 1,145 m from any entrance and Piano Cave. Resulting peak particle velocities ranged between 0.067 and 0.659 mm/s while airblast overpressure ranged between 99 and 130 dB(L). Lewis Environmental Consultants (1985) recommended the following limits.

- *A maximum peak particle velocity of 25 mm/s at the nearest entrance of the Piano Cave was considered a conservatively lower limit based upon the following reasoning.*
  - *The Piano Cave is an interesting natural feature but it is not an historical building, a monument, a building of special value or significance, a house or a low rise residential building.*
  - *The Piano Cave consists of an irregular air void within thick walls, floor and roof of a strong massive limestone. None of the weak construction materials which one finds in residential buildings (eg plaster, glass mortar) is present.*
  - *Peak particle velocity limits of 50 mm/s and 75 mm/s are applied to newly grouted rocks, newly applied shortcrete, etc (eg at the Harding Dam site, Western Australia).*
- *A peak air overpressure (140 dB(L)) was also considered a conservatively low limit based on:*
  - *This airblast is the maximum overpressure measured at a small entrance to a voluminous cave. Therefore, any airblast which enters through this relatively narrow opening would be rapidly dissipated by divergence effects once it started to propagate within the cave.*
  - *The shawls [stalactites], which are probably the most fragile elements within the cave, are likely to exhibit smaller areas and be thicker than large plate-glass windows. Therefore, it is most unlikely that these shawls will be broken by peak overpressures as low as 140 dB(L).*

*It was not possible to define the peak overpressure at the entrance to the cave which would damage the most delicate [stalactite] within the cave, but it is believed that this would be around 170 dB(L), this being 31.5 times greater than the 140 dB(L) limit recommended.*

Blast monitoring was also carried out in Stop Press Cave in the adjoining national park during Stage 3 of the Red Dome pits (circa 1996). Peak particle velocities for blasts ranged from 0.25 to 3.1 mm/s (Niugini Mining (Aust) Pty Ltd 1998). Niugini Mining also reported that no structural damage had been observed in any local karst systems 'visited' (sites not specified) and that under the prevailing conditions the probability of rock damage was low with peak particle velocities in excess of 50 mm/s likely to be required to initiate damage.

Although the values of the national park and karst systems do not appear to have been impacted by noise and vibration from the previous Red Dome operations, the project referral submitted to the Department for Environment and Heritage (March 2006) identified the potential for degradation of endangered species habitat quality due to noise and vibration associated with blasting. Subsequently, the Referral approval conditions included a requirement to limit maximum peak particle velocity to 25 mm/s and maximum peak air overpressure to 140 dB(L) at nominated cave entrances.

In accordance with conditions of the current EA, a blast management program has been developed for the Mungana underground development. The monitoring component of the program entails monitoring five blasts within a three month period at five locations (the entrances of caves and on karsts known to provide habitat for the Greater Large-eared Horseshoe Bat and Northern Quoll populations which are listed as *Endangered* under the EPBC Act). Monitoring is synchronised with known blast levels (stope and development). One round of monitoring has been completed (reporting not yet available). The monitoring will provide baseline data for future underground development planning.

Additional vibration investigations will be carried out as part of the open pit EIS and will include modelling of blast designs aimed at preventing impact to limestone karst formations

### 3.10 Noise

Given the locations of the Red Dome leases (15 km from Chillagoe), the only potential noise impacts associated with operations are those resulting from traffic on the Burke Development Road,; specifically noise generated by haulage through the township of Chillagoe.

The current traffic loading is dominated by existing transport associated with the Mungana underground development, cattle transports (Type I and Type II road trains) hauling stock to and from the Mareeba and Charters Towers sale yards, and freight and fuel transports servicing Gulf communities. This activity is largely restricted to the period from April to December. During the wet season transport use of the road is limited by trafficability.

There will be an increase in the frequency of road transports during construction. During operations, overall transport levels are expected to be similar to those currently generated by the Mungana underground development.

Background noise monitoring data and further assessment of potential noise impacts will be carried out as part of the EIA.

### 3.11 Air

Existing potential sources of particulate emissions from the surrounding environment primarily comprise:

- existing Mungana underground operations
- grazing activities (eg dust from earthmoving equipment or overgrazed areas)
- mining (eg marble mines operating in the Chillagoe region)
- marble crushing and bagging in Chillagoe
- unsealed roads
- smoke.

During the Red Dome Gold operation, gaseous emissions from point (eg processing plant) and non point source (eg cyanide leaching pads and TSF) occurred. As with dust, since cessation of mining no residual impacts associated with these emissions are evident and air quality is considered to be consistent with pre-mining levels.

In accordance with conditions of the current EA, a dust monitoring program has been established (March 2009) involving deployment of dust deposition gauges at a reference site and within 10 m of the opening of designated cave entrances and karsts known to provide habitat for the Greater Large-eared Horseshoe Bat and Northern Quoll populations (listed as *Endangered* under the EPBC Act). The program will continue for a minimum of two years.

### 3.12 Cultural Heritage

A number of cultural heritage studies have been conducted in the mining lease area, Red Dome, including assessments of the historic mines of Red Dome, Griffith, Dorothy, Lady Jane and Girofla and the historic town of Mungana (former). These assessments covered Indigenous and historical cultural heritage, and were prepared from the late 1980s to 1995 to fulfil the legislative requirements of various mining companies involved in the region's most recent era of mining (Grimwade 1991a, 1991b, 1992, 1993, 1995; Grimwade & Meiklejohn 1994; McNiven 1988; NRA 2004b).

#### 3.12.1 Indigenous Cultural Heritage

The area lies within the estate of the Wakamin people. In terms of the archaeological record, surveys to date have covered the majority of the MGOPD area but some areas have not been assessed (potential waste dump footprint to the west). To date, 67 sites have been identified in the Red Dome–Mungana area and these are mainly described as artefact scatters. Thirty-two sites are listed on the DERM cultural heritage database, however the exact nature and significance of the sites requires review. It is likely that some may have been destroyed by Red Dome mining operations. ML 5319 includes a 2 ha Aboriginal Reserve (NRA 2004b).

Draft Cultural Heritage Management Plans have been negotiated with two interested parties and all indigenous cultural heritage work is now being carried out according to these agreements. Additional cultural heritage surveys will be undertaken as part of the EIS, with agreed management outcomes incorporated into mine planning.

#### 3.12.2 Non Indigenous Cultural Heritage

The following historical context for the Mungana area is taken from a cultural heritage assessment of the Mungana area prepared by NRA (2004b).

##### Historical Context

The history of the Mungana Group of mines at Chillagoe, north Queensland, follows that of north Queensland's pre-World War II mining industry. Similar to the pattern of development at the former Mt Garnet mine and smelter, which is also owned by Kagara, it shows the style of overcapitalised enterprises (which were expected to carry their own development costs) spending too much on surface work on the basis of unproven ore bodies. The Mungana Group, with its impressive surface works, attracted a lot of attention from investors. However, it failed within a few years and decades of company reconstructions and failed attempts to revive the mine followed.

The remains of the former mining area include the former town of Mungana, the Girofla Mine and Smelter, the Lady Jane Mine, the former townsite adjacent to the Lady Jane Mine, and a section of the branch line from Chillagoe to Mungana (the former Chillagoe Railway).

These places form part of the Chillagoe mineral field developments which are strongly linked to the mining empire created by John Moffat and others in the late nineteenth and early twentieth centuries. Their development contributed to the opening of the Chillagoe Smelters and its eventual closure which, in turn, led to their demise by the early twentieth century. The re-opening of the district to large-scale mining in the late twentieth century resulted in the open-cut at Red Dome. This project resulted in the deposition of vast quantities of waste rock adjacent to Lady Jane mine, and the obliteration of several other early underground mines including Dorothy, Red Dome and Griffiths Hill.

### Statement of significance

The cultural heritage significance of the area was assessed by Jane Lennon & Associates and Howard Pearce (1996) Significance was reassessed by Gordon Grimwade and Associates (2007) as part of a nomination of a number of areas to the Queensland Heritage Register (**Table 9**) The nomination was made by Kagara Ltd (2007) to ensure significant areas and sites were clearly identified and agreed boundaries were established. A management regime consistent with the requirements of the Register was also adopted. The Heritage Council subsequently entered the areas as 'archaeological places' on the Register. These areas are mapped on **Figure 4** and a summary of the areas is provided below.

**Table 9: Cultural Heritage Significance**

Significance criteria	Girofla mine	Girofla smelter	Mungana town	Lady Jane
a. History	XO	XO	XO	XO
b. Rarity	X	XO	XO	
c. Potential information	O	O	XO	O
d. Characteristics	XO	XO		
e. Aesthetics			XO	
f. Degree of creativity	X	X		
g. Social or cultural association				
h. Historical association	O	O	O	O

Assessment by Lennon and Pearce shown as X.

Assessment by Gordon Grimwade & Associates shown as O (source: Kagara Ltd 2007)

The sites listed in **Table 9** are considered to be significant places for the State of Queensland as they reflect important stages in the development of the Chillagoe mineral field and its far-reaching effects across the state. The associations with John Moffat provide a strong link with the economic and political history of Queensland. The sites can be expected to provide considerable information on mining methods, processes and early mining settlements of the early twentieth century.

### 3.13 Native Title

As of 30 June 2009 there were no determinations or active Native Title applications over the Red Dome Project mining lease area.

### 3.14 Community

Chillagoe is located within the Tablelands Regional Council local government area, on the Atherton Tablelands in North Queensland. The area has a population of 42,196 people and is currently experiencing growth of 0.5–1.0% per year.

Mareeba is the nearest major town centre to the operation with a population of 8,000 people. Other major towns in the area include Atherton, Malanda and Herberton and smaller towns include Ravenshoe, Mt Garnet, Kuranda, Dimbulah and Mount Molloy. The townships of Almaden and Petford are within the Chillagoe district.

Mining began in the Chillagoe district in about 1900, producing mainly copper and lead. The original Red Dome Gold Mine was the last large mine in the area when it closed. Local industries near the township include lime works, marble mining, and cattle. Tourism is also strong, given the township's limestone caves, mining history and position as a gateway to the far north. The Chillagoe Industrial Estate has also recently attracted renewed interest.

Following is a summary of economic and demographic characteristics taken from analysis conducted by Elliott Whiting (2006) prior to the development of the Mungana underground polymetallic mine.

Population in the region (defined as the former Mareeba Shire) has grown over the period 1996 to 2005 (18,217 to 18,850). While growth has been lower than average population growth rates in Queensland, it has been greater than neighbouring shires (former shires of the Tablelands Regional Council). However, analysis of population growth within age cohorts showed negative growth in the 0–20 and 20–40 year group and a higher growth rate in the 60–80 year group, when compared to Queensland and Australian average growth rates. It was assumed that this difference is related to the lack of employment opportunities for people in the 20–40 year group and the shift to a retirement based economy in parts of the region.

Over the 1996 to 2005 period, the labour force increased by 192 people and the number of unemployed persons decreased by 543 people, giving an increase in the number of employed persons of 735.

The most significant job losses over this period have occurred in mining (-120) (Note, this was prior to the development of the Mungana underground polymetallic mine). The most significant job creation has been in Health and Community Services (+269), Retail Trade (+215) and Manufacturing (+161). This broad trend of declining employment in the primary production sector and increasing employment in retail trade, services and manufacturing is consistent with trends in the broader Australian employment market.

In summary, the region shows the following key economic characteristics.

- Increasing population.
- No population growth in the 20–40 year age group, suggesting some limitation in employment opportunities within this age group.
- Increasing number of jobs in the region, however high historical unemployment rate.
- Strengthening in the services and retail sector and decline in the agriculture and commodity sectors.

## 4. Community Consultation

### 4.3 Consultation Process

As part of its existing operations, Kagara has held various community meetings and intends to continue to build upon these established relationships and processes. Affected and interested persons will be included in the community consultation program for the Project and will be provided with a copy of the Terms of Reference Notice and EIS for public comment in accordance with the statutory process. The community consultation program will include meetings with affected and interested persons as part of the proponent's ongoing program of community engagement which includes:

- liaison meetings with indigenous interested parties
- community meetings.

## 5. EIS Trigger Criteria

Triggers for deciding whether a non-standing mining application requires an EIS are provided in DERM's *Guideline 4 – Deciding the Level of Impact Assessment for the Mining Industry*. **Table 12** provides an assessment of the MGOPT against each trigger criterion.

**Table 12: EIS Trigger Criteria**

<b>EIS Trigger Criteria</b>	<b>Triggered</b>	<b>Comment</b>
1. Significant Impact on Category A or B environmentally sensitive areas (ESAs).	Undecided	Category A ESAs (National Park) occur adjacent to the project ML. An EPBC referral has been made for the entire Red Dome Project (including development of an open pit) and was determined to be 'Not a Controlled Action – Particular Manner'. Nevertheless, additional investigations will be undertaken to validate previous findings regarding potential impacts on National Park. Category B ESAs. Archaeological Places on the Queensland Heritage Register lie within the MLs; listing of these places and determination of boundaries was undertaken by Kagara Ltd and DERM in consultation. A European Cultural Heritage Management Plan is in place, outlining activities and management that can be carried out within these areas.
2. Involve any mining in a marine area.	No	The proposal does not include mining in a marine area.
3. Involve any mining less than 500 m landward from the highest astronomical tide.	No	The proposal does not involve mining within 500 m of HAT.
4. Require the construction of more than 150 new dwelling units.	No	Accommodation requirements will be met by the existing 240-person capacity Chillagoe Camp.
5. Include any activity that would otherwise be a Level 1 ERA with an annual fee greater than \$4,000.	No	The proposal is not likely to require additional ERAs to the current activities approved.
6. Involve the mining of more than 2 million tonnes of mineral or run of mine ore per annum.	No	Maximum per annum is expected to be 1.7m tones.
7. Involve the abstraction of more than 2 million m <sup>3</sup> of water per annum from natural surfaces and/or groundwater sources.	No	Current water extraction for the Mungana polymetallic underground mine is 946 ML per annum (946,000 m <sup>3</sup> ). It is expected that the open cut will fall within the dewatered zone and thus no additional abstraction will be required.
8. Result in more than 25 ha remaining post mining in a non-beneficial land capability where an acceptable alternative may be feasible.	No	The proposal will result in 21.2 ha (the Open Pit) of non-beneficial land capability. Remaining areas will be returned to low intensity grazing use.
9. Involve any non-standard mining activity less than 2 km from a town	No	Mining activities are located 15 km from the nearest town (Chillagoe).

---

<b>EIS Trigger Criteria</b>	<b>Triggered</b>	<b>Comment</b>
10. Contain a dam that requires a dam failure assessment under the <i>Water Act 2000</i> .	Yes	The development may include a waste dump sediment dam. If this is adopted a dam failure assessment is likely to be required.
11. Include mining for uranium or asbestos.	No	The proposal entails mining of gold and polymetallic reserves.

---

## 6. References

- AGE 2006. Report on Mungana Mineral Prospect Environmental Approvals – Groundwater (Project No. NG256). December 2006.
- AGE 2007. Mungana Mineral Prospect Tailings Dam Storage Options Groundwater Investigations. (Project No. NG256/B). June 2007.
- C&B 2001. Water Quality Report, Red Dome Gold Mine. Prepared by C&B Consultants Pty Ltd. for Niugini Mining. July 2001.
- C&B 2002. Water Quality Report, Red Dome Gold Mine. Prepared by C&B Consultants Pty Ltd. for Niugini Mining. September 2002.
- Elliot Whiting Pty Ltd. 2007 Mungana Project, Preliminary Social Impact Assessment. Report prepared for Kagara Pty Ltd.
- EPBC Referral 2006/2639.
- ERMMM 1999. Fauna Investigations at the Red Dome Mine Site Following Decommissioning. Prepared by ERM Mitchell McCotter Pty Ltd. for Niugini Mines, May 1999.
- Gordon Grimwade and Associates, 2007. Mungana Cultural Heritage (Non-Indigenous) Management Strategy. A report prepared for Kagara Pty Ltd, January 2007.
- Grimwade, G. 1991a. Cultural Resources Appraisal: Proposed Waste Dump Extension, Opera Creed, Red Dome Mine. Prepared for Red Dome Mine Pty Ltd. by Resource Consulting Services Pty Ltd.
- Grimwade, G. 1991b. Cultural Resources Appraisal Redcap MLs 5089 – 5092. Prepared for Red Dome Mine Pty Ltd. by Resource Consulting Services Pty Ltd.
- Grimwade, G. 1992. Cultural Resources Site Assessment, Griffith Mine. Prepared for Red Dome Mine Pty Ltd. by Resource Consulting Services Pty Ltd.
- Grimwade, G. 1993. North-west Mungana Prospect: Preliminary assessment of cultural heritage issues. Prepared for Red Dome Pty Ltd. by Resource Consulting Services Pty Ltd.
- Grimwade, G. 1995. Cultural Heritage Study Mungana Prospect: Assessment of impact of proposed waste dumps and haul roads. Prepared for Niugini Mining Pty Ltd, Red Dome Mine by Gordon Grimwade and Associates.
- Grimwade, G. and Meiklejohn, A. 1994. North-west Mungana Prospect: Preliminary Assessment of Cultural Heritage Issues, ML 5319. Prepared for Red Dome Pty Ltd. by Resource Consulting Services.
- IT Environmental 1999. Site Contamination Report: Domains 1,2,3,4,5,6,8,9,10,14,15 & 16. Red Dome Gold Mine, Queensland. Prepared by IT Environmental (Australia) Pty Ltd. for Niugini Mining, 2 July 1999.
- Jane Lennon and Associates & Pearce, H. 1996. Mining Heritage Places Study: Northern and Western Queensland. **Vol 3**. unpublished report to Environmental Protection Agency, Brisbane.
- John Lewis & Associates. 1983. Preliminary Environmental Studies, Red Dome Project, Mungana Queensland. John Lewis & Associates, Brisbane.
- Kagara Ltd. 2007. Nomination on Queensland Heritage Register. Application to Cultural Heritage Branch of EPA, April 2007.

- Kagara Pty Ltd. 2007. Red Dome Project. Mungana Development, Environmental Management Plan.
- Lewis Environmental Consultants 1985. Environmental Impact Study: Red Dome Project, Mungana Queensland. Report to Elders Resources Limited by Lewis Environmental Consultants, December 1985.
- Mareeba Shire Council. 1999. *Pest Management Plan 1999/2000*.
- McNiven, I. 1988. A Preliminary Archaeological Survey of the North-west Mungana Prospect (ML 4271), via Chillagoe, North Queensland. Prepared for Elders Resources Limited by University of Queensland Archaeological Services Unit.
- NHMRC & NRMCC 2004. *Australian Drinking Water Guidelines. National Water Quality Management Strategy*. National Health and Medical Research Council and Natural Resources Management Ministerial Council. Commonwealth of Australia. AVH (Australian Virtual Herbarium). 2007. Online Database. <http://www.anbg.gov.au/avh/>
- Niugini Mining (Australia) Pty Ltd. 1995. Red Dome Gold Mine Mining Lease Nos. 4928, 4977, 5176, 5319 Environmental Management Overview Strategy November 1992 (Amended November 1995).
- Niugini Mining (Australia) Pty Ltd. 1998. Annual Monitoring Review July 1998.
- NMA 2007. Mungana Development – Noise, Vibration and Air Quality Assessment. Report prepared for Kagara Pty Ltd, 26 June 2007.
- NRA 1995a. Surface Geochemistry Report, North-West Mungana. Prepared by Natural Resource Assessments Pty Ltd. for Niugini Mining (Australia) Pty Limited, December 6 1995.
- NRA 1995b. Vegetation and Soil Management Plan for North-West Mungana (ML 5319). Prepared for Niugini Mining (Australia) Pty Limited, August 1995.
- NRA 1995c. North-West Mungana fauna survey. Prepared by Natural Resource Assessments Pty Ltd. for Niugini Mining (Australia) Pty Limited.
- NRA 1995d. Limnological Survey – Wet Season. Prepared by Natural Resource Assessments Pty Ltd. for Niugini Mining (Australia) Pty Ltd. September 1995.
- NRA 2004a. Red Dome 2004 Rehabilitation Monitoring Report. Prepared by Natural Resource Assessments Pty Ltd. for Kagara Zinc Ltd.
- NRA 2005a. Red Dome Environmental Investigation - Limnology Study (2004 Wet Season). Prepared by Natural Resource Assessments Pty Ltd. for Kagara Pty Ltd. February 2005.
- NRA 2005b. Red Dome Environmental Investigation – Limnology Study (2005 Wet Season). Prepared by Natural Resource Assessments Pty Ltd. for Kagara Pty Ltd. June 2005.
- NRA 2005c. Summation of Field Work and Preliminary Findings for Mungana 2005 Wet Season Aquatic Survey (Technical Note). Prepared by Natural Resource Assessments Pty Ltd. for Kagara Pty Ltd. July 2005.
- NRA 2005d. Summation of Field Work and Preliminary Findings for the Mungana 2005 Dry Season Aquatic Survey (Technical Note). Prepared by Natural Resource Assessments Pty Ltd. for Kagara Pty Ltd. August 2005.
- NRA 2005e. Environmental Investigation, Red Dome Mine, Chillagoe. Prepared by Natural Resource Assessments Pty Ltd. for Kagara Pty Ltd. June 2005.

- NRA 2006a. Summation of Field Work and Preliminary Findings for Red Dome 2005 Dry Season Aquatic Survey (Technical Note). Prepared by Natural Resource Assessments Pty Ltd. for Kagara Pty Ltd. April 2006.
- NRA 2006b. Summation of Field Work and Preliminary Findings for Red Dome 2006 Wet Season Limnology (Technical Note). Prepared by Natural Resource Assessments Pty Ltd. for Kagara Pty Ltd. November 2006.
- NRA 2006c. Summation of Field Work and Preliminary Findings for Red Dome 2006 Dry Season Limnology Survey (Technical Note). Prepared by Natural Resource Assessments Pty Ltd. for Kagara Pty Ltd. November 2006.
- NRA 2006d. Summation of Field Work and Preliminary Findings for the Mungana 2006 Wet Season Limnology Survey (Technical Note). Prepared by Natural Resource Assessments Pty Ltd. for Kagara Pty Ltd. November 2006.
- NRA 2006e. Summation of Field Work and Preliminary Findings for Mungana 2006 Dry Season Limnology Survey (Technical Note). Prepared by Natural Resource Assessments Pty Ltd. for Kagara Pty Ltd. November 2006.
- NRA 2007a. The Distribution of the Greater Large-eared Horseshoe Bat, *Rhinolophus philippinensis maros*, in the Chillagoe Region. Report prepared for Kagara Pty Ltd.
- NRA 2007c. Summation of Field Work and Preliminary Findings for Mungana 2007 Wet Season Limnology Survey (Technical Note). Prepared by Natural Resource Assessments Pty Ltd. for Mungana Pty Ltd. October 2007.
- NRA 2007d. Summation of Field Work and Preliminary Findings for Mungana 2007 Dry Season Limnology Survey (Technical Note). Prepared by Natural Resource Assessments Pty Ltd. for Mungana Pty Ltd. December 2007.
- NRA 2008. Raw Water Dam Pumped Release 2008 Limnology Survey. Prepared by Natural Resource Assessments Pty Ltd. for Mungana Pty Ltd. November 2008.
- NRA 2009a. Mungana 2008 Wet Season Limnology Survey. Prepared by Natural Resource Assessments Pty Ltd. for Mungana Pty Ltd. February 2009.
- NRA 2009b. Mungana 2008 Dry Season Limnology Survey. Prepared by Natural Resource Assessments Pty Ltd. for Mungana Pty Ltd. April 2009.
- NRA 2009c. Mungana 2009 Wet Season Environmental Impact Monitoring Program. Prepared by Natural Resource Assessments Pty Ltd. for Mungana Pty Ltd. July 2009.
- NRA 2009d Spill 1 Investigation 2009 – Environmental Impact Monitoring Program Survey. Prepared by Natural Resource Assessments Pty Ltd for Mungana Pty Ltd. August 2009.
- RLA 2008. Groundwater Monitoring Bores for Assessment of Potential Impact on Caves in the National Park. Technical Note to Mungana Pty Ltd dated 10 February 2008.