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## **Vista Gold Australia**

### **Mt Todd Gold Project**

#### **Notice of Intent**

April 2011



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# Contents

1.	Introduction	1
1.1	Overview	1
1.2	Proponent	1
1.3	Consultant	2
2.	Location of project	3
2.1	Location, land tenure and project area	3
2.1.1	Mine site	3
2.1.2	Quarry	3
2.2	Site history	7
3.	Project description	9
3.1	Project overview	9
3.2	Construction and commissioning activities	11
3.3	Mining and processing	11
3.3.1	Mining	11
3.3.2	Ore processing	12
3.4	Mine facilities and infrastructure	14
3.4.1	Heap Leach Pad	16
3.4.2	Low Grade Ore Stockpiles	16
3.4.3	Clay borrow area	16
3.4.4	Administration and plant site buildings	16
3.4.5	Limestone kiln	16
3.4.6	Site Access	17
3.5	Waste disposal	17
3.5.1	Waste Rock Dump	17
3.5.2	Tailings Storage Facility	17
3.5.3	Water	17
3.5.4	Active water treatment	17
3.5.5	Passive / semi-passive water treatment	18
3.6	Operations water management	19
3.7	Power and gas supply	19
3.8	Workforce and accommodation	19
3.8.1	Workforce	19
3.8.2	Accommodation	19



3.9	Chemical, Fuel and Oil Storage	20
3.10	Explosives Magazines / Depot	20
3.11	Rehabilitation and Closure	20
3.12	Limestone Quarry	22
4.	Legislative Framework and Licensing Requirements	23
4.1	Commonwealth legislation	23
4.1.1	Environment Protection and Biodiversity Conservation Act 1999	23
4.1.2	Native Title Act 1993	24
4.1.3	National Environment Protection Measures (Implementation) Act 1998	24
4.2	Northern Territory Legislation	24
4.2.1	Mining Act 1980	24
4.2.2	Mining Management Act 2001	24
4.2.3	Environmental Assessment Act 1982 and Environmental Assessment Administrative Procedures Act 1984	25
4.2.4	Northern Territory Aboriginal Sacred Sites Act 1989	26
4.2.5	Heritage Conservation Act 1991	26
4.2.6	Water Act 1992	26
4.2.7	Waste Management and Pollution Control Act 1998	26
4.2.8	Other	27
4.3	Guidelines	27
5.	Site Description	28
5.1	Site Selection	28
5.2	Environmental Setting	28
5.3	Climate	29
5.4	Geology and Soils	29
5.4.1	Mt Todd Gold Mine	29
5.4.2	Limestone Quarry	29
5.5	Surface Water	30
5.5.1	Mt Todd Gold Mine	30
5.5.2	Limestone quarry	38
5.6	Groundwater	38
5.6.1	Mt Todd Gold Mine	38
5.6.2	Limestone quarry	43
5.7	Land units and capacity	43
5.7.1	Mt Todd Gold Mine	43



5.7.2	Limestone quarry	44
5.8	Flora and vegetation	46
5.8.1	Mt Todd Gold Mine	46
5.8.2	Limestone quarry	62
5.9	Fauna	65
5.9.1	Mt Todd Gold Mine	65
5.9.2	Limestone quarry	79
5.10	Air quality	83
5.10.1	Mt Todd Gold Mine	83
5.10.2	Limestone quarry	86
5.11	Noise and vibration	86
5.11.1	Mt Todd Gold Mine	86
5.11.2	Limestone quarry	89
5.12	Aboriginal heritage	89
5.12.1	Mt Todd Gold Mine	89
5.12.2	Limestone quarry	93
5.13	Non-indigenous heritage	95
5.13.1	Mt Todd Gold Mine	95
5.13.2	Limestone quarry	96
5.14	Social	96
5.14.1	Mt Todd Gold Mine and limestone quarry	96
5.15	Economics	97
5.15.1	Mt Todd Gold Mine and Limestone quarry	97
5.16	Greenhouse gas emissions	98
5.16.1	Mt Todd Gold Mine and Limestone quarry	98
5.17	Rehabilitation and decommissioning	98
6.	Summary	99
7.	References	100

## Table Index

Table 1	Proponent contact details	2
Table 2	Consultant contact details	2
Table 3	Mt Todd Gold Mine site history	7
Table 4	Approximate development footprints of existing and proposed mine facilities and infrastructure	15
Table 5	Summary of Stream Flow Information	32



Table 6	Onsite Water Storage Facilities	33
Table 7	Surface water - potential impacts and mitigation (mine site)	37
Table 8	Groundwater – potential impacts and mitigation (mine site)	42
Table 9	Water levels (NRETAS, 2011)	43
Table 10	Areas of vegetation types affected by past and proposed mine expansion	51
Table 11	Vegetation types – potential impacts and mitigation (mine site)	53
Table 12	<i>Utricularia singeriana</i> (threatened (it is vulnerable to extinction) under the NT TPWC Act) and other flora – potential impacts and mitigation measures	58
Table 13	Presence of EPBC listed species within the proposal area	67
Table 14	Mosquito species as vectors for disease	71
Table 15	Native fauna – potential impacts and mitigation (mine site)	73
Table 16	Macroinvertebrates - potential impacts and mitigation (mine site)	77
Table 17	Biting Insects – potential impacts and mitigation (mine site)	78
Table 18	Presence of EPBC listed species in the quarry proposal area	80
Table 19	Air Quality – Potential impacts and mitigation (mine site)	85
Table 20	Noise and Vibration – Potential impacts and mitigation (mine site)	88
Table 21	Aboriginal heritage –potential impacts and mitigation (mine site)	92
Table 22	Aboriginal heritage – potential impacts and mitigation (limestone quarry site)	94

## Figure Index

Figure 1	Location of project – regional context	4
Figure 2	Mt Todd mine leases	5
Figure 3	Existing site layout	6
Figure 4	Proposed works	10
Figure 5	Simplified process schematic	13



Figure 6	Geology of Limestone Quarry Exploration Lease Application Area	30
Figure 7	Catchment boundaries	31
Figure 8	Water bodies on site	34
Figure 9	Aquifers	39
Figure 10	Land Systems – Mt Todd mine site	45
Figure 11	Mt Todd mine – Vegetation map	47
Figure 12	NRETAS flora records – Mt Todd mine	50
Figure 13	NRETAS NVIS Vegetation (1:1,000,000) - Quarry	63
Figure 14	NT Fauna Atlas Records – Gouldian Finch – Mt Todd mine	66

## Appendices

- A Pit and Tailing Storage Facility 1 Stages
- B EPBC Protected Matters Search Tool Report & Flora and Fauna Species List (Mine Site)
- C EPBC Protected Matters Search Tool Report & Flora and Fauna Species List (Limestone Quarry Site)
- D AAPA Search Results (Mine Site)
- E AAPA Search Results (Limestone Quarry Site)



# 1. Introduction

## 1.1 Overview

Vista Gold Australia is proposing to:

- ▶ Re-establish and operate the Mt Todd Gold Mine, located approximately 55 km north of Katherine, Northern Territory (NT) and
- ▶ Establish and operate a limestone quarry, approximately 20 km west of the mine site and north west of Katherine. (Limestone will be used as a neutralising agent in mining operations and rehabilitation).

The objectives of this Notice of Intent (NOI) are:

- ▶ To notify the Northern Territory Government of the proposed project
- ▶ To provide an overview of key elements of the project
- ▶ To provide an indication of potential impacts and management measures of the project
- ▶ To provide the NT Department of Resources (DOR) and the NT Department of Natural Resources, Environment, the Arts and Sport (NRETAS) sufficient information to formally determine the level of assessment required under the NT *Mining Management Act* or the *Environmental Assessment Act* 1982 i.e. an environmental impact statement (EIS) or public environment report (PER).

The project is at the prefeasibility stage. Information on some elements of the project is limited at the time of preparation of the NOI. Additional information will be developed throughout 2011 and included in the EIS, assuming the project will trigger further environmental assessment.

The structure of this NOI is based on NRETAS' NOI Guidelines.

## 1.2 Proponent

The proponent for the project is Vista Gold Australia Pty Ltd (Vista Gold). Vista Gold is a wholly owned subsidiary of Vista Gold Corporation. Vista Gold has been working with Vista Gold Corporation in determining the feasibility of the Mt Todd Gold Mine.

Vista Gold Corporation is an international gold mining company with over 20 years history of gold exploration, development and operations. In addition to Mt Todd, Vista Gold Corporation has projects in the United States, Mexico and Indonesia.





Contact details for Vista Gold are provided in Table 1.

**Table 1 Proponent contact details**

Company	Vista Gold Australia Pty Ltd
Contact	Ray Iacono
Address	PO Box 1467, Double Bay NSW, Australia 1360
Phone	+61 2 9327 4600
Fax	+61 2 9388 7313
Email	<a href="mailto:riacono@vistagoldaustralia.com.au">riacono@vistagoldaustralia.com.au</a>

### 1.3 Consultant

GHD Pty Ltd (GHD) has been engaged by Vista Gold to prepare the NOI. Contact details for GHD are provided in Table 2.

**Table 2 Consultant contact details**

Company	GHD Pty Ltd
Contact	Kylie Fitzpatrick
Address	Level 5, 66 Smith Street, Darwin, Northern Territory, Australia, 0800
Phone	+61 8 8982 0107
Fax	+61 8 8981 1075
Email	<a href="mailto:kylie.fitzpatrick@ghd.com">kylie.fitzpatrick@ghd.com</a>



## 2. Location of project

### 2.1 Location, land tenure and project area

#### 2.1.1 Mine site

The Mt Todd Gold Mine site is located approximately 55 km north west of Katherine, and 250 km south of Darwin, NT, Australia (Figure 1). The topographical feature named Mt Todd is within the mine lease. The mine site is accessed via Jatbula Road (restricted mine access road), approximately 10 km west of the Stuart Highway (the main highway between Darwin and Adelaide).

Mining and associated operations will occur on mine leases MLN 1070, MLN 1071, and MLN 1127 covering 5,365 ha (Figure 2). Vista Gold also controls exploration leases EL 25576, EL 25668, EL 25669, EL 25670 covering 117,632 ha.

The project area is in a historical mining district. Mt Todd Gold Mine site is a brownfield/disturbed site. The site was previously mined for gold in the 1990s. Mining operations ceased in the 2000s (section 2.2). Mining infrastructure such as tailing dams, waste rock dumps and remains of processing facilities remain on site (section 3) (Figure 3).

The mine is surrounded by Exploration Lease 25576 and 25670, controlled by Vista Gold. Surrounding land uses immediately adjacent to the mine site include:

- North – Horseshoe Tin Field
- East – Nitmiluk National Park
- South – Edith River and Edith Falls Road
- West – Yinberrie Hills.

The nearest sensitive receptor (in this case residential area) is the Werenbun Community approximately 8 km east (upstream of the Edith River located to the immediate south of the mine site).

#### 2.1.2 Quarry

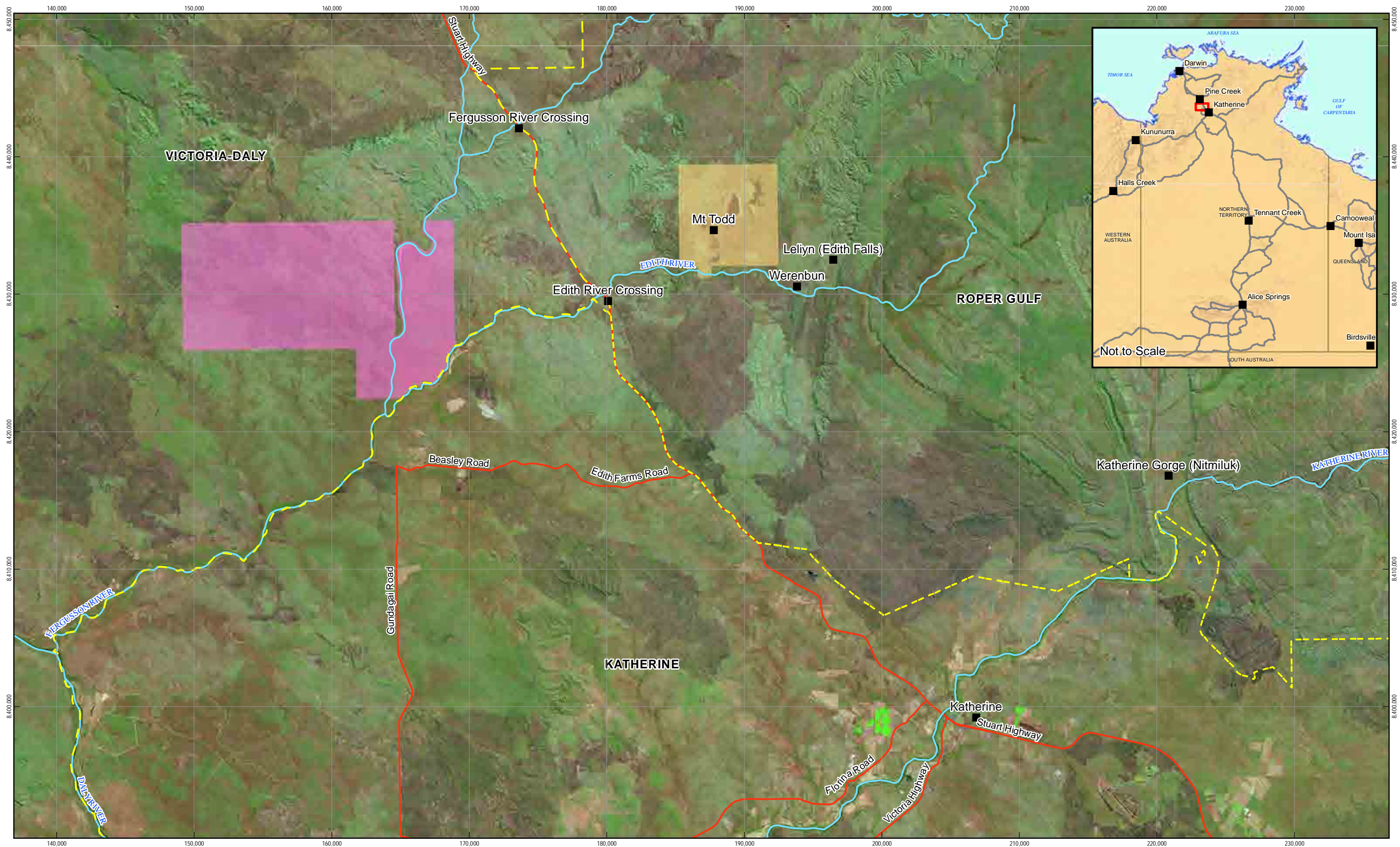
Vista Gold submitted an application for exploration leases over an area approximately 20 km west of the Mt Todd Gold Mine site and approximately 10 km west of the Stuart Highway (Figure 1). An exploration lease has yet to be granted and work has not yet commenced to define the location of the quarry.

The quarry is estimated to be 150 metres x 150 metres at 25 metres depth. Flexibility exists to alter these dimensions and to locate the quarry to avoid environmental impact. Support facilities for fuel storage, equipment maintenance, office, lunch room, ablutions and training room will be required. Limestone will be stockpiled at the mine site.

Land uses in the vicinity of the area of the Exploration Lease (EL) application include:

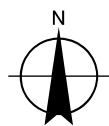
- North – Pastoral areas and EL 25885
- East – EL 23568, EL 23569 and Stuart Highway (10km east)
- South – Fairview Peak, pastoral areas and Fergusson River
- West – Dead Horse Hill and pastoral areas.





1:250,000 (at A3)  
0 2.5 5 7.5 10  
Kilometres

Map Projection: Universal Transverse Mercator  
Horizontal Datum: Geocentric Datum of Australia  
Grid: Map Grid of Australia 1994, Zone 53



#### LEGEND

- Place Names
- Major Roads
- Rivers
- LGA Boundaries
- Mt Todd Mineral Leases
- Proposed Quarry Exploration Area



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Mt Todd Gold Project

Job Number 43-21801  
Revision 0  
Date 11 APR 2011

Location of Project - Regional Context

Figure 1

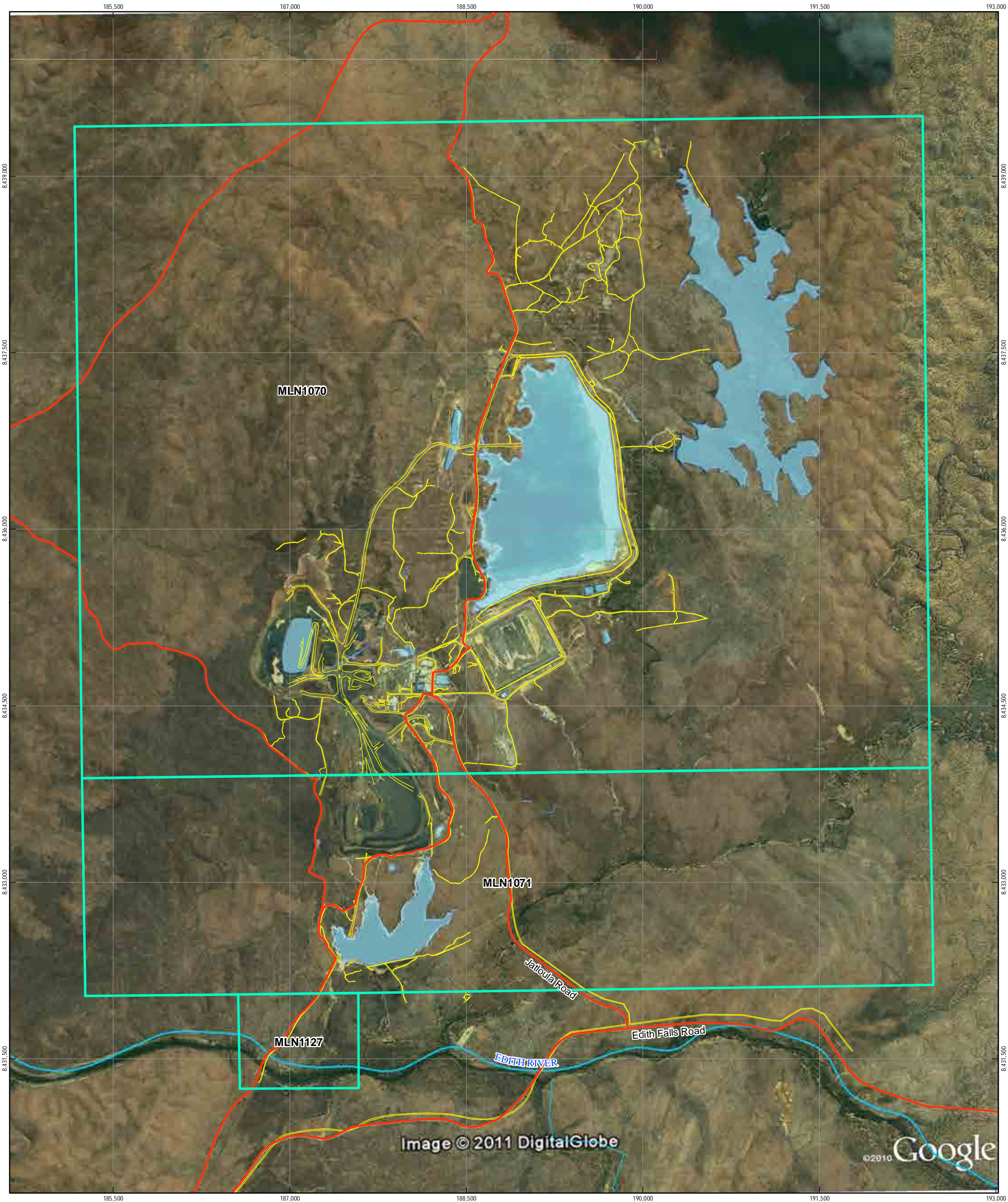
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Data source: NRETAS - Drainage (2011). Navteq - Roads (2008). State Boundaries (2008). Vista Gold - Mt Todd Mining Leases, Proposed Quarry Exploration Area (2011). Geoscience Australia - Landsat Imagery (2007). Place Names, LGA Boundaries (2008). Created by: CM

66 Smith Street Darwin NT 0800 Australia T 61 8 8982 0100 F 61 8 8981 1075 E [drwmail@ghd.com](mailto:drwmail@ghd.com) W [www.ghd.com.au](http://www.ghd.com.au)

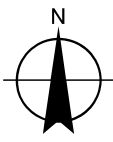




- LEGEND**
- Mineral Lease Boundary
  - Existing Mine Layout
  - Access Roads
  - Water bodies
  - Waterways

0 0.5 1 1.5  
Kilometres

Map Projection: Universal Transverse Mercator  
Horizontal Datum: Geocentric Datum of Australia  
Grid: Map Grid of Australia 1994, Zone 53



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## Mt Todd Mine Leases

## Figure 2

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Data source: NRETAS - Waterways (2011). Vista Gold - Mineral Leases, Water Bodies, Mine Layout (2011). Google Earth Pro - Imagery (Date Extracted: 28/03/2011). GHD - Access Roads (2011). Created by: CM

66 Smith Street Darwin NT 0800 Australia T 61 8 8982 0100 F 61 8 8981 1075 E drwmail@ghd.com W www.ghd.com.au





LEGEND

— Access Roads





## 2.2 Site history

The Mount Todd Gold Project began in 1986 with several companies involved in the assessment of the mineralisation. Pegasus Gold Australia Pty Ltd operated the mine from 1993 to 1997, when the project closed as a result of technical difficulties and deterioration of gold's market value.

A joint venture, comprising Multiplex Resources Pty Ltd and General Gold Resources Ltd bought the deeds to the mine in 1999 and operated until 2000. Vista Gold acquired concession rights in 2006. An overview of the site history is provided in Table 3.

**Table 3 Mt Todd Gold Mine site history**

Dates	Details
Pre-1988	<p>Gold and tin were discovered in the Mt Todd area in 1889, the majority of deposits were worked in the period from 1902 to 1914.</p> <p>Tungsten, molybdenum and bismuth were discovered at Yinberrie Wolfram field in 1913, 5 km west of Mt Todd and mined.</p> <p>Several companies undertook exploration for uranium and gold in the area at and around Mt Todd from the 1950s onwards.</p>
1986	Pacific Gold Mines NL discovered Quigleys and Gold Reef and limited test mining was undertaken until 1987.
1988	Shell Company of Australia (Billiton) and Zapopan NL discovered the Mt Todd mineralisation (Batman deposit) and acquired Pacific Gold Mines NL Quigleys and Gold Reef interests.
1992	Zapopan acquired Shell Company of Australia's interest through shares within Pegasus Gold. Pegasus Gold Australia Pty Ltd (Pegasus Gold) acquired full ownership of Zapopan in 1995.
1992 – 1997	<p>Feasibility studies for Phase I, a heap leach operation which focused predominately on the oxide portion of the deposit, commenced during 1992. The Phase I project was predicated upon a 4 Mtpy heap leach plant designed to recover 90,000 ounces of gold per year on an annualised basis over a life of four years. This began in late 1993. The treatment rate was subsequently expanded to 6 Mtpy in late 1994.</p> <p>Phase II involved expanding to 8 Mtpy and treatment through a flotation and carbon in leach circuit. A June 1995 feasibility study indicated that treatment of transitional and primary ore from the Batman pit would provide an 8-year mine life and recover 2 million ounces of gold. Capital cost for Phase II was estimated at \$207.8 million.</p> <p>The Pegasus board approved the project on August 17 1995 and commissioning commenced in November 1996. The final capital cost to complete the project was \$232 million.</p> <p>Design capacity was never achieved due to inadequacies in the crushing circuit. An annualised throughput rate of just under 7 Mtpy was achieved by mid 1997. Problems with the flotation circuit resulted in reduced recoveries and necessitated closure of the circuit. High reagent consumption caused by cyanide soluble copper minerals further hindered efforts to reach design production. Operating costs were above those predicted in the feasibility study.</p> <p>The spot price of gold deteriorated from above \$400 an ounce in early 1996 to below \$300 an ounce during 1997. According to the 1997 Pegasus Gold Annual Report, the economics of the project were seriously affected by the slump. Underperformance of the project and higher operating costs led to the mine being closed and placed on care and maintenance on November 14 1997.</p>
1999 – 2000	In February 1999, General Gold agreed to form a joint venture with Multiplex Resources and Pegasus Gold to own, operate, and explore the mine. The joint venture appointed General Gold as the operator with operations occurring between March 1999 and July 2000.



Dates	Details
2000 – 2006	<p>Operations ceased in July 2000, with administrators appointed. Pegasus, through the Deed Administrators, regained possession of various parts of the mine assets in order to recoup the balance of the purchase price owed to it. Most of the equipment was sold in June 2001 and removed from the mine site. The tailing facility and raw water facilities remain at the site.</p> <p>The Deed Administrators, Pegasus Gold, the NT government and the Jawoyn Association Aboriginal Corporation (JAAC) held the property between July 2000 and March 2006.</p>
2006 -2011	<p>Vista Gold purchased the rights to the Mt Todd property on 1 March 2006. The acquisition was completed on June 16 2006. The agreement with the NT Government was for an initial five year term with an extension of five years at Vista Gold's option, and three additional years at the option of the NT Government. This agreement provided that Vista Gold would initiate a comprehensive review of the project to evaluate current site conditions and develop programs to stabilise the legacy facilities minimising offsite migration of potential contaminants. Vista Gold was additionally required to examine all technical, economic and environmental issues, estimate the cost to rehabilitate the site, explore and evaluate the potential of the project, and prepare a technical and economic feasibility study for the potential development and re-starting of operations of the Mt Todd Gold Mine site. Finally, Vista Gold was to review the site water management plan and provide recommendations for improvement.</p> <p>The agreement acknowledged the NT Government's commitment to rehabilitate the site and that Vista Gold has no obligation for pre-existing conditions until it submits and receives approval of a Mine Management Plan for resumption of mining operations.</p> <p>Vista undertook the required environmental reviews in 2006. Four reports were issued by MWH in late 2006 or early 2007 covering the topics of Environmental, Water Management, Closure Planning and the TSF.</p> <p>Vista completed an initial NI 43-101 Compliant Technical Report on the Mt Todd Gold Mine on June 26 2006. A Preliminary Economic Assessment report was completed on December 29 2006.</p> <p>An update to the resource report was completed in May 2008 and again in February 2009 based on the results of additional drilling, sampling, assaying, and testing during 2007 and 2008. An updated Preliminary Economic Assessment report was released on June 11 2009.</p> <p>Vista Gold provided notice to the NT Government in June 2010 that it wished to extend the agreement. In November 2010 the NT Government acknowledged that Vista Gold had fulfilled its obligations for the initial term, and the agreement has been extended for five years until December 31 2015.</p> <p>A Preliminary Feasibility Study report for the Mt Todd Gold Mine was issued on October 1, 2010. This was updated for a 10.65 Mtpy ore mining rate on January 28, 2011.</p>



## 3. Project description

### 3.1 Project overview

The Project consists of:

- ▶ The mining of gold from the existing Mt Todd Gold Mine - Batman Pit (previously mined and now in care and maintenance) (Figure 4)
- ▶ Quarrying and processing of limestone extracted from a nearby outcrop of Katherine Limestone

The proposed development phases for the Mt Todd Gold Mine are:

- ▶ Pre-mining site preparation such as reclamation of existing facilities including:
  - Dewatering of Batman Pit and treatment of acid and metal laden leachates (acid rock drainage (ARD)/ML) from existing water storage ponds, heap leach facilities and tailing facilities (an on-going environmental issue at the site) through implementation of the proposed pre-production Water Management Plan
  - Existing road, telecommunication, electricity, gas, and water infrastructure and facilities
- ▶ Construction of the Ore Processing Plant, Water Treatment Plant, Power Station, Workshops, Office Buildings, Warehouses, Support Buildings, Limestone Quarry, Lime Kiln, Sludge Disposal Cell, Equalisation Pond and tailing storage facilities (TSF)
- ▶ Mining of ore from the existing Batman Pit over a 15 year period
- ▶ Mine closure through rehabilitation of disturbed areas and ongoing treatment of ARD/ML.

Gold mining will be of an open-pit truck and shovel operation, using large haul trucks, hydraulic shovels and front end loaders to transport ore to the crusher, ore stockpiles, waste dumps and tailing storage facilities. Extracted ore, up to 10.65 million tonne per year (Mtpy), will be transported to an Ore Processing Plant where it will be crushed, pre-aerated and subjected to carbon in leach (CIL) leaching followed by adsorption, desorption and recovery (ADR) leading to gold dore (unrefined gold). The CIL tailing will be detoxified and sent to an impoundment; from which plant process water will be recycled. Figure 4 provides an overview of the proposed general arrangement for the Mt Todd Gold Mine.

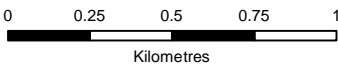
The proposed limestone quarry will consist of a 300 – 500 tonne per day (tpd) open pit mine utilising a drill and blast, loader and truck operation. Product will be transported to Mt Todd and fed into a jaw crusher and screening plant prior to processing in a 150 tpd vertical lime kiln. The kiln will produce the lime or ore processing and waste water treatment. An access road will be constructed to the quarry.

Sections 3.2 to 3.12 are based on the Mt Todd Gold Mine Preliminary Feasibility Study (TetraTech 2011).

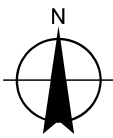




- LEGEND**
- |                                  |  |
|----------------------------------|--|
| — Access Roads                   | Batman Pit Proposed 15yr Boundary            |
| Proposed Processing Plant        | Proposed New Tailing Storage Facility (TSF2) |
| Limestone Storage and Lime Plant | Proposed Rock Dump Expansion                 |



Map Projection: Universal Transverse Mercator  
Horizontal Datum: Geocentric Datum of Australia  
Grid: Map Grid of Australia 1994, Zone 53



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## Proposed Works

## Figure 4

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Data source: Tetra Tech - Existing and Proposed Mine Layout (2011). Vista Gold - Imagery (2011). GHD - Access Roads (2011). Created by: CM

66 Smith Street Darwin NT 0800 Australia T 61 8 8982 0100 F 61 8 8981 1075 E [drwmail@ghd.com](mailto:drwmail@ghd.com) W [www.ghd.com.au](http://www.ghd.com.au)





## **3.2 Construction and commissioning activities**

The main construction and commissioning activities for the Mt Todd Gold Mine are:

- Ongoing dewatering of the Batman Pit
- Ongoing operation of the existing Water Treatment Plant (WTP) to treat ARD/ML until relocated
- Construction of temporary facilities (i.e. lay down areas, offices, workshops, etc)
- Construction of permanent workshops, offices, etc
- Construction of pipelines, Ore Processing Plant, Power Station, Limestone Crusher, and Lime Kiln
- Recommissioning the existing Tailing Storage Facility (TSF1)
- Construction of a new Tailing Storage Facility (TSF2) at year 5
- Construction of new sumps, decant towers and collection ditches
- Construction of a new WTP, Sludge Disposal Cell and Equalisation Pond.

Plant equipment and construction materials will be transported to the site by road. Any imports via the Port of Darwin would use existing freight receiving and staging areas. Trucking numbers would be established by contractors involved in the engineering and construction period.

## **3.3 Mining and processing**

### **3.3.1 Mining**

Initial mining operations at Mt Todd will be focussed on the previously mined Batman deposit. Investigations of the Quigleys and other deposits will be ongoing. The production schedule of up to 10.65 Mtpy of ore will occur over a 15 year period.

Drilling and blasting, to loosen rock ahead of mining, will be undertaken and designed to produce rock sizes that conform to processing requirements. Blasted ore will be loaded into trucks for transportation to ore stockpiles prior to processing.

Batman Pit will be significantly deepened and enlarged from its current depth of 114 m to a proposed depth of 471 m. The surface area of the pit will be increased from approximately 40 ha to 266 ha.

Scaling and blasting of selected pit benches and walls will be confirmed during the production phase.

The Pit will incorporate 6 m benches for mining. In areas where the material is consistently ore or waste, benches may be mined in 12 m heights. The ultimate pit design is shown in Figure 4 and Appendix A.

Water will be sprayed onto unsealed roads to suppress dust using a water cart. Environmentally benign surfactants may be used on road surfaces to reduce the water demand for dust suppression where practical and economically viable.



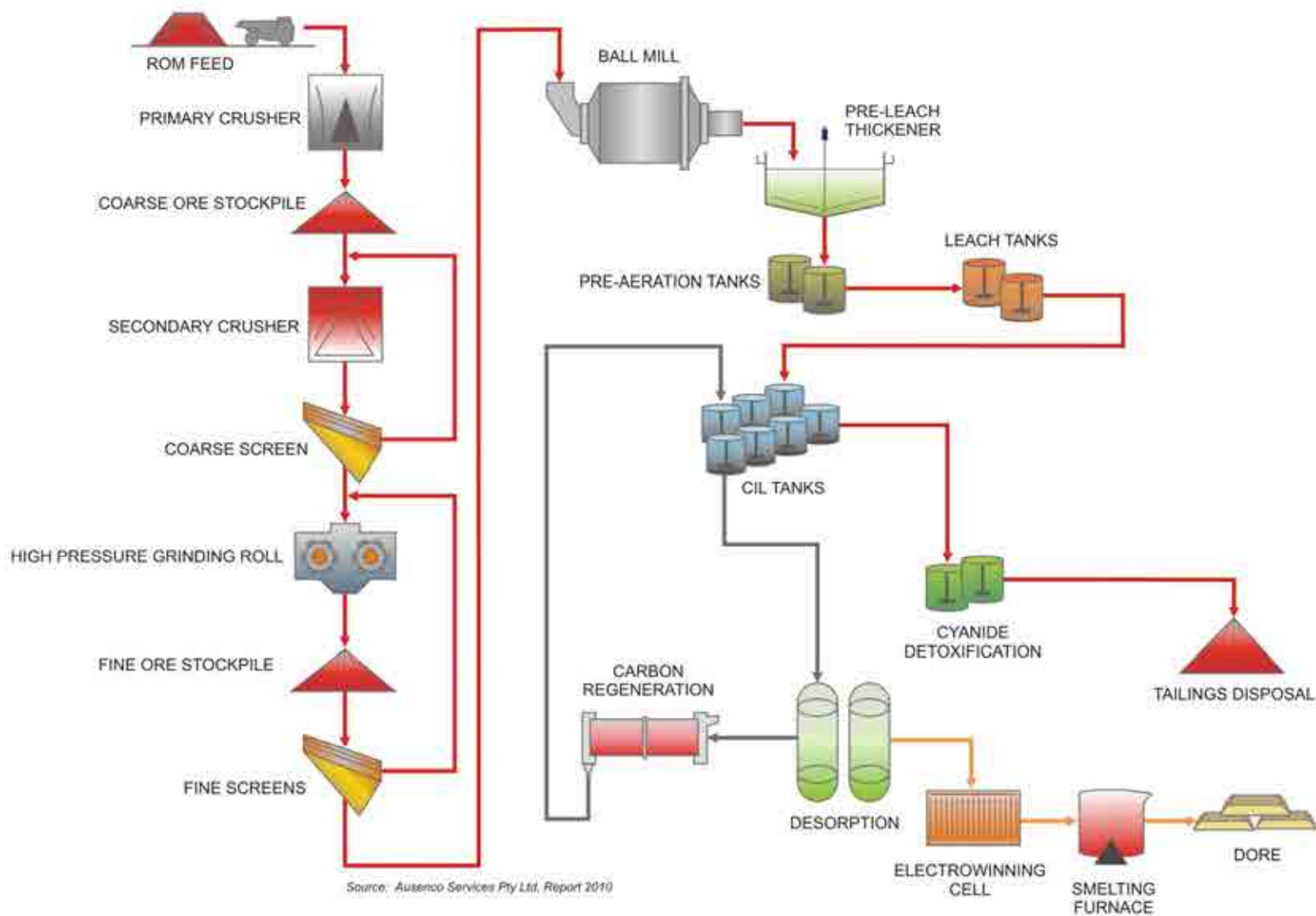
### **3.3.2 Ore processing**

A new Ore Processing Plant will be constructed in the vicinity of the current Process Plant and Pad Area. It is anticipated the existing disturbance area will not change significantly.

The Process Plant will consist of a primary gyratory crusher, secondary cone crusher, coarse screening, coarse ore stockpile, high pressure grinding rolls (HPGR), fine ore surge storage, fine screening, classification, ball mill, pre-leach thickener, pre-aeration, CIL circuit, elution circuit, gold room, cyanide detoxification and tailings pumps. Plant operation will be monitored using a control system from a centrally located control room.

A simplified process schematic is provided in Figure 5.

The final product will be gold dore (impure gold) bars. The bars will be stored in a secured area at the mine and trucked to Darwin in an armoured car for onward secure shipment to a refinery. It is expected that an average of one armoured truck shipment would be required per week.



**Figure 5 Simplified process schematic**



### **3.4 Mine facilities and infrastructure**

Existing facilities at the Mt Todd Gold Mine will be reused during the proposed operations. Major facilities that exist at Mt Todd include (Figure 3):

- ▶ Batman Pit (which is at present a retention pond (RP3))
- ▶ Waste Rock Dump (WRD), WRD retention pond (RP1) and pumping system
- ▶ Tailings Storage Facility (TSF) and TSF decant and polishing ponds
- ▶ Process Plant and Operations Area
- ▶ Low Grade Ore Stockpile 1 (LGO1), LGO Pond (RP2) and pumping system
- ▶ Raw Water Dam (RWD)
- ▶ WTP
- ▶ Mine roads and other ancillary facilities (e.g. pipelines).

Major new facilities proposed include (Figure 4):

- ▶ Low Grade Ore Stockpile 2 (LGO2), lined LGO2 collection ditch and lined LGO2 sump
- ▶ Run-on diversion up-gradient of RP1, TSF1 and WRD
- ▶ New WTP
- ▶ New Limestone Kiln
- ▶ New Tailings Disposal Facility (TSF2) and sumps
- ▶ TSF1 and TSF2 closure spillways
- ▶ Modified TSF1 decant ponds
- ▶ Lined TSF1 and TSF2 collection ditches
- ▶ Collection ditch at toe of closed WRD
- ▶ Modified HLP seepage collection pump and pipeline
- ▶ Pumps and pipelines
- ▶ Clay borrow area
- ▶ Three anaerobic treatment wetlands (or equivalent passive/semi-passive water treatment system).

Approximate development footprints of existing and proposed facilities and infrastructure are provided in Table 4.



**Table 4 Approximate development footprints of existing and proposed mine facilities and infrastructure**

Facility / Infrastructure	Existing Footprint	Proposed Footprint
Batman Pit	Depth – 114 m Perimeter – 1,275 m Area – 40 ha	Depth – 471 m Perimeter – 4,200 m Area – 100 ha
WRD	Area – 70 ha Height – 24 m	Area – 200 ha Height – 140 -170 m
TSF1	Area – 170 ha Height – 16 m	Area – 170 ha Height – 34 m
Process Plant and Operations Area	Area – 15 ha	Area – 15 ha
Heap Leach Pad (HLP)	Area – 40 ha	Area – 40 ha
LGO1	Area – 10 ha	Area – 10 ha
LGO2	N/A	Area – 30 ha
Existing WTP	Process Plant and Operations Pad	Decommissioned during the construction period and replaced by a new WTP
RWD	Volume – 4,287,313 m <sup>3</sup>	Volume – 4,287,313 m <sup>3</sup>
New WTP	Process Plant and Operations Pad	Process Plant and Operations Pad
Limestone Kiln	N/A	0.6 ha
Equalisation Pond	N/A	Area – 1.7 ha
Sludge Disposal Cell	N/A	Area – 2 ha
TSF2	N/A	Area – 420 ha Height – 80 m
Clay Borrow Area	N/A	Area – 12 ha
Administration and Plant Site Buildings		32 ha
Anaerobic Treatment Wetlands	N/A	Area – 10 ha

Key components of mine infrastructure are discussed below. The Waste Rock Dump, Tailings Storage Facilities and Passive Water Treatment Systems are discussed in Section 0.



#### **3.4.1 Heap Leach Pad**

The existing HLP covers an area of 40 ha and is 20 to 25 m thick with side slopes as steep as 1H:1.6V. The slopes are dissected by a dense network of rills and gullies. The heap leach pad is not required for renewed gold production at Mt Todd and will be rehabilitated and closed by Vista following approval to return the site to operation.

#### **3.4.2 Low Grade Ore Stockpiles**

LGO1 (current Low Grade Ore Stockpile) will be used for the first five years of production. A second low grade stockpile (LGO2) will be constructed adjacent to the WRD.

#### **3.4.3 Clay borrow area**

Based on drill core data, sources of clay may be available on site; although there is uncertainty around the quantity and quality of clay available. Clay or other low-permeability materials are a critical component in controlling the moisture retention and release properties of the store and release cover. The location of the borrow area will likely be in the vicinity of the previous borrow area, to the SE of TSF1. Storm water drainage controls, and erosion and sediment controls will be designed and constructed to minimise erosion and channel scour within the low-permeability borrow area. Based on requirements, the borrow area would likely be 12 ha with a depth of 15 m. The total volume of borrow would be around 1.5M m<sup>3</sup>.

#### **3.4.4 Administration and plant site buildings**

Administration and plant site buildings will consist mostly of prefabricated and steel-framed-and-clad construction. Buildings will include a mine workshop, mine office, plant workshop, plant warehouse, operations administration office, main administration office, main plant amenities and ablutions, plant laboratory, medical facility and plant security building/gatehouse.

A modular wastewater treatment plant will be located in the process plant. The plant will provide a level of treatment sufficient for discharged effluent to be used as irrigation water.

Site communications will be based around the existing Telstra connection to the site. A cellular telephone tower would likely also be erected near the site.

A fire protection system consisting of hydrants and hose reels in key areas on a ring main system will be located on site.

Proposed administration and plant site buildings will be slightly to the north of the existing location of administration and plant site buildings. (The location will be moved north to allow for expansion of Batman Pit) (pers. comm. Ausenco March 2011).

#### **3.4.5 Limestone kiln**

A jaw crusher and screening plant will be constructed adjacent to the kiln to process raw limestone from the quarry (Figure 4).



### **3.4.6 Site Access**

Access to the mine will be via sealed roads; the Stuart Highway, Edith Falls Road and the mine access road, Jatbula Rd.

## **3.5 Waste disposal**

### **3.5.1 Waste Rock Dump**

The existing WRD will be extended. WRD development over the 15 year mine-life is shown in Figure 4. The existing WRD comprises approximately 16 Mt of waste rock. The ultimate WRD dump will contain around 214 Mt of material, with an additional 5.6 Mt used to flatten areas around the crushing plant and the stockpile area. The WRD will expand to around 200 ha from its current area of 70 ha. The current WRD is around 24 m high. The ultimate WRD design will be 140 to 170 m high.

Additional waste is to be placed to level an area to the northeast of the waste dump and extending north around the crushing area.

Waste will also be placed as part of the construction for TSF1 and TSF2, and suitable waste will be used in capping TSF1. The total tonnage required for TSF1 and TSF2 construction is 4 Mt and 43 Mt respectively with an additional 7 Mt used for the capping of TSF1.

The total waste storage capacity available is 273 Mt; slightly more than the capacity required.

### **3.5.2 Tailings Storage Facility**

Thickened tailings are expected to be generated from the Ore Processing Plant at a rate of 30,000 tpd. The Mt Todd Gold Mine will require a total of 150 Mt of tailings storage over the proposed 15 year mine life. Tailings will be stored in two facilities: the existing TSF1 located to the northeast of the existing Ore Processing Plant pad and the proposed TSF2 to be located in the valley southeast of TSF1 (Figure 4).

It is proposed to dispose approximately 60 Mt of tailings at the existing TSF1. TSF1 will be raised (currently 16 m above surrounding ground level) to approximately 34 m above the surrounding ground level to accommodate this volume. The embankment raise will be completed in six stages. Appendix A – Stage 2 Plan shows the first and ultimate raises for TSF1.

The remaining 90 Mt of tailings will be disposed in the proposed TSF2 (Appendix A – Stage 7 Plan). The ultimate height of TSF2 is approximately 80 m above the surrounding ground level. TSF2 has been designed to operate as a zero-discharge facility, so all seepage from the underdrain, toe drain, and overdrain systems will be collected and pumped back to the impoundment.

### **3.5.3 Water**

Both active and passive approaches have been adopted for water treatment. The characteristics of these treatment systems are discussed below.

### **3.5.4 Active water treatment**

The goals of active water treatment and sludge disposal are:





- ▶ Partial dewatering of Batman Pit by planning year -1 to permit in-pit preparation activities (lay backs) prior to initiation of mining while meeting Water Discharge Licence (WDL) and Edith River water quality–base effluent standards
- ▶ Year-round collection, containment and treatment of all ARD/ML prior to effluent release
- ▶ Ensure that treated ARD/ML complies with the WDL numeric water quality standards
- ▶ Use neutralisation reagents and flocculants efficiently
- ▶ Minimise the volume and water content of sludge produced from water treatment
- ▶ Provide adequate long-term storage and containment of sludge in the on-site disposal facility
- ▶ Promote rapid sludge consolidation.

Waste water from the WRD retention pond, tailing facility return ponds, and equalisation pond will be treated in the new WTP. This will be initiated during the pre-production phase of the project to empty water from the retention ponds, continue through the operations phase of the project, and then continue into the closure and post-closure periods until acid and metal laden leachate (ARD/ML) flows and water quality properties are conducive to treatment in passive/semi-passive water treatment systems. Approximately 62 Mm<sup>3</sup> of ARD/ML will be treated in the new WTP during the mine-life.

Most of the tailing return water will be re-used in the process plant. Attempts will also be made to use water from the WRD retention pond as process water in the plant, in an effort to reduce the overall amount of treated effluent to be released to the environment.

A lined Equalisation Pond will be constructed for mixing of ARD/ML from various on-site sources prior to treatment and to temporarily store ARD/ML in case of system upset. A lined Sludge Disposal Cell will be constructed for the permanent disposal of water treatment sludge.

Wastewater from onsite amenities will be treated in a continuous activated sludge WWTP.

### **3.5.5 Passive / semi-passive water treatment**

The goals of the passive/semi-passive water treatment are:

- ▶ Elimination or drastic curtailment the costs and continual inputs (e.g. reagents, power, staff) required to operate and maintain the New WTP
- ▶ Elimination of sludge disposal cell operations and maintenance
- ▶ Year-round collection, containment and treatment of all ARD/ML prior to effluent release
- ▶ Treated ARD/ML that complies with the WDL numeric water quality standards.

Passive and semi-passive water treatment systems typically include one or more of the following: constructed anaerobic and aerobic wetlands; Successive Alkalinity Producing Systems (SAPS); oxic limestone drains (OLD); anaerobic limestone drains (ALD); sulfate-reducing bacteria bioreactors; aeration and settling basins; waterfalls; permeable reactive barriers; and other passive treatment methods.

Passive and semi-passive water treatment systems are generally appropriate for ARD/ML with a discharge of between ~ 24 m<sup>3</sup> and ~ 48 m<sup>3</sup>/h and low levels of mineral acidity. Passive water treatment systems have successfully treated ARD/ML flows of up to 120 m<sup>3</sup>/h. It is estimated that three passive



treatment systems (most likely anaerobic wetlands or SAPS) will be required covering a total area of around 11 ha.

In planning year 13 of the production phase ARD/ML flows from the reclaimed TSF1 and HLP will be treated in Passive Treatment System 1. ARD/ML flows from the reclaimed WRD will be treated in Passive Treatment System 2 immediately following the closure phase in planning year 19. ARD/ML flows from TSF2 will be treated in Passive Treatment System 3 in planning year six of the post-closure phase (planning year 24).

The location and final form of these systems is yet to be determined.

### **3.6 Operations water management**

Raw water will be harvested from the existing raw water dam. Raw water will be used for crusher sprays, reagent make-up, potable water production, process water-make-up, gland water, filter plant seal water make-up and as fire water reserve.

Most of the tailing return water will be re-used in the process plant. Attempts will also be made to use water from the WRD retention pond as process water in the plant, in an effort to reduce the overall amount of treated effluent to be released to the environment.

Potable water (1.7 m<sup>3</sup>/h) will be treated via filtration, chlorination and ultra violet sterilisation and stored in a Potable Water Tank.

### **3.7 Power and gas supply**

The property has an existing high-pressure gas line and connection to the local utility grid via two existing transmission lines. Site electrical power demands are estimated at 46 MW. Electrical demand will be met through the installation of a RR Trent 60 Wet Low Emissions single gas turbine generator located on the existing Mt Todd generating station plot.

Water consumption in the Power Plant is primarily for evaporative cooling of the turbine inlet air, injection into the combustor for NO<sub>x</sub> control and periodic cleaning of the turbine compressor section. The existing raw water dam will supply the required 340 litres per minute for Power Plant operation.

The gas turbine is rated for 64 MW. It is anticipated that excess power generated at site will be sold to the local utility, Power and Water Corporation and exported to the grid via existing transmission lines.

### **3.8 Workforce and accommodation**

#### **3.8.1 Workforce**

The construction workforce is expected to peak at around 400.

The mine workforce, including operations, maintenance, engineering, geological and support personnel, is expected to peak at around 300.

#### **3.8.2 Accommodation**

Construction and operations personnel will be housed in Katherine and surrounding areas. It is expected that all employees will live in the local area.



Vista Gold is working with the Katherine Town Council and a developer to secure accommodation. This will be a combination of single and family units and entail a combination of existing and new dwellings. It is expected that building consents will be obtained by the developer.

Vista Gold recognises that the influx of people will impact Katherine and will need to be addressed in future project approvals.

### **3.9 Chemical, Fuel and Oil Storage**

Diesel will be stored onsite in a single storage area close to the heavy equipment workshop. Refuelling facilities will be provided in the heavy vehicle workshop area. It is anticipated that 80,000 L of diesel will be used daily.

Various reagents for mixing and processing in the Ore Processing Plant will be transported to and stored on site.

- ▶ Sodium cyanide will be transported to site as a solid in a vendor bulk sparging unit in 22 t packages. The cyanide will be recovered by dissolving it in water and transferring it to a 494 m<sup>3</sup> storage tank.
- ▶ Sodium hydroxide will be transported to site as a liquid by bulk truck delivery and transferred into a 30 m<sup>3</sup> storage tank.
- ▶ Flocculant will be transported to site as a solid powder and stored in a 15 t dry storage silo. A flocculent solution will be made by dissolving the powder in raw water and storing it in two 1027 m<sup>3</sup> tanks.
- ▶ Sodium metabisulfate will be transported to site as a solid powder. Sodium sulfite solution will be made by mixing it with raw water in a 123 m<sup>3</sup> storage tank.
- ▶ Hydrochloric acid will be transported to site as a liquid by bulk truck delivery. Storage tank capacity will be for 14 days.
- ▶ Carbon will be supplied to site in bulk bags by bulk truck delivery.
- ▶ Fluxes will be transported to site as solids in bags via bulk truck delivery.

Lubricating oil will be stored in bulk containers inside a bunded area with spill protection and recovery.

Waste oil will be stored in a tank within a bunded area and held for collection by a contractor for reprocessing and recycling.

All chemicals, fuels and oils will be stored and contained according to Australian Standards.

### **3.10 Explosives Magazines / Depot**

Packaged explosives will be stored in ANFO/Emulsion storage bins, powder magazines and a cap magazine to be built and operated in accordance with Dangerous Goods regulations. Applications for a Magazine Licence or a licence to store dangerous goods will be submitted to the relevant government agencies before commencing construction of the explosive storage facilities.

### **3.11 Rehabilitation and Closure**

The impact of water quality on the surrounding environment has been the primary environmental issue since closure of the Mt Todd mine site in 2000. All mine retention ponds including the main pit contain



water with low pH levels and elevated concentrations of chemical constituents. Ongoing environmental studies of the mine site will influence mine closure and rehabilitation efforts scheduled to occur as a continuous process throughout the life of the mine. Ongoing refinement of rehabilitation objectives supported by up-to-date environmental site information will be a requirement of mine closure and environmental rehabilitation plans.

Mine closure and subsequent rehabilitation efforts at Mt Todd may be developed according to the following objectives developed from the NT Department of Resources Mine Close Out Objectives (DoR, 2006):

- ▶ Reduce the need for long term monitoring and maintenance through design of and construction of landforms that are geotechnically and geochemically stable
- ▶ Develop landforms that are consistent with the surrounding landscape
- ▶ Develop an environmental monitoring and reporting program which is focused towards demonstrating the achievement of closure outcomes
- ▶ Undertake progressive rehabilitation of the site during operations
- ▶ Ensure that the full cost of decommissioning and rehabilitation is understood and that a mechanism for funding exists.

As with the majority of mine closure plans, progressive rehabilitation of the site during operations will occur. The major and immediate environmental issue for the Mt Todd site is management of water quality. Vista Gold (2011) has developed a set of goals and drivers for closure and subsequent water management for the mine site including:

- ▶ Control existing acid-generating conditions
- ▶ Reduce or eliminate the acid and metal loads in seepage and runoff water
- ▶ Minimise adverse impacts to the surface and groundwater systems surrounding Mt Todd
- ▶ Physically and chemically stabilise mine waste and other mine-related surface disturbances
- ▶ Protect public safety
- ▶ Comply with applicable water quality based effluent standards
- ▶ Comply with NT Government regulations governing mine development and closure.

The NT Government acknowledges current responsibility to rehabilitate the Mt Todd Gold Mine site. Vista Gold has no rehabilitation obligations for pre-existing environmental conditions until it submits and receives approval of a Mine Management Plan for resumption of mining operations (Vista Gold 2011). This Notice of Intent is submitted to DoR to initiate the environmental permitting process. It does not indicate that Vista Gold wishes to commence mining activity at Mt Todd. The liability and responsibility for rehabilitation of the existing disturbance at Mt Todd will remain with the NT Government until after the environmental permitting process has been concluded i.e, until the approval of a Mine Management Plan.

Vista Gold will implement closure plans and rehabilitation strategies for ongoing remediation of the site and good environmental stewardship as part of its mining operations.



### **3.12 Limestone Quarry**

Lime will be used in processing and water treatment of proposed operations. Vista Gold proposes to establish and operate a limestone quarry at a nearby outcrop of the Katherine Limestone. The 300 – 500 tpd quarry operation will consist of a conventional open pit mining/quarry operation using a drill and blast, loader and truck operation. This rate of mining will provide flexibility around the timing of limestone extraction.

The resulting product will be trucked to the mine site to feed the lime kiln. It is estimated that around 12 loads will be transported per day.

Support facilities for fuel storage, equipment maintenance, office, lunch room, ablutions and training room will be required.



## 4. Legislative Framework and Licensing Requirements

### 4.1 Commonwealth legislation

#### 4.1.1 Environment Protection and Biodiversity Conservation Act 1999

Under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), any development requires assessment if it has the potential to affect one or more of eight matters of National Environmental Significance (NES). The matters of NES include:

- World Heritage properties
- National Heritage places
- Wetlands of international importance (listed under the Ramsar Convention)
- Listed threatened species and ecological communities
- Migratory species protected under international agreements
- Commonwealth marine areas
- The Great Barrier Reef Marine Park
- Nuclear actions (including uranium mines).

The environment under the EPBC Act includes:

- a) Ecosystems and their constituents
- b) Natural and physical resources
- c) Qualities and characteristics of locations, places and areas
- d) Heritage values of places
- e) The social, economic and cultural aspects of a thing mentioned in paragraphs a), b) or c).

The EPBC Protected Matters Search Tool indicates that Kakadu Stages 1&3 (a RAMSAR listed wetland) and 10 threatened species and 14 migratory species are likely to, may or are known to occur in the search area (project area plus a 10km buffer). These however are upstream of the mine and will not be impacted.

Immediately adjacent to the west of Batman Pit is known breeding habitat for the listed Gouldian Finch. The pit is proposed to be expanded to the west. Approximately 117 ha (1.8%) of the *E. tintinnans* dominated woodlands shown in Figure 11 is proposed to be cleared. This is one of the vegetation types where the Gouldian finch breeds, making nests in hollows of *E. tininntans*.

Section 5.8 and 5.9 provide an overview of the flora, vegetation and fauna of the project area and potential impacts and mitigation measures.

A referral under the EPBC Act will be submitted to the Federal Department of Sustainability, Environment, Water, Population and Communities (SEWPAC) at the beginning of April 2011.

If the Federal Minister of Environment declares the action (project) as a “non controlled action” the environmental assessment process will be under the NT legislative process. If the Minister declares the



action to be a “controlled action”, the NT/Commonwealth bilateral environmental assessment process will apply.

#### **4.1.2 Native Title Act 1993**

The objectives of the *Native Title Act* 1993 are:

- (a) To provide for the recognition and protection of native title;*
- (b) To establish ways in which future dealings affecting native title may proceed and to set standards for those dealings;*
- (c) To establish a mechanism for determining claims to native title; and*
- (d) To provide for, or permit, the validation of past acts, and intermediate period acts, invalidated because of the existence of native title.*

#### **4.1.3 National Environment Protection Measures (Implementation) Act 1998**

Under the *National Environment Protection Measures (Implementation) Act* 1998, the National Environmental Protection Council (NEPC) was established to set national environmental goals and standards for Australia through the development of National Environment Protection Measures (NEPMs). The NEPC is part of the Environment Protection and Heritage Council (EPHC).

Section 14(1) of the NEPC Act prescribes that NEPMs may relate to any one or more of the following:

- Ambient air quality
- Ambient marine, estuarine and fresh water quality
- The protection of amenity in relation to noise
- General guidelines for the assessment of site contamination
- Environmental impacts associated with hazardous wastes
- The re-use and recycling of used materials.

## **4.2 Northern Territory Legislation**

### **4.2.1 Mining Act 1980**

The objectives of the *Mining Act* 1980 are to a) provide a framework within which persons may undertake activities to explore for and mine mineral resources; and b) enable the value of mineral resources in the Territory to be maximised.

An authorisation under the Mining Act must be obtained prior to commencement of mining activities.

### **4.2.2 Mining Management Act 2001**

The *Mining Management Act* 2001 provides for authorisation of mining activities, management of mining sites, preparation of the environment on mining sites and related purposes. The Act is administered by DoR. The objectives of the act are:



- ▶ Ensure the development of the Territory's mineral resources in accordance with environmental standards consistent with best practice in the mining industry
- ▶ Protect the environment by:
  - the authorisation and monitoring of mining activities
  - requiring appropriate management of mining sites
  - facilitating consultation and cooperation between management and workers in implementing environment protection management systems
  - implementing audits, inspections, investigations, monitoring and reporting to ensure compliance with agreed standards and criteria
  - specifying the obligations of all persons on mining sites with respect to protection of the environmental.
- ▶ Assist the mining industry to introduce programs of continuous improvement to achieve best practice environmental management
- ▶ Enable persons connected with the mining industry to participate in the implementation of this Act through the establishment of a Mining Board to advise the Minister on:
  - Guidelines for the industry
  - specification of competencies required by persons involved in the industry
  - best practice in mining activities.
- ▶ Minimise the liability of the Territory by requiring the payment of security to provide for the rehabilitation of mining sites or to rectify environmental harm caused by mining activities.

An approved Mining Management Plan will be required prior to commencement of proposed works. The Minister will require security for potential costs of rectifying environmental harm or rehabilitating the site.

#### **4.2.3 Environmental Assessment Act 1982 and Environmental Assessment Administrative Procedures Act 1984**

The *Environmental Assessment Act 1982* and the *Environmental Assessment Administrative Procedures Act* ensure, to the greatest extent practicable, that each matter affecting the environment which is, in the opinion of the NT Minister, a matter which could reasonably be considered to be capable of having a significant effect on the environment, is fully examined and taken into account in, and in relation to:

- ▶ The formulation of proposals
- ▶ The carrying out of works and other projects
- ▶ The negotiation, operation and enforcement of agreements and arrangements (including agreements and arrangements with authorities of the Commonwealth, the States and other Territories)
- ▶ The making of, or the participation in the making of, decisions and recommendations
- ▶ Incurring of expenditure.

This NOI was prepared in accordance with the *Information Guidelines for a Notice of Intent (NOI)* (NRETAS).





The NT Environment Minister would determine whether the proposal is likely to have a significant impact on the environment following submission of the NOI and referral from the Minister for Resources. If the impact is likely to be significant, a Public Environment Report or Environmental Impact Statement will be required.

#### **4.2.4 Northern Territory Aboriginal Sacred Sites Act 1989**

The *Northern Territory Aboriginal Sacred Sites Act* 2004 is administered by the Aboriginal Areas Protection Authority (AAPA). The Act provides for the location, recognition, description and protection of sites sacred under Aboriginal tradition. All sacred sites (even if not registered) are protected under the Act and it is an offence to enter or carry out work on a sacred site without permission or a certificate issued by the AAPA. The certificate sets out conditions under which the work may be carried out.

Refer to section 5.12.

#### **4.2.5 Heritage Conservation Act 1991**

As specified under the Act, the main object is to:

*'Provide a system for the identification, assessment, recording, conservation and protection of places and objects of prehistoric, protohistoric, historic, social, aesthetic or scientific value, including geological structures, fossils, archaeological sites, ruins, buildings, gardens, landscapes, coastlines and plant and animal communities or ecosystems of the Territory'.*

Refer to sections 5.12 and 5.13.

#### **4.2.6 Water Act 1992**

The *Water Act* 1992 covers allocation, use, control, protection and management of NT water resources.

Pollution under the Act includes directly or indirectly altering the physical, thermal, chemical, biological or radioactive properties of the water so as to render it less fit for a prescribed beneficial use for which it is or may reasonably be used, or to cause a condition which is hazardous or potentially hazardous to:

- ▶ Public health, safety or welfare
- ▶ Animals, birds, fish or aquatic life or other organisms
- ▶ Plants.

A Waste Discharge Licence (WDL 178) for the Mt Todd site is applicable under this Act. Refer to section 5.5.

#### **4.2.7 Waste Management and Pollution Control Act 1998**

The purpose of the *Waste Management and Pollution Control Act* 1998 is to protect the environment through objectives and approvals, encouraging effective and responsible waste management and reduction and response to pollution. This Act facilitates the implementation of national environment protection measures made under the *National Environment Protection Council (Northern Territory) Act* 1999, and incorporates environmental compliance plans and audits.



Section 14 of the Act establishes a process for notifying the Environmental Protection Agency (the administering agency for the Act) about incidents causing, or threatening to cause pollution. Schedule 2 of the Act requires environment protection/licensing for certain activities.

Refer to Chapter 5.

#### **4.2.8 Other**

Other legislation that may be applicable to the project includes:

- *Territory Parks and Wildlife Conservation Act*
- *Soil Conservation and Land Utilisation Act 2001*
- *Weeds Management Act 2001*
- *Bushfires Act 2004*
- *Dangerous Goods Act 1994*
- *Traffic Act 1987.*

#### **4.3 Guidelines**

The following NT Guidelines may be applicable to this project:

- *Guidelines to Prevent Mosquito Breeding*, Department of Health and Community Services, 1988
- *Erosion and Sediment Control Plan Content*, NRETAS, 2006
- *Policy - Road Traffic Noise on NT Government Controlled Roads*, DPI, 2006
- *NT Health and Families: Requirements for Mining, Construction and Bush Camps (Environmental Health Information Fact Sheet No. 700).*



## 5. Site Description

### 5.1 Site Selection

The Mt Todd site was selected for its known mineralisation/gold deposit. A 2008 exploration programme allows reappraisal of the Mt Todd gold reserves. The reappraisal provides a more accurate estimate of gold reserves than previous assessments and confirms the economic feasibility of the project. Ongoing exploration will continue to identify potential additional reserves.

The Mt Todd Gold Mine site was developed as a mine and significant infrastructure remains in place; some of which will be used if the project proceeds. The majority of new infrastructure will be located in areas previously disturbed by historical mining.

Vista Gold plans to fully mine the economic resource available at Mt Todd. A decommissioning and remediation plan would commence on approval of a Mining Management Plan for operation of the mine; relieving the NT government of the legacy to rehabilitate the existing site (not rehabilitated by previous mining operators).

Limestone could be sourced from a variety of potential locations in the Mt Todd-Katherine-Mataranka area. The area chosen is very close to the mine to minimise costs and carbon dioxide emissions incurred in transport of the limestone to the mine, and for administrative and operational efficiency. Vista Gold could purchase lime commercially as a substitute for producing lime, or as a supplement to requirements.

### 5.2 Environmental Setting

Key environmental elements of or surrounding the site include:

- ▶ Mt Todd which lies in the project area and has an elevation of 230m
- ▶ The Yinberrie Hills located to the west of Batman Pit. The Yinberrie Hills are on an Interim List for the Register of National Estate. They are not listed under the EPBC Act. The Yinberrie Hills is one of a few known major breeding sites for the nationally endangered Gouldian finch
- ▶ The Edith River located immediately south of the mine site. The mine site is downstream of Edith Falls
- ▶ Discharge from site governed by Waste Discharge Licence 178
- ▶ Limited information available on the hydrogeology of the site
- ▶ An historic mining district
- ▶ A community approximately 8km east of the site as the nearest sensitive receptor
- ▶ Previous mining for gold in the 1990s. Mining operations ceased in the 2000s. Mining infrastructure such as tailings dams, waste rock dumps and remains of processing facilities remain on site
- ▶ A lack of rehabilitation from previous mining activities. Environmental concerns such as water management are ongoing.



### **5.3 Climate**

The climate in the Katherine Region is typically characterised by hot, humid wet seasons lasting from November to March followed by a hot, dry season from April to October. Transition periods occur between the wet and dry seasons, typically lasting one month. A majority of rain falls in the wet season.

The Bureau of Meteorology indicates the Katherine region has an average rainfall of approximately 1,100 mm which is highly seasonal ranging from 0.4 mm in June to 269.4 mm in January (BoM 2011).

Temperatures have average maxima of 35.9° and minima of 20.3°. Relative humidity at 09:00 hours ranges from 83% in February to 52% in August, with respective monthly values of 60% and 24% at 15:00 hours. Daily evaporation rates range from 7.9 mm in October to 4.9 mm in June, with an annual average of 6.2 mm.

### **5.4 Geology and Soils**

#### **5.4.1 Mt Todd Gold Mine**

The Mt Todd Gold Mine is located within the Early Proterozoic Pine Creek Geosyncline (PCG), comprising meta-sediments, granitoids, basic intrusives, acid and intermediate volcanic rocks. The deposits are similar to other gold deposits of the PCG. Gold deposits in the PCG are classified as orogenic gold deposits in the subdivision of thermal aureole gold style (Tetra Tech, 2011).

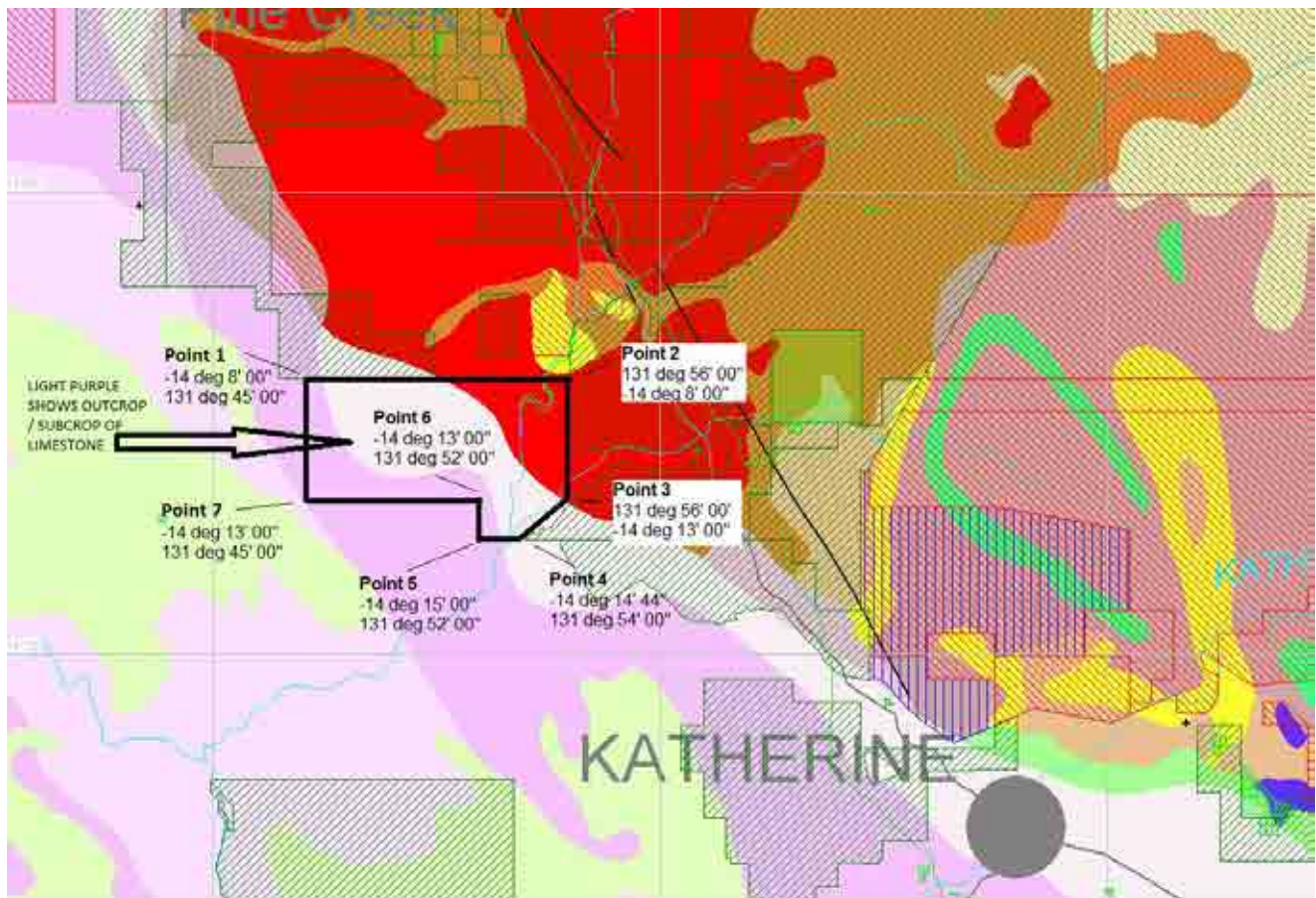
The Batman Deposit shares some characteristics with intrusion-related gold systems, especially in terms of the association of gold with bismuth and reduced ore mineralogies. This makes the deposit unique in the PCG. The mineralisation within the Batman Deposit is directly related to the intensity of the north-south trending quartz sulfide veining. The lithological units impact on the orientation and intensity of mineralization (ibid).

Sulfide minerals associated with the gold mineralisation are pyrite, pyrrhotite, and lesser amounts of chalcopyrite, bismuthinite, and arsenopyrite. Galena and sphalerite are also present but appear to be post-gold mineralisation and are related to calcite veining, bedding, and the east-west trending faults and joints (ibid).

#### **5.4.2 Limestone Quarry**

An outcrop / subcrop of limestone is shown in Figure 6.

Soils vary from sandy and loamy red and yellow earths to lateritic and yellow podsollic soils on the gently undulating land, often over compact clay sub-soils. Heavier textured grey soils are found on the floodplains and levees of the Daly River system while stony and skeletal soils occur in the hills (Kerle, 1996).



**Figure 6 Geology of Limestone Quarry Exploration Lease Application Area**

(source NTGS Geological Maps)

## 5.5 Surface Water

### 5.5.1 Mt Todd Gold Mine

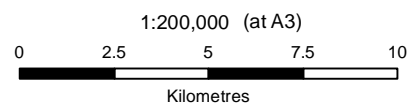
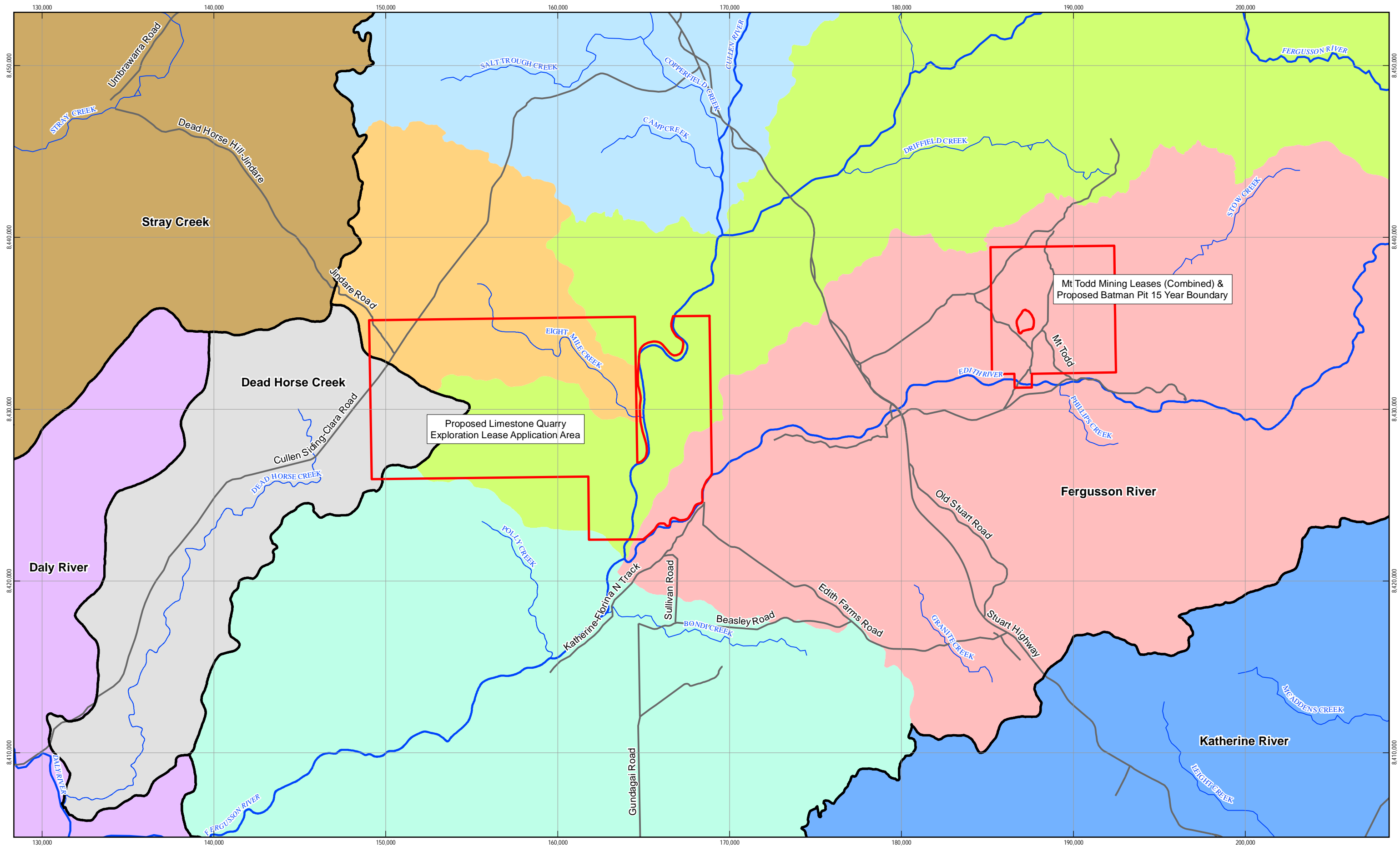
#### *Existing Environment*

##### **Catchments areas and surface drainage**

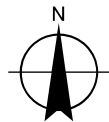
The Mt Todd Gold Mine is located in the Daly River Catchment (Figure 7). The Daly River is one of the NT's largest rivers with a catchment area of 52,577 km<sup>2</sup>. It is one of a few catchments in the NT that have perennial flow (Faulks, 1998).

The five main tributary systems are the Katherine River, Flora River, Fergusson River, King River and Douglas River. Stream flow information is presented in Table 5.





Map Projection: Universal Transverse Mercator  
Horizontal Datum: Geocentric Datum of Australia  
Grid: Map Grid of Australia 1994, Zone 53



#### LEGEND

Catchments	Dead Horse Creek	Fergusson River Above Edith River	Stray Creek
Cullen River and Copperfield Creek	Edith River	Fergusson River Below Edith River	
Daly River Below Fergusson River	Eight Mile Creek	Katherine River Below Seventeen Mile Creek	



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## Catchment Boundaries

## Figure 7

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Data source: NRETAS - Subcatchment Boundaries, Waterways (2011). Vista Gold - Proposed Batman Pit 15 Year Boundary, Mt Todd Mining Leases (2011). Navteq - Roads(2008). GHD - Proposed Quarry Boundary (2011). Created by: CM

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**Table 5 Summary of Stream Flow Information**

Gauging Station Number	Tributary	Catchment Area (km <sup>2</sup> )	Mean Annual Flow Volume (m <sup>3</sup> /sec)	Mean Annual Discharge Volume (m <sup>3</sup> /sec)
G8140040	Daly River	47,100	5,750,000,000	213.90
G8140001	Katherine River	8,640	1,922,000,000	87.17
G8140044	Flora River	5,900	762,300,000	30.80
G8140008	Fergusson River	1,490	415,600,000	23.49
G8140068	King River	11,000	207,800,000	7.64
G8140063	Douglas River	842	148,800,000	6.07

The Fergusson River is fed by the Edith River. Several tributaries to the Edith River cross or come in close proximity to the mine site.

Horseshoe Creek and Batman Creek transverse the east of the site from north to south entering Stow Creek which runs directly into the Edith River. West Creek and Burrell Creek are located in the south west of the site and enter the Edith River directly (Figure 8). The Edith River flows westwards to the Fergusson River.

A gauging station is located on the Edith River downstream of the mine. The catchment area for the gauge is 671 km<sup>2</sup>. The maximum recorded river height at this station is 6.44m (NRETAS, 2011).

TetraTech (2011) identified several surface water bodies, see Figure 8 present on site including the:

- ▀ Raw Water Supply Reservoir
- ▀ Waste Rock Dump Pond
- ▀ Low-Grade Ore Dump Pond
- ▀ Batman Pit Lake
- ▀ Plant Runoff Pond
- ▀ Tailings Storage Facility Pond
- ▀ Heap Leach Pond
- ▀ Decant/Polishing Pond.

A description of the individual tributary catchments to the Edith River in the Mount Todd Water Management Plan 2010/2010, (Vista Gold Australia, 2011) is summarised below.

- ▀ Horseshoe Creek is fed naturally by its catchment area; including the raw water supply reservoir and a drainage diversion channel around the tailings storage facility.
- ▀ Batman Creek is fed naturally by its catchment area upstream of the mine site.
- ▀ Stow Creek is fed by Batman Creek and Horseshoe Creek.
- ▀ A large majority of Burrell Creek is essentially covered by the waste rock dump.



- West Creek is fed predominately by the western diversion drain, located to the west of the waste rock dump.

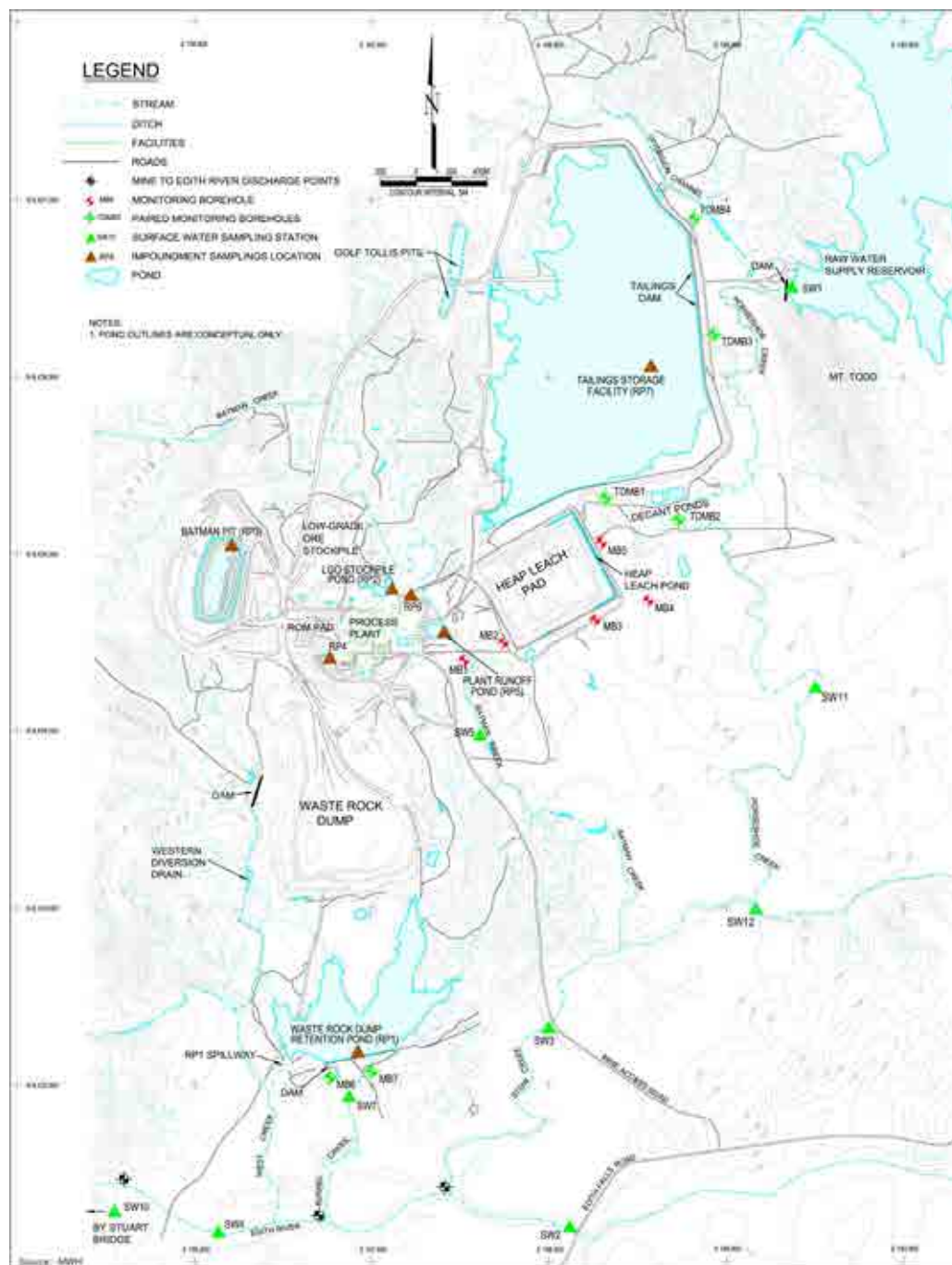
Onsite water storage facilities and the capacity of each facility are listed in Table 6.

**Table 6 Onsite Water Storage Facilities**

Retention Pond Number	Details	Storage Capacity (m3)	Storage Capacity (ML)
Raw Water Supply Reservoir	Water Supply	4,500,000	4,500
RP1	Waste Rock Dump Retention Pond	1,000,000	1,000
RP2	Low-grade Ore Stockpile Pond	5,000	5
RP3	Batman Pit	10,600,000	10,600
RP5	Plant Run-off Pond	20,000	20
RP7	Tailing Impoundment Facility	5,070,000	5,070
n/a	Decant / Polishing Ponds	30,000	30
n/a	Barren Solution Pond	6,600	6.6
n/a	Heap Leach Pad Moat	17,000	17

Source: Vista Gold Australia (2010)





**Figure 8 Water bodies on site**



## **Water quality**

A review of environmental data was undertaken by MWH in 2006 "*Mt Todd Environmental Management Services- Report 1: Environmental Assessment*" for Vista Gold. One section provided an assessment of quality assured surface water data from July 2002 to May 2006.

MWH (2006) compared the water quality data with the 95% species protection trigger values (ANZECC/ARMCANZ 2000) and found that concentrations of metals at SW2 were generally well below the guideline levels. Concentrations of aluminium, copper and zinc above guideline levels have occurred. Concentrations of aluminium, cadmium, copper and zinc above guideline levels have been recorded at SW4. (Figure 8 provides an indication of surface water sampling locations). SW10 has recorded levels of iron, manganese, copper and zinc above guideline levels. Sulphate was observed to increase from SW2 to SW4 and attributed to the influence of the Mt Todd site. Sulphate is a good indicator of mine waters as it is a major component of acid rock drainage (ARD).

The MWH report (2006) concludes the Mt Todd site contributes significant intermittent amounts of zinc and copper, and lesser amounts of aluminium, cadmium and cobalt to the Edith River. Comparisons with the ANZECC/ARMCANZ (2000) guidelines indicate that copper and zinc are the main analytes of concern.

The results of surface water sampling from sites SW2, SW3, SW4 and SW10 from 2002 to 2011 show that downstream sites of SW4 and SW10 receive discharges from the Mt Todd site. This is evidenced by increases in aluminium, cadmium, copper and zinc concentrations, in some cases above ANZECC/ARMCANZ (2000) 95% species protection trigger values. The proposed Mt Todd source of the metals is supported by the observed levels of sulphate, a major component of ARD.

The MWH (2006) report stated there was no evidence of a copper sink in the Edith River. This is supported by sediment data (MTG Fluvial Sediments.xlsx, August 2008) showing the sample sites having the same chemical make-up as soils in the surrounding area. Sediments at the sample sites contain gravel and sand with very low total organic carbon (TOC).

Macroinvertebrate studies have shown no adverse impacts at the monitoring sites, with one exception. Data collected in 2004 showed a marked difference in similarity between the downstream Edith River monitoring sites and the upstream reference site on the Fergusson River. The similarity differences resulted of lower overall abundances and taxa richness in 2004. A similar decrease in total abundance and taxa richness was observed at the downstream reference site on the Fergusson River. It is unclear why these differences in similarity occurred. It is clear that since that time the Edith River monitoring sites have demonstrated similar or greater abundances and diversity compared to the reference sites monitored on the Fergusson River.

It is important to note that metal speciation analysis performed by ERISS (2005) showed that 83% of aluminium, 96% of copper and 23% of zinc are not bioavailable at these sites. Bioavailability, ecotoxicological effects and macroinvertebrate data must be taken into account when determining species protection trigger values at these sites. Stakeholder advice will be sought to determine an appropriate percentage species protection trigger value. The current 95% trigger values and 20,000 dilution factor at the site are probably conservative.

## **Potential impacts**

Potential impacts are described in Table 7.



***Mitigation measures***

Mitigation measures are described in Table 7.



**Table 7 Surface water - potential impacts and mitigation (mine site)**

An action is likely to have a significant impact on surface water if there is a real chance or possibility that it will:	Impact	Likelihood	Consequence	Risk	Mitigation	Residual Risk
Contaminate receiving water bodies to levels exceeding national water quality guidelines, for an extended period.	Contaminants in surface runoff (e.g. leachate from waste rock and ore) potentially adversely impacting water quality downstream aquatic environment and downstream users	Possible	Moderate to Major	High	Water balance model Water treatment such as using lime as a neutralising agent. Water Management Plan Ongoing monitoring and evaluation	To be determined
Irreversible adverse impacts on downstream water quality and habitat	Adverse impacts on downstream aquatic habitats from physically altered surface water flow patterns	Possible	Minor to Moderate	Moderate to High	Water balance model Water Management Plan Ongoing monitoring and evaluation	To be determined
Irreversible adverse impacts on downstream water quality and habitat	Adverse impacts on downstream aquatic habitats from contaminated water	Possible	Moderate to Major	High	Water Management Plan Ongoing monitoring and evaluation	To be determined
Irreversible adverse impacts on downstream water quality and aquatic environment	Eroded sediment from disturbed areas, processing areas and waste rock stockpiles entering waterways	Possible	Minor	Moderate	Water Management Plan Ongoing monitoring and evaluation	To be determined
	Pooling creating breeding grounds for biting insects	Possible	Minor	Moderate	Water Management Plan Ongoing monitoring and evaluation	To be determined



### **5.5.2 Limestone quarry**

#### ***Existing environment***

The quarry is located in the Daly River Catchment (Faulks, 1998). Several water bodies are located in the proposed mineral exploration lease (application pending) including Eight Mile Creek and the Fergusson River. Unnamed creeks in the area flow into the Fergusson River which enters the Daly River.

A gauging station is located downstream of the proposed quarry on the Fergusson River. The maximum recorded river height at this station is 15.27m (NRETAS, 2011b).

#### ***Potential impacts***

Potential impacts from quarry construction and operation include:

- Contaminants in surface runoff potentially adversely impacting water quality downstream
- Eroded sediment from disturbed areas and stockpiles entering waterways
- Physically altered surface water flow patterns
- Adverse impacts on downstream aquatic habitats from contaminated water
- Pooling creating breeding grounds for biting insects.

#### ***Mitigation measures***

- Erosion and Sediment Control Plan.

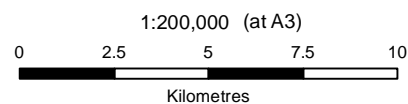
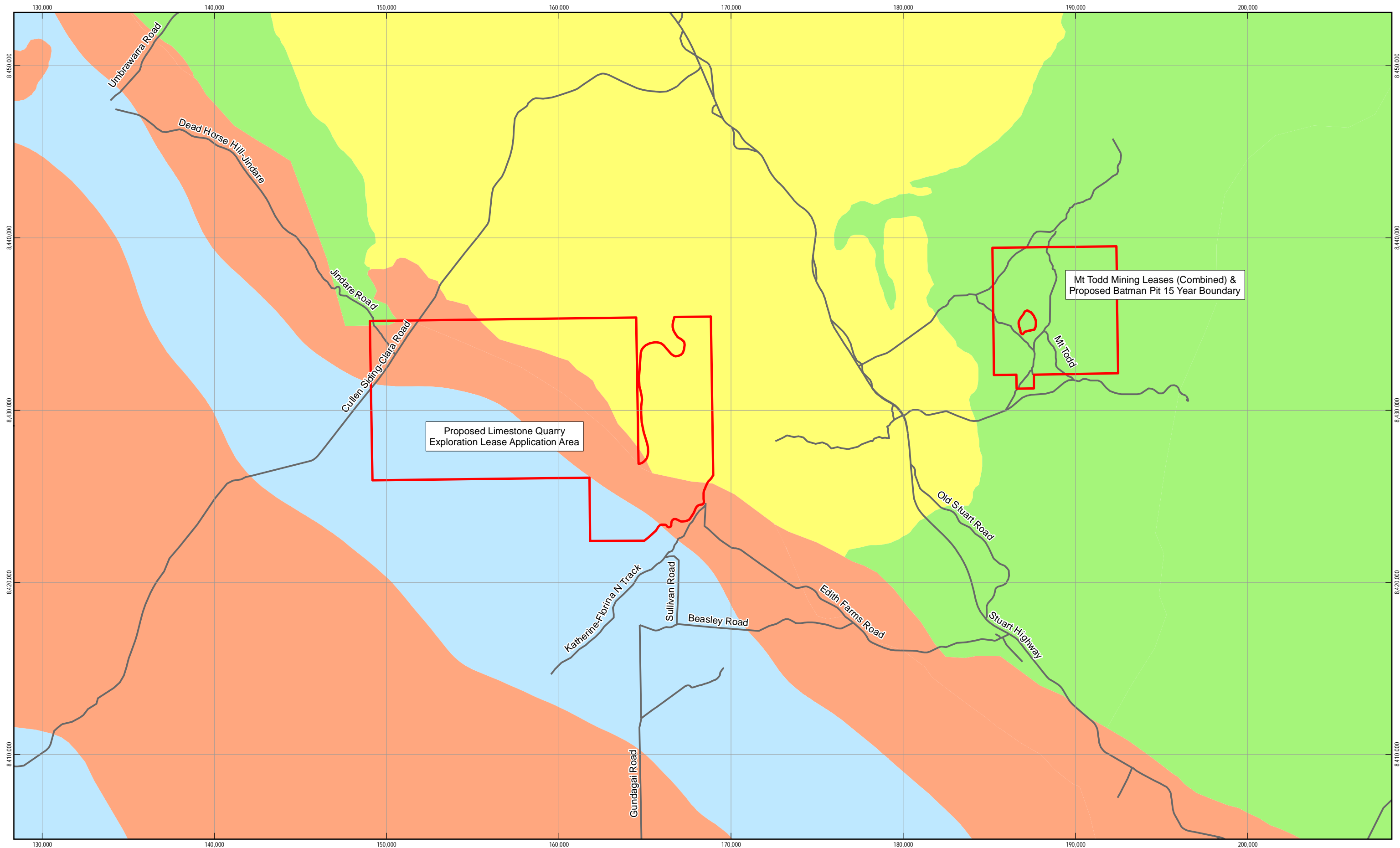
## **5.6 Groundwater**

### **5.6.1 Mt Todd Gold Mine**

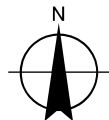
#### **Geology and aquifers**

The Mt Todd deposit is located in the Early Proterozoic Pine Creek geosyncline. The geology is comprised of greywackes (metamorphosed to hornfels in mineralised areas), shales, felsic tuff and lamprophyre dykes.

The hydrogeology of the Pine Creek mining region, described in Power and Water Authority (1989), highlights the Burrell Creek Formation as capable of providing sustainable yields of 0.5 to 2 L/s in zones of intense alteration, faulting or shearing. Otherwise, rock classified as fractured and weathered with minor groundwater resources in the Mt Todd area is generally not a significant groundwater resource for substantial developments such as mines (Power and Water Authority, 1989). Regional aquifers include carbonate systems. No such systems are present locally.



Map Projection: Universal Transverse Mercator  
Horizontal Datum: Geocentric Datum of Australia  
Grid: Map Grid of Australia 1994, Zone 53



#### LEGEND

- |  |  |  |   |
|--|--|--|---|
|  | Fractured and karstic rock                           |  | Fractured and weathered rock                              |
|  | Fractured and karstic rocks, regional scale aquifers |  | Fractured weathered rock with minor groundwater resources |



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## Aquifers

## Figure 9

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Data source: NRETAS - Aquifers (2011). Vista Gold - Mt Todd Mining Leases 2011). Navteq - Roads(2008). GHD - Proposed Quarry Boundary (2011). Created by: CM

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### **Groundwater flow systems**

The conceptual hydrogeological model for the Mt Todd area is a fractured rock aquifer, overlain by a number of groundwater sources and sinks. A groundwater sink is an area where groundwater is lost out of the system i.e. a local piezometric low point. A source is where groundwater is added to the system i.e. a local piezometric high point.

The fractured rock aquifer is likely to contain areas of higher groundwater flow associated with: (i) natural features such as the base of weathering, shear zones, faults and fold axes; and (ii) existing anthropogenic features such as the extensive network of drill holes and the alteration of the rock mass due to blasting and unloading adjacent to mine workings.

Regional groundwater flow is hypothesised to be generally westwards, mimicking the surface water flow of the Edith River. The regional flow is likely to be interrupted by local groundwater highs and lows associated with groundwater sources and sinks. Local topography is likely to provide localised groundwater high points beneath elevated features such as the Yinberrie Hills and Mt Todd, or low points where groundwater may discharge as springs in surface water courses (although neither of these hypotheses have been confirmed). MWH (2006a) considered it likely that groundwaters discharge to surface waters during periods (May to December) when no surface run-off water from the mine enters the Edith River.

### **Anthropogenic groundwater sinks and sources**

An example of a groundwater sink is the currently flooded Batman Pit (RP3) where evaporation (or pumping) can exceed inflow, resulting in a regional (or local) groundwater low point. On these occasions groundwater flows into the pit holding water in contact with the mine workings. If inflows into the pit, including surface water, exceed the outflows and the water level rises to a level greater than the regional water table, the groundwater is no longer contained in the pit and the pit is likely to become a groundwater source. The Batman Pit is expected to act as a significant groundwater sink during mining, due the net average annual evaporation and ongoing pumping far exceeding average annual rainfall. The source/sink scenario will be a function of rainfall, evaporation, pumping and infiltration (in or out) during non-operational periods. The flooded Golf Tollis pits are likely to function similarly.

Water levels in the Golf/Tollis pits are maintained within 5m of the ground surface (MWH, 2006c). Groundwater inflows in the Batman Pit have been observed at: (i) the northern end of the pit at depths of 30-40 m below ground level, in an area referred to as "the waterfall"; and (ii) in the southwest corner of the pit in the uppermost bench (MWH, 2006). Pre-mining groundwater was observed at 10-20 m below ground level in the Batman Pit, with higher producing zones from 50-80 m below ground level (MWH, 2006).

Groundwater is likely to be recharged from infiltration of direct rainfall, leakage from the ephemeral surface water courses that flow after wet season rainfall events, and leakage from the perennial Edith River where (and when) river levels are above the surrounding groundwater level. The high rainfall in the wet season, combined with thin alluvial cover and extensive areas of outcrop in surface drainages, are likely to result in high rates of aquifer recharge (Rockwater 1994).

The key potential anthropogenic groundwater sources are infiltration from the raw water dam, the Tailing storage facility (TSF), heap leach pad, low grade ore (LGO) stockpile, process plant, unlined earthen surface water diversion drains, pits, waste rock dumps and the waste rock dump retention pond and the proposed new TSF.





### **Groundwater chemistry**

MWH (2006a) indicated that no known groundwater sites could be considered as representative of regional or background monitoring. Waters contaminated with AMD (Acid and Metalliferous Drainage) are present in the surface water retaining features at Mt Todd, including: the tailing storage facility (TSF), the heap leach pad, the LGO stockpile, process plant, the pits, the waste rock dump and the waste rock dump retention pond. These features present a potential source of groundwater contamination through AMD.

Sulfate concentrations are used as an indicator of contamination associated with AMD. Annual (September/October 2009) groundwater monitoring data from the mine site indicate:

- High levels of sulfate (>1000 mg/L SO<sub>4</sub>) in TD2 Shallow, TD2 Deep and MB7S
- Elevated levels of sulphate (100-1000 mg/L SO<sub>4</sub>) in MB3 and TD1 Deep
- Low levels of sulphate (10-100 mg/L SO<sub>4</sub>) in TDMBD1 and MB1
- Very low levels sulphate (<10 mg/L SO<sub>4</sub>) in MB4, TD1S, BW17P and TD3 Deep.

Preliminary analysis of the data suggest two water types corresponding to those with high levels of SO<sub>4</sub> and those with lower levels. BW17P (the only bore monitored from its BW series bores), located well to the north of the mine site is the only bore not directly associated with mine features. BW17P (very low sulphate levels) may be considered to be a proxy for background levels until any purpose-drilled background bores are installed. Groundwater levels observed are shallow (close to surface) and may be highly sensitive to recharge events. Few transient groundwater level data are available. Likewise groundwater chemistry may be highly sensitive to recharge and annual chemistry data are insufficient to reveal a pattern.

### **Protected beneficial uses**

Groundwater in the region is referred to as the Katherine Area groundwater and has declared beneficial uses as per NRETAS (2011a). These are use of raw water for drinking, agricultural or industrial purposes. The declared beneficial use for surface water in the Edith River catchment, including the mine site and the Edith River up and downstream of the site is the protection of aquatic ecosystems (NRETAS 2011b).

### **Groundwater resource utilisation**

NRETAS (2011c) indicated the presence of four bores at Leliyn and a single bore at Werenbun. The bores are approximately 6.5 and 4 kilometres respectively from the Mt Todd site and are assumed to be up-gradient. No additional information could be found to indicate additional local use of the groundwater resource.

### **Potential impacts**

Potential impacts are described in Table 8.

### **Mitigation measures**

Mitigation measures are described in Table 8.





**Table 8 Groundwater – potential impacts and mitigation (mine site)**

An action is likely to have a significant impact on groundwater if there is a real chance or possibility that it will:	Impact	Likelihood	Consequence	Risk	Mitigation	Residual Risk
Cause significant drawdown extending well beyond the limits of the mining lease.	Significant drawdown could impact on groundwater flows to the Edith River and interfere with production bores in the area.	Possible	Moderate	High	Groundwater modelling will be conducted to determine the potential for and scale of drawdown.	To be determined
Lead to contamination of groundwater with AMD outside the mineral lease and/or release of AMD contaminated groundwater to surface water	AMD from surface facilities is contaminating the groundwater.	Almost certain	Moderate	High	<p>Additional and upgraded monitoring bores and sampling will be instituted to provide better understanding of contamination levels and consequences</p> <p>Existing ponds and tailing facilities will be upgraded/replaced to limit potential for leaching of AMD to groundwater</p> <p>Mine operations include neutralisation of waste water to manage AMD to ground and surface waters.</p>	High



## 5.6.2 Limestone quarry

### *Existing environment*

A regional aquifer is likely to underlie the carbonate systems of the proposed limestone quarry area (Power and Water Authority 1989). These aquifers produce significant quantities of groundwater of good quality.

The location of the quarry has not been determined. Groundwater may be present at surface in sinkholes or at springs near the quarry site. The hydrogeology of the quarry area will be investigated and modelled once a location has been determined.

Water levels in the area can be relatively shallow (Table 9) and although the proposed quarry is relatively small, drawdown effects are likely and require assessment.

**Table 9 Water levels (NRETAS, 2011)**

I.D	Date	Depth (m)	Static Water Level (m BGL)
RN034045	19/04/2004	43	4
RN035241	19/06/2006	31	5
RN035590	01/12/2007	26	6
RN036451	21/11/2008	55	12

### *Potential impacts*

Potential impacts will be identified and assessed once a location has been determined.

### *Mitigation measures*

Mitigation measures will be determined once a location has been decided and potential impacts identified.

## 5.7 Land units and capacity

### 5.7.1 Mt Todd Gold Mine

#### *Existing environment*

Land systems in the area are classified by Stuart Miller and Associates (1990) into two categories:

1. the Baker Land System defined as rugged hills and strike ridges on resistant Burrell Creek Greywacke, sandstone and siltstone;
2. The Bend Land System defined as undulating hills on lower proterozoic sediments

The mine is situated within the Bend Land System defined as undulating hills on lower proterozoic sediments and the River Land System comprising major creek and river drainage floors, and an irregular distribution of levees, back plains and depressions areas, dissected by erosion gullies (ANRA, 2009) (Figure 10).



The proposed mining operations will occur in an existing mineral lease where mining operations previously occurred and mining infrastructure remains.

***Potential impacts***

Additional land in an existing mineral lease will be used. There will be an expanded pit, a new TSF(2) and minor amendments to the layout of the facilities.

The proposed mine will have negligible adverse impact on existing land units and capacity.

If mining operations proceed, progressive rehabilitation of the site will occur improving the current state of the land i.e. a significant positive impact.

***Mitigation measures***

Mine operations will be confined to the existing mineral leases. Facilities will use existing facilities and foundations where possible. Progressive rehabilitation of the site will occur. Refer to section 3.11.

**5.7.2 Limestone quarry**

***Existing environment***

Refer to section 5.4.

***Potential impacts***

The project has limited potential to reduce the land available for agricultural or horticultural activities in the region. Extensive land suitable for these land uses will remain in the region. The area will be rehabilitated at the end of the project. The final pit void(s) will be permanently unavailable for agricultural or horticultural activities.

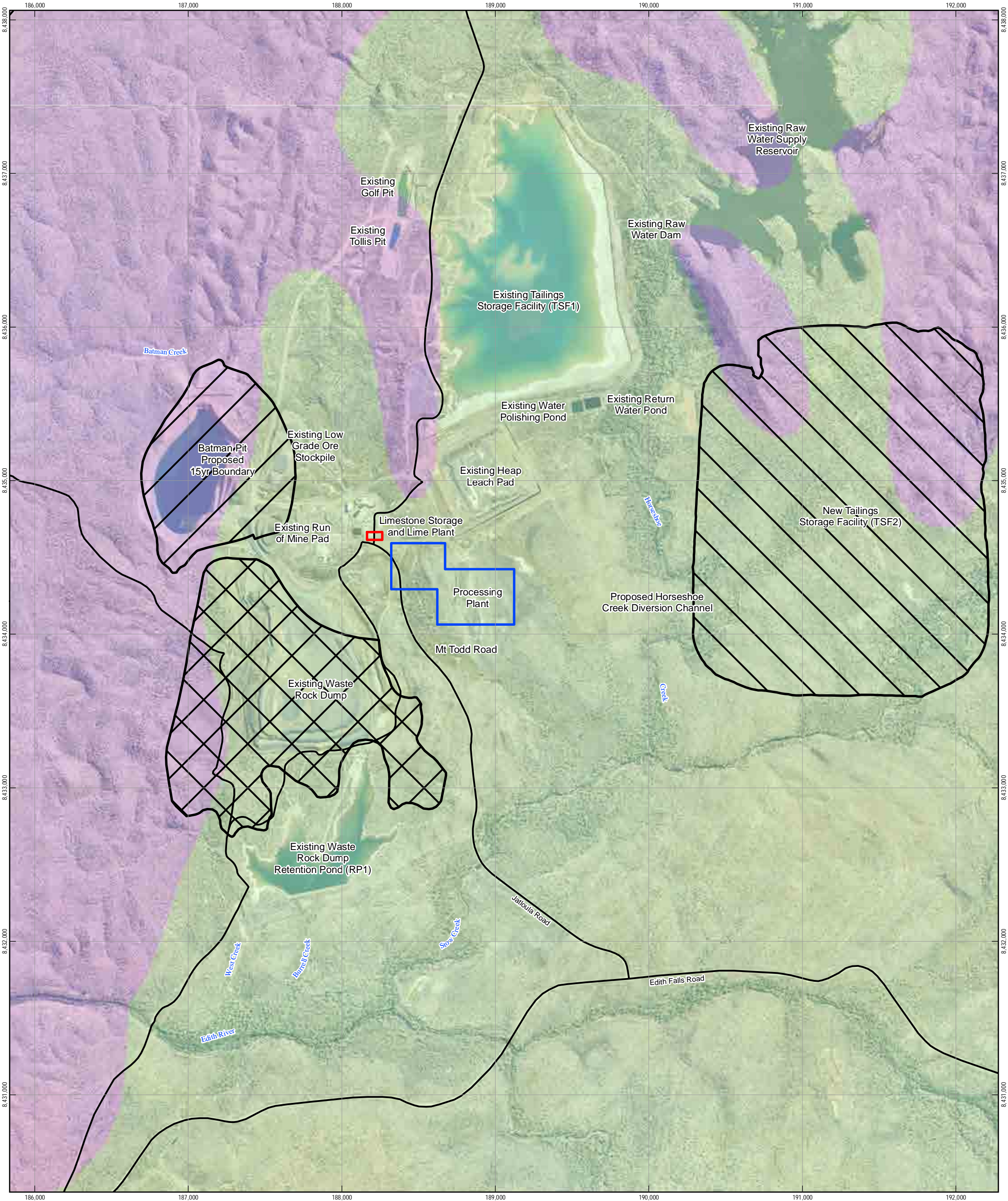
Topsoils/subsoil erosion is expected to occur through the operation of the quarry, potentially impacting on future land use.

***Mitigation measures***

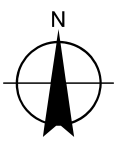
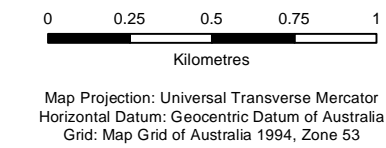
Mitigation measures are to:

- ▶ Minimise the disturbance footprint and undertake progressive rehabilitation.





- LEGEND**
- Limestone Storage and Lime Plant
  - Proposed Processing Plant
  - Batman Pit Proposed 15yr Boundary
  - Proposed New Tailing Storage Facility (TSF2)
  - Proposed Rock Dump Expansion
  - Access Roads
  - Land Systems**
  - Baker
  - Bend



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## Land Systems - Mt Todd Mine Site

Figure 10





## 5.8 Flora and vegetation

### 5.8.1 Mt Todd Gold Mine

#### *Existing environment*

##### **Vegetation**

Vegetation of the area was mapped at 1:50,000 by Wilson and Clark (1990) prior to the development of the Mt Todd Gold Mine. That map has been modified using information available on the existing mine infrastructure layout and overlaying it on recent satellite imagery (Figure 11).

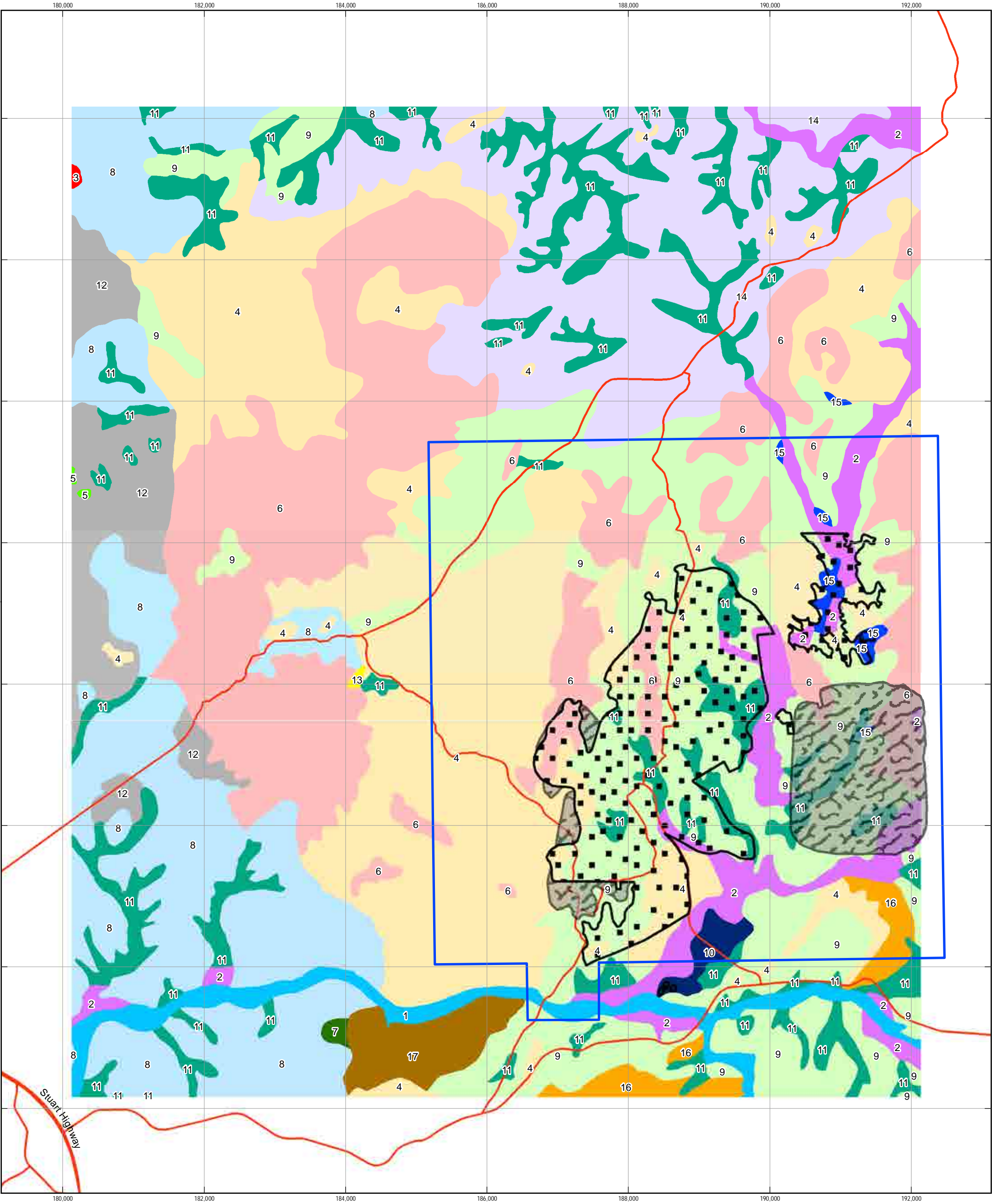
The existing vegetation types are:

- *Melaleuca* forest
- *Eucalyptus bigalerita*/E. spp open forest
- *E. tetrodonta* woodland
- *E. tintinnans*/*Eucalyptus* spp., *Erythrophleum chlorostachys* woodland
- *E. tintinnans*/*Eucalyptus* spp., woodland on granite
- *E. tintinnans*/*Corymbia dichromophloia* woodland
- *Corymbia dichromophloia* woodland with *Plectrachne pungens* grassland
- *E. phoenicea* woodland
- *E. tectifera* woodland
- *E. tectifera*/*C. confertifolia* woodland
- *C. latifolia* /*E. bigalerita* open woodland with areas of grassland
- *C. aff. latifolia*, *Eucalyptus* spp., open woodland
- *E. miniata* low open woodland/mixed tall woodland
- *E. tectifera*/*C. clavigera* low woodland – open woodland

The Commonwealth government's protected matters search tool (PMST) found there was no threatened ecological community likely to occur in the proposal area. A copy of the search results is provided in Appendix B.

The dominant communities in the area of the mine prior to its development were the *E. tintinnans* dominated woodlands in rocky hills and *E. tectifera* dominated woodlands in the surrounding plains.

Previous development of the site resulted in reductions of the extent of the *E. tintinnans* woodlands and the *E. tectifera* woodlands. An additional area of *E. tintinnans* woodland was removed during an expansion of the mine pit in the mid-1990s.



**LEGEND**

Mount Todd Mining Lease Extents

Vegetation Disturbance

Proposed Future Vegetation Disturbance

Roads

1 *Melaleuca* forest, with bare areas

2 *E. bigalerita* *Eucalyptus* spp. open-forest

3 *E. tetradonta* woodland

4 *E. tintinnans* *Eucalyptus* spp. *Erythrophleum chlorostachys* woodland

5 *E. tintinnans* *Eucalyptus* spp. woodland on Granite

6 *E. tintinnans* *E. dichromophloia* woodland

7 *C. dichromophloia* woodland with a *Plectrachne pungens* grassland

8 *E. phoenicea* woodland

9 *E. tectifera* woodland

10 *E. tectifera* *C. confertiflora* woodland

11 *E. latifolia* *C. bigalerita* open-woodland with areas of grassland

12 *C. aff. latifolia* *Eucalyptus* spp. open-woodland

13 *E. miniata* low open-woodland/mixed tall shrubland

14 *E. tectifera* *C. clavigera* low woodland - open-woodland

15 Man made clearings

16 *E. tectifera* woodland \ *E. tintinnans* *Eucalyptus* spp. *Erythrophleum chlorostachys* woodland

17 *E. tintinnans* *E. dichromophloia* woodland / *E. tintinnans* *Eucalyptus* spp. *Erythrophleum chlorostachys* woodland





## Flora

The EPBC PMST did not record a threatened plant species as likely to occur in the mine area.

The NT Herbarium database provides records of 840 plant species in the area (8,261 records). Wilson and Clark (1990) recorded 173 species, including 58 not found in the NT Herbarium Database.

Herbarium records and the records of Wilson and Clark (1990) for the area contain no record of a species listed as threatened under the EPBC Act. The vegetation types present at the mineral lease have not changed significantly from those mapped by Wilson and Clark (1990).

The bladderwort *Utricularia singeriana* is the area's only species listed as threatened (it is vulnerable to extinction) under the NT TPWC Act. It is recorded from three locations in the NT: Port Darwin, near the Yinberrie Hills, and the upper Fergusson River in Nitmiluk (Katherine Gorge) National Park (Kerrigan and Cowie 2006). The Port Darwin population is apparently extinct. Several hundred have been counted in the Nitmiluk population. Hundreds are reported from the Yinberrie population which is well outside the mine lease boundary (Figure 12).

The populations are small and vulnerable to chance events. It is thought the populations may be susceptible to trampling from feral or domestic stock, and to alterations in hydrology. No research has been done to determine which of these factors, or any other influence, may threaten the populations (Kerrigan and Cowie 2006).

## Weeds

The mine site has infestations of nine species of weeds listed as Class A or B (the mine area plus 10 km border) under the *Weeds Management Act* (Vista Gold 2010/2011; Anonymous, undated; NRETAS data, GHD pers. Obs.). The list is annotated with the class of each species under the *Weeds Act* and with an \* to denote those species known from the immediate mine area:

- Devils claw (*Martynia annua*) (A)
- Bellyache bush (*Jatropha gossypifolia*) (A/B)
- Mission grass (*Pennisetium polystachyon*) (B)\*
- Gamba grass (*Andropogon gayanus*) (B)\*
- Rubber bush (*Calotropis procera*) (B)\*
- Hyptis (*Hyptis suaveolens*) (B)\*
- Coffee senna (*Senna occidentalis*) (B)
- Noogoora Burr (*Xanthium strumarium*) (B)
- Spiny-head sida (*Sida acuta*) (B)\*

and at least three unlisted environmental weeds:

- Stinking passion vine (*Passiflora foetida*)
- Roselle (*Hibiscus sabdariffa*)
- Natal grass (*Melinis repens*).

Class A weeds are to be eradicated and the growth and spread of Category B weeds are to be controlled.



The mine conducts active weed control under its Environmental Management Program. Weed management focuses on gamba grass, mission grass, rubber bush and stinking passion vine. Weed infestations in the mine development area are distributed in low weed density, sparsely distributed patches.

### **Fire**

The area surrounding the mine has been impacted by wildfire at least since records began in 1993. Between 1993 and 2004 all areas were burnt in more than three years, and 73% was burnt in over 6 years. The fires tend to occur as hot fires late in the dry season. This is thought to have a detrimental impact on the native vegetation (O'Malley 2006). The potential impacts can not be attributed to ongoing maintenance activities associated with the mine. Except for controlled burns to produce fire breaks for protection of facilities, widespread fires originate as wildfires from off-site.



**LEGEND**

- Utricularia singeriana
- Mt Todd Mining Leases
- Roads
- Waterways





### Potential impacts and mitigation measures

Assessments of impacts are made according to guidelines provided in DEWHA (2009).

The guidelines for significance of impacts on critically endangered or endangered ecological communities are used to assess impacts on all vegetation types, even though none of the types is threatened under the EPBC Act or the TWPC Act.

Areas of the mine site will need to be cleared to provide space for:

- Expansion of the mine pit
- Additional waste rock dumps
- A new tailing storage facility (TSF)
- Storage and processing of limestone to quick lime.

Other potential sources of impact include noise, dust and possibly wildfire.

### Vegetation

The area of each vegetation type mapped by Wilson and Clark (1990) together with the existing areas of disturbance from previous activities, and that proposed for the mine expansion are provided in Table 10. An area of 11.74 ha in addition to that listed in Table 10 is to be cleared. This area lies to the east of the mapped area and its vegetation type has not been determined.

**Table 10 Areas of vegetation types affected by past and proposed mine expansion**

Community	Total Areas	Total Currently Disturbed	Additional to be Disturbed	Total Disturbed
<i>Melaleuca</i> forest	301.92	0 (0%)	0 (0%)	0 (0%)
<i>E. bigalerita</i> /E. spp. Open forest	656.78	68.01 (10.36%)	36.43 (5.55%)	104.44 (15.90%)
<i>E. tetradonta</i> woodland	3.80	0 (0%)	0 (0%)	0 (0%)
<i>E. tintinnans</i> /E.spp., <i>Erythrophleum chlorostachys</i> woodland	3565.50	151.34 (4.25%)	29.18 (0.82%)	180.52 (5.06%)
<i>E. tintinnans</i> /E.spp., woodland on granite	3.36	0 (0%)	0 (0%)	0 (0%)
<i>E. tintinnans</i> /C. <i>dichromophloia</i> woodland	2795.70	94.05 (3.36%)	87.52 (3.13%)	181.57 (6.5%)
C. <i>dichromophloia</i> woodland with <i>P. pungens</i> grassland	12.11	0 (0%)	0 (0%)	0 (0%)
<i>E. phoenicea</i> woodland	2077.55	0 (0%)	0 (0%)	0 (0%)
<i>E. tectifera</i> woodland	3117.77	629.65 (20.20%)	262.99 (8.44%)	892.64 (28.63%)



Community	Total Areas	Total Currently Disturbed	Additional to be Disturbed	Total Disturbed
<i>E. tectifera</i> / <i>C. confertifolia</i> woodland	58.49	1.76 (3.02%)	0 (0%)	1.76 (3.02%)
<i>C. latifolia</i> / <i>E. bigalerita</i> open woodland with areas of grassland	1405.02	142.91 (10.17%)	65.02 (4.63%)	207.93 (14.80%)
<i>C. aff. latifolia</i> , <i>Eucalyptus</i> spp., open wopodland	577.82	0 (0%)	0 (0%)	0 (0%)
<i>E. miniata</i> low open woodland/mixed tall shrubland	4.43	0 (0%)	0 (0%)	0 (0%)
<i>E. tectifera</i> / <i>C. clavigera</i> low woodland – open woodland	1818.03	0 (0%)	0 (0%)	0 (0%)
Anthropogenic clearings	46.26	24.10 (52.08%)	1.89 (4.09%)	25.99 (56.17%)
<i>E. tectifera</i> woodland/ <i>E. tintinnans</i> , <i>Eucalyptus</i> spp., <i>Erythrophleum chlorostachys</i> woodland/	154.47	0 (0%)	0 (0%)	0 (0%)
<i>E. tintinnans</i> , <i>C. dichromophloia</i> woodland/ <i>E. tintinnans</i> , <i>Eucalyptus</i> spp., <i>Erythrophleum chlorostachys</i> woodland	200.88	0 (0%)	0 (0%)	0 (0%)

Potential impacts and mitigation measures are described in Table 11.



**Table 11 Vegetation types – potential impacts and mitigation (mine site)**

An action is likely to have a significant impact on a critically endangered or endangered ecological community if there is a real chance or possibility that it will:	Impacts on Vegetation Types	Likelihood	Consequence	Risk	Mitigation	Residual Risk
Reduce the extent of an ecological community	<p>A number of vegetation types will be reduced in size (Table 10).</p> <p>The vegetation with the greatest reduction is the <i>E. tectifera</i> woodland (8% from this proposal). This vegetation type occupies approximately 49,093.4 km<sup>2</sup> in the top End. 28.6% of it is in conservation reserves (Baker <i>et al.</i>, 2005). Baker <i>et al.</i>, (2005) do not provide comparable figures on the areas and reservation of the <i>E. bigalerita/E. spp.</i>, open forest (5% reduction from this proposal) or <i>C. latifolia/E. bigalerita</i> open woodland (6% reduction from this proposal) with areas of grassland. Wilson and Clark (1990) refer to these communities as “extensive” in Arnhem Land and “common” in appropriate habitat in the Darwin to Katherine region respectively.</p> <p>The two <i>E. tintinnans</i> woodland communities will be reduced by an overall 5.7% (1.8 % attributable to this proposal). <i>E. tintinnans</i> woodland communities occupy approximately 22,063 km<sup>2</sup> of the Top End with 42.9% in conservation reserves (Baker <i>et al.</i>, 2005).</p>	Almost certain	Minor	High	<p>The vegetation removed will be the minimum required for the mine's development.</p> <p>Areas of vegetation to be removed will be marked to avoid clearing unintended areas.</p> <p>Clearing will not eliminate any vegetation type from the area.</p>	High





An action is likely to have a significant impact on a critically endangered or endangered ecological community if there is a real chance or possibility that it will:	Impacts on Vegetation Types	Likelihood	Consequence	Risk	Mitigation	Residual Risk
	<p>The proposed mine expansion will not impact on any other plant community.</p> <p>Impacted vegetation types seem extensive in area and where it can be determined, seem well reserved for conservation purposes.</p>					
Fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines	<p>No vegetation type will be fragmented i.e. suffer an increased level of isolation from other vegetation of the same type or other types.</p> <p>Fire breaks will be built.</p>	Unlikely	Minor	Low	<p>The vegetation map will be reviewed prior to planned clearing to avoid fragmenting vegetation types to an extent greater than exists in the area.</p> <p>Fire breaks will be restricted to limiting potential for late season fire to penetrate the area from the Stuart Highway and the Edith Falls Road.</p>	Low
Adversely affect habitat critical to the survival of an ecological community	<p>No habitat critical to the survival of an ecological community will be adversely affected.</p>	Rare	Insignificant	Low	<p>The vegetation map will be reviewed prior to planned clearing to avoid impacting habitat likely to be critical to the survival of any vegetation type.</p> <p>Impacts from mine operations on dust levels, noise, groundwater levels and quality, and surface water quality will be spatially restricted close to the mine and will be monitored to allow management of potential impacts on communities.</p> <p>Fire and weeds will be managed under the EMP.</p>	Low



An action is likely to have a significant impact on a critically endangered or endangered ecological community if there is a real chance or possibility that it will:	Impacts on Vegetation Types	Likelihood	Consequence	Risk	Mitigation	Residual Risk
Modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns	Neither groundwater levels, surface water flows nor the quality of those waters or the soils are likely to be modified or destroyed. Management of mineral-rich wastes is likely to be a significant improvement over what has happened in the past.	Possible	Minor	Moderate	Impacts from mine operations on dust levels, noise, groundwater levels and quality, and surface water quality will be spatially restricted close to the mine and will be monitored to allow management of potential impacts on communities.	Low
Cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting	Potentially negative impacts from the mine and its operations are likely to be spatially constrained to the immediate locality of the mine.	Possible	Moderate	High	<p>Impacts from mine operations on dust levels, noise, groundwater levels and quality, and surface water quality will be spatially restricted close to the mine and will be monitored to allow management of potential impacts on communities.</p> <p>Fire breaks will be built to protect vegetation from late dry season wildfires entering the site from the Stuart Highway and Edith Falls Road.</p> <p>Early dry season fuel reduction burns will continue as part of the mine EMP in collaboration with the Jawoyn Association.</p> <p>Weed management will continue to as part of the mine EMP.</p>	Low



An action is likely to have a significant impact on a critically endangered or endangered ecological community if there is a real chance or possibility that it will:	Impacts on Vegetation Types	Likelihood	Consequence	Risk	Mitigation	Residual Risk
<p>Cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:</p> <ul style="list-style-type: none"> <li>– assisting invasive species, that are harmful to the listed ecological community, to become established, or</li> <li>– causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community</li> </ul>	<p>The quality and integrity of the vegetation types will not be directly impacted and factors such as weeds, fire, dust, or mineral rich wastes that will be spatially restricted to containment areas on the mineral lease.</p>	Possible	Moderate	High	As above	Low
Interfere with the recovery of an ecological community.	There is no recovering ecological community in the area.	Insignificant	Rare	Low	N/A	Low



### **Threatened Flora**

Areas of the mine site will need to be cleared to provide space for new mining infrastructure.

Proposed clearing has little impact on the conservation status of the individual vegetation types, and is unlikely to have a measurable conservation impact on the populations of individual species that make up the communities.

The threatened *Utricularia singeriana* population lies west of the Yinberrie Hills which separate it from the mine site (Figure 12). It is unlikely to suffer an impact from clearing.

*U. singeriana* is protected from significant dust levels by the population's distance from mine.

Fire is not listed as a threat to the vulnerable *U. singeriana* (Kerrigan and Cowie 2003). The mine undertakes annual, early dry season control burns in the Yinberrie Hills and mine areas as part of its Environmental Management Program. Additional measures would be required to reduce the risk of late season wildfire.

Potential impacts are described in Potential impacts are described in Table 12.

### **Weeds**

Site preparation, clearing of land and operation of mining activities provide opportunity for invasion and spread of weeds. The quality and integrity of vegetation types could be impacted by the importation of additional weed species.

Weed management will continue as part of the mine EMP, including monitoring to allow eradication of colonising weed species and ensuring vehicles arrive on site in a clean condition.

The adjacent roads and highways are weed infested making weed control on colonisation critical.





**Table 12** *Utricularia singeriana* (threatened (it is vulnerable to extinction) under the NT TPWC Act) and other flora – potential impacts and mitigation measures

An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:	Impacts on threatened and other flora	Likelihood	Consequence	Risk	Mitigation	Residual Risk
Lead to a long-term decrease in the size of a population	<p>The <i>U. singeriana</i> population is spatially distant from the mine's activities and will not be cleared, subject to mineral-rich wastes, alteration in hydrology or any other mine related activity that may lead to a long-term decrease in its size.</p> <p>Some native flora will be reduced in population size by clearing to a minor extent locally and regionally.</p>	Rare	Moderate	Low	<p>Clearing will be the minimum required to accommodate the mine's expansion.</p> <p>All areas to be cleared will be clearly marked and responsible personnel well briefed on the limits to clearing.</p> <p>Dust levels, groundwater levels and quality, and surface water quality will be monitored to allow management of potential impacts on native plants.</p>	Low
Reduce the area of occupancy of the species	<p>The <i>U. singeriana</i> population is spatially distant from the mine's activities and will not be cleared, subject to mineral-rich wastes, alteration in hydrology or any other mine related activity that may lead to a long-term decrease in area of occupancy.</p> <p>The area of occupancy of some native flora will be impacted by clearing. The extent of the reduction is minor locally and trivial at the regional level.</p>	Rare	Moderate	Low	<p>Clearing will be the minimum required to accommodate the mine's expansion.</p> <p>All areas to be cleared will be clearly marked and responsible personnel well briefed on the limits to clearing.</p> <p>Dust levels, groundwater levels and quality, and surface water quality will be monitored to allow management of potential impacts on native plants.</p>	Low



An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:	Impacts on threatened and other flora	Likelihood	Consequence	Risk	Mitigation	Residual Risk
Fragment an existing population into two or more populations	<p>The <i>U. singeriana</i> population is spatially distant from the mine's activities and will not be cleared, subject to mineral-rich wastes, alteration in hydrology or any other mine related activity that may lead to its fragmentation.</p> <p>There is a minor chance of fragmenting distributions of other plant species. All the area's plant species have fragmented distributions at some level.</p>	Unlikely	Minor	Low	<p>The vegetation map will be reviewed prior to planned clearing to reduce the chance of fragmenting populations to extents greater than exist in the area.</p> <p>Dust levels, groundwater levels and quality, and surface water quality will be monitored to allow management of potential impacts on native plants.</p>	Low
Adversely affect habitat critical to the survival of a species	<p>The <i>U. singeriana</i> population is spatially distant from the mine's activities and will not be cleared, subject to mineral-rich wastes, alteration in hydrology or any other mine related activity that may adversely affect the quality of its habitat. There is no known habitat that is critical to the regional survival of plant species other than <i>U. singeriana</i>.</p> <p>There is no known species other than <i>U. singeriana</i> that seems likely to occupy a habitat critical to the survival of the species in the area.</p>	Unlikely	Minor	Low	<p>The vegetation map will be reviewed prior to planned clearing to avoid impacting habitat likely to be critical to the survival of any species of plant.</p> <p>Dust levels, groundwater levels and quality, and surface water quality will be monitored to allow management of potential impacts on native plants.</p>	Low
Disrupt the breeding cycle of a population.	<p>The <i>U. singeriana</i> population is spatially distant from the mine's activities and exists in a separate water catchment. The population will not be cleared, or be subject to mineral-rich wastes, alteration in hydrology or any other mine related activity that might disrupt its breeding cycle (e.g. pollination, seed dispersal, growth period).</p> <p>No other plant species seems likely to have its breeding cycle affected by the development. Small components of some plant population may experience dust deposition immediately adjacent to the mine, possibly reducing breeding.</p>	Possible	Minor	Moderate	<p>Dust levels, groundwater levels and quality, and surface water quality will be monitored to allow management of potential impacts on native plants.</p>	Low



An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:	Impacts on threatened and other flora	Likelihood	Consequence	Risk	Mitigation	Residual Risk
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	<p>The <i>U. singeriana</i> population is spatially distant from the mine's activities and exists in a separate water catchment. The population will not be cleared, subject to mineral-rich wastes, alteration in hydrology or any other mine related activity that may modify, destroy, remove, isolate or decrease the availability or quality of habitat leading to the species decline.</p> <p>There is no other known plant species likely to experience a decline caused by deterioration in habitat.</p>	Unlikely	Moderate	Moderate	<p>The vegetation map will be reviewed prior to planned clearing to avoid impacting of any habitat likely to be critical to the survival of any plant species.</p> <p>Dust levels, groundwater levels and quality, and surface water quality will be monitored to allow management of potential impacts on native plants.</p>	Low
Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat.	<p>Absence of mine related activities in the area or catchment of the <i>U. singeriana</i> population reduces the potential for invasive species to be introduced to its area. The site of the population is uncontrolled and may be subject to activities unrelated to the mine.</p> <p>Other plant species in the immediate area of the mine's disturbance may be potentially vulnerable to invasion by weeds.</p>	Possible	Minor	Moderate	<p>Weed management will continue to as part of the mine EMP, including monitoring to allow eradication of colonising weed species and ensuring vehicles arrive on site in a clean condition.</p> <p>The adjacent roads and highways are weed infested making weed control on colonisation critical.</p>	Low



An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:	Impacts on threatened and other flora	Likelihood	Consequence	Risk	Mitigation	Residual Risk
Introduce disease that may cause the species to decline.	<p>Absence of mine related activities in the area or catchment of the <i>U. singeriana</i> population reduces the potential for disease to be introduced to its area.</p> <p>The site of the population is uncontrolled and may be subject to activities unrelated to the mine.</p> <p>To date there is no unequivocal record of <i>P. cinnamomi</i> being associated with disease in undisturbed native vegetation in the NT. It is generally accepted that the environmental conditions are not conducive to the establishment and persistence of <i>P. cinnamomi</i> in susceptible native plant communities (Anon. 2006).</p>	Unlikely	Moderate	Moderate	Vehicles will arrive on site in a clean condition.	Low
Interfere with the recovery of the species.	<p>Absence of mine related activities in the area or catchment of the <i>U. singeriana</i> population reduces the potential for interference with the species recovery. The site of the population is uncontrolled and may be subject to activities unrelated to the mine. No other plant species is suffering from the threat of extinction.</p>	Rare	Insignificant	Low	N/A	Low





## 5.8.2 Limestone quarry

### *Existing environment*

#### **Vegetation**

The vegetation of the quarry area and access road was mapped at 1:1,000,000 by NRETAS. Mapping at this scale is too broad for description and assessment of vegetation potentially impacted by a relatively small quarry.

There is no other vegetation mapping for the area on and surrounding the mineral exploration lease.

The EPBC PMST found there was no threatened ecological community likely to occur in the proposed area. A copy of the search results is provided in Appendix C.

#### **Native flora**

The EPBC PMST did not record a threatened plant species as likely to occur in the quarry area.

The NT Herbarium database provides records of 396 plant species in the area (1,552 records).

Herbarium records for the area contain no record of a species listed as threatened under the EPBC Act or the *Territory Parks and Wildlife Conservation Act*.

#### **Weeds**

The quarry site has infestations of at least three species of weeds listed as Class B under the *Weeds Act*:

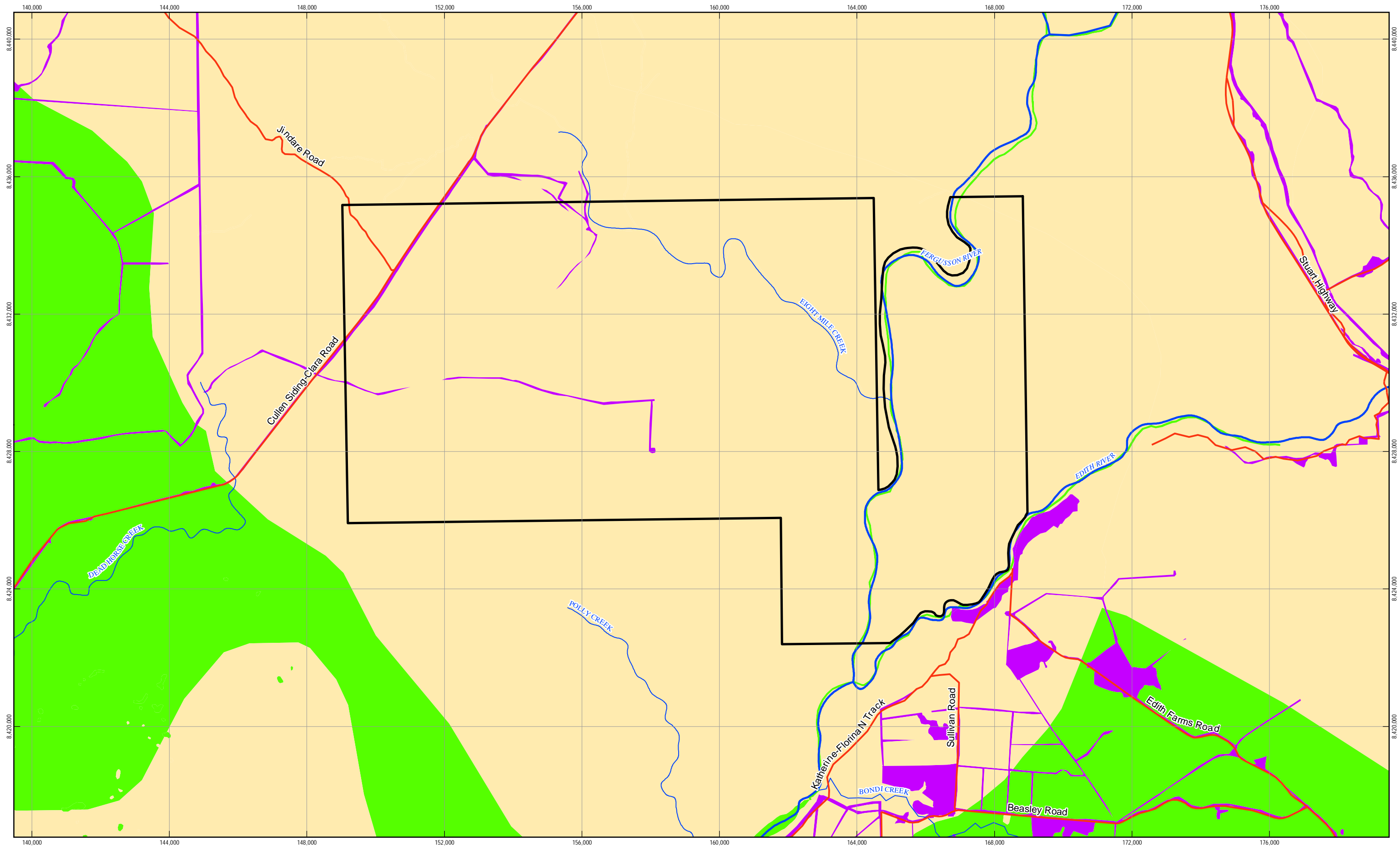
- ▶ Mission grass (*Pennisetium polystachyon*)
- ▶ Hyptis (*Hyptis suaveolens*)
- ▶ Spiny-head sida (*Sida acuta*)

Growth and spread of Category B weeds are to be controlled.

#### **Fire**

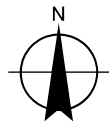
The area surrounding the quarry has been impacted by late season wildfire over the past seven years (2003-2010). There were mostly no late fires in the area southeast of the Fergusson and Edith Rivers, with most of the remainder experiencing late fire in two or three of the seven years. Some areas experienced late fire in four years with a relatively small area having late fire in five years (North Australia Fire Information [www.firenorth.org.au](http://www.firenorth.org.au); accessed 4 March 2011). Only areas to the southeast of the Fergusson River received no or only one fire at any time of year over the period. Most of the rest of the area was burnt three to five times, with areas to the northwest experiencing fires in five to seven of the seven years.

Annual, early dry season control burns would be part of the quarry Environmental Management Program.



1:100,000 (at A3)  
0 1 2 3 4  
Kilometres

Map Projection: Universal Transverse Mercator  
Horizontal Datum: Geocentric Datum of Australia  
Grid: Map Grid of Australia 1994, Zone 53



#### LEGEND

- Proposed Quarry Boundary (Estimated)
- Roads
- Open Forest
- Pastoral/Horticulture/Roads
- Woodland



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Vista Gold Australia Pty Ltd  
Mt Todd Gold Project

Job Number	43-21801
Revision	0
Date	11 APR 2011

NRETAS NVIS Vegetation (1:1,000,000) - Quarry

Figure 13

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Data source: NRETAS - Vegetation NVIS (2011). Navteq - Roads(2008). GHD - Proposed Quarry Boundary (2011). Created by: CM

66 Smith Street Darwin NT 0800 Australia T 61 8 8982 0100 F 61 8 8981 1075 E [drwmail@ghd.com](mailto:drwmail@ghd.com) W [www.ghd.com.au](http://www.ghd.com.au)



### ***Potential impacts and mitigation***

#### **Vegetation**

Some vegetation will be cleared in the establishment of the quarry and its access road. It is not possible to define the vegetation type affected.

Other potential sources of impact on the vegetation include:

- ▶ Dust and exhaust emissions' modification of air quality
- ▶ Potential for alteration of surface hydrology
- ▶ Potential for alteration of hydrogeology
- ▶ Potential for changes in patterns of wildfire.

#### **Flora**

There is no known threatened plant species recorded for the proposed quarry area. The quarry area will be surveyed to confirm the absence of threatened plant species.

#### **Weeds**

Proposed activities provide opportunities for weed establishment and population growth. This could result in expansion of existing weed populations and colonisation by additional species. There are a relatively large number of weeds not recorded from the quarry area that are found in the Darwin-Katherine region. There is significant potential for transport of additional weeds to the site.

There are no formal guidelines for assessment of impacts of development actions on the weed environment. Weeds figure prominently in potential impacts dealt with in the guidelines provided in DEWHA (2009).



## 5.9 Fauna

### 5.9.1 Mt Todd Gold Mine

#### *Existing environment*

##### **Native fauna**

The EPBC PMST indicated that nine threatened species and 12 non-threatened migratory species may occur in the mine site area (refer to Appendix A). Table 13 lists the threatened and migratory species potentially occurring at the site and an assessment of their likelihood of occurrence in the proposal area.

The NT Parks and Wildlife Commission's Fauna Atlas contains 7,341 records of 307 species of fauna from within a 10 km boundary around the mineral lease. The records are for species of terrestrial vertebrate: 42 mammals (144 records) (six exotic species), 187 birds (6,910 records), 64 reptiles (244 records) and 14 frogs (44 records).

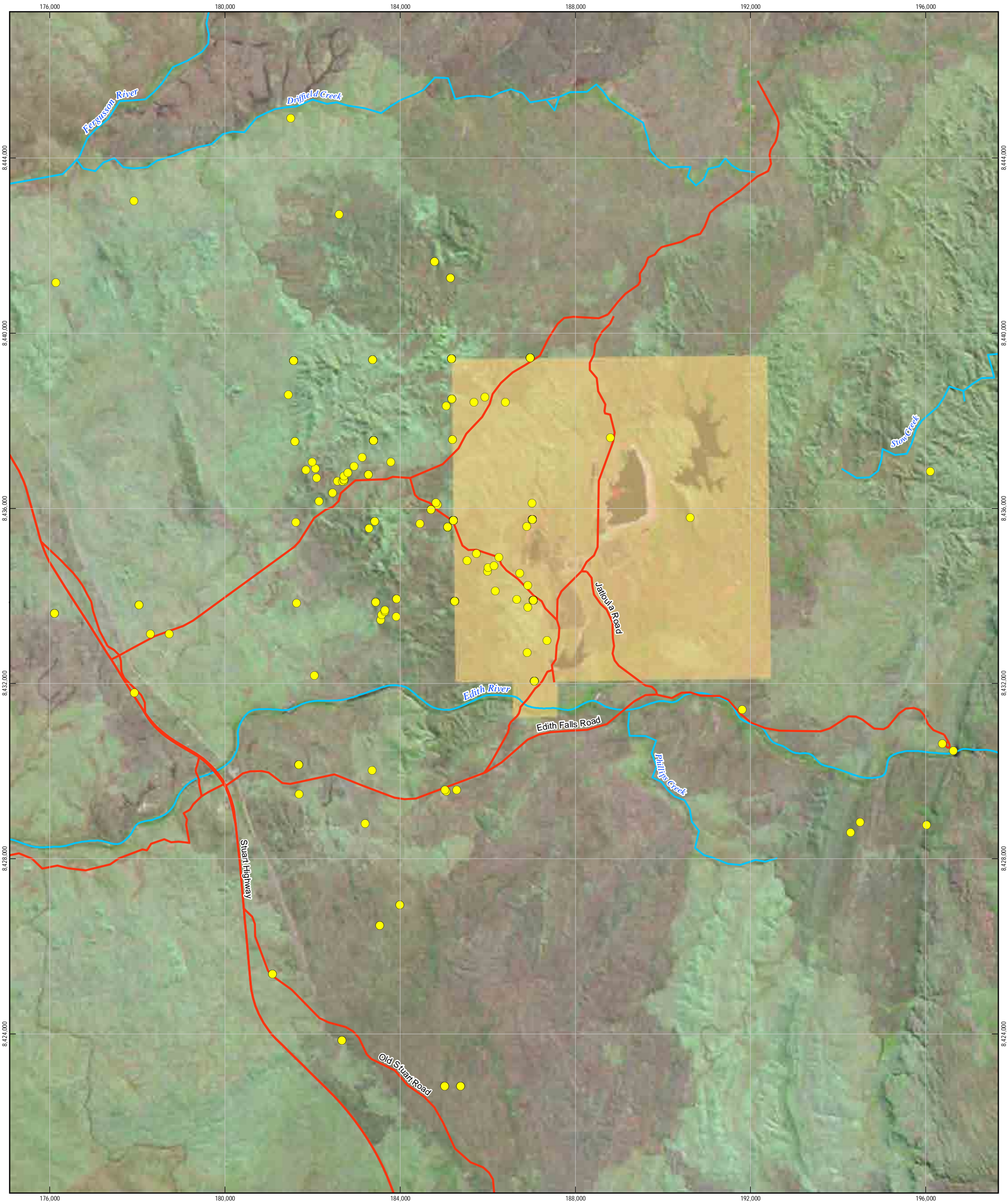
A survey conducted for the initial development of the Mt Todd Gold Mine (Lane *et al.*, 1990) recorded 227 species of terrestrial vertebrate: 35 mammals (5 exotic), 131 birds (an additional 21 species were listed from previous records but not seen in the survey), 47 reptiles (an additional 5 species were listed from previous records but not seen in the survey) and 14 frogs i.e. a total of 253 known from the area at that time. These records include five species not found in the Fauna Atlas (one frog, three reptiles and one mammal, while the Fauna Atlas includes 75 species not recorded by Lane *et al.*, (1990)(one frog, 18 reptiles, 48 birds and nine mammals)

Nine (2.9%) of the total recorded species (Fauna Atlas plus Lane *et al.*, 1990) are listed as threatened under the EPBC Act. Table 13 lists these species, the levels of threatened status to which they have been assigned, and documents the status of populations in the area of the mineral lease and elsewhere in the NT.

An additional three species are listed as threatened under the *Territory Parks and Wildlife Conservation Act* (Table 13).

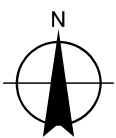
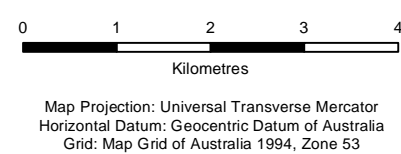
The NT Fauna Atlas has records of birds listed as migratory under the EPBC Act. The majority of these are birds of prey, migrant shore birds, waterbirds and ducks that are relatively common in the region. The habitat of the development area does not provide significant areas of appropriate habitat for migrant shore birds, waterbirds or ducks. Species likely to occur/known to occur and potentially have significant populations are listed in Table 13.





LEGEND

- Fauna Records
- Mt Todd Mining Leases
- Roads
- Waterways



CLIENTS|PEOPLE|PERFORMANCE

Vista Gold Australia Pty Ltd  
Mt Todd Gold Project

Job Number	43-21801
Revision	0
Date	11 APR 2011

Gouldian Finch - Mt Todd Mine

Figure 14



**Table 13 Presence of EPBC listed species within the proposal area**

Species	EPBC Act	TPWC Act	Recorded from site	Discussion
Bare-rumped sheath-tail bat ( <i>Saccolaimus saccolaimus nudiclunatus</i> )	CE			The Northern Territory distribution of this species seems confined to the more northern area of Kakadu National Park. The NT Fauna Atlas does not record this species in the Yinberrie Hills.
Northern quoll ( <i>Dasyurus hallucatus</i> )	E	CE	✓	<p>Rocky habitats and open eucalypt forests are the preferred habitats although a wide range of habitats is used. The Northern quoll has been recorded from the Pine Creek to Katherine area in recent times, and was recorded by Lane <i>et al.</i>, (1990) in the Yinberrie Hills. There are 4 records from the Yinberrie Hills in the NT Fauna Atlas. All are from a location well outside the mine lease boundary.</p> <p>There is no shortage of habitat for the Northern Quoll.</p> <p>Population decline was evident in the 1980s (Braithwaite and Griffiths, 1994) although the causes were not clear. Invading cane toads drastically reduced populations across the Top End. Some survive (Woinarski <i>et al.</i>, 2001; Woinarski <i>et al.</i>, 2008).</p> <p>The quoll's future population trends are largely dependent on their interaction with the cane toad.</p>
Northern brush-tailed phascogale ( <i>Phascogale pirata</i> )	V			The phascogale is usually located in tall open forests. It is uncommon and little is known of their ecology or behaviour in the Top End. It was not recorded by Lane <i>et al.</i> , (1990) in the Yinberrie Hills. There are 0 records from the Yinberrie Hills in the NT Fauna Atlas.
Brush-tailed rabbit rat ( <i>Conilurus penicillatus</i> )	V			Recent records are restricted to the Tiwi islands, Cobourg Peninsula, Kakadu, the Inglis Islands and Groote Eylandt. There is no record for the Yinberrie Hills in the NT Fauna Atlas and it was not recorded in the Yinberrie Hills by Lane <i>et al.</i> , (1990).





Species	EPBC Act	TPWC Act	Recorded from site	Discussion
Gouldian finch ( <i>Erythrura gouldiae</i> )	E	E	✓	<p>The Gouldian finch was once distributed throughout the tropical savannas of northern Australia. The species is now restricted to isolated areas mostly in the NT and Kimberley. The finches are known to occupy two different habitats. Nesting occurs in <i>E. brevifolia</i> or <i>E. tintinnans</i> woodlands on rocky hills where they feed largely on the seed of <i>Sorghum</i> (Price 1992, Tidemann <i>et al.</i>, 1999). During the wet season they move from the hills into lowlands drainage systems and feed on seed of perennial grasses (Dostine and Frankiln 2002; Zhang and C. Hempel, 2001).</p> <p>The Yinberrie Hills is possibly the best known and best studied population in the Top End. Its population has been monitored since 1996. The population does not seem to be in decline (Ward and Voulkolos, 2009).</p> <p>Causes of the decline remain speculative (e.g. Tidemann <i>et al</i> 1992; Bell 1996; Franklin 1999; O'Malley. 2006). There are 496 records in the NT Fauna Atlas (Figure 14).</p>
Partridge pigeon ( <i>Geophaps smithii smithii</i> )	V	V	✓	<p>The Partridge Pigeon is a ground dwelling granivore known to occur across the Top End of the NT and the Kimberley. This species has declined or disappeared from much of the lower rainfall parts of its range over the last century. It occurs in eucalypt woodlands and nests in dense assemblages of grasses. Inappropriate fire regimens may be a cause of the species decline (Fraser <i>et al.</i>, 2003). The partridge pigeon was not recorded by Lane <i>et al.</i>, (1990). The NT Fauna Atlas has 8 records from five locations outside the mine lease boundary.</p>
Red goshawk ( <i>Erythrotriorchis radiatus</i> )	V	V		<p>The Red goshawk forages in open eucalypt woodland, often along the edges of rainforest or mangrove, or riparian forest margins. They nest in unusually tall trees (compared to surrounding woodlands), usually in close vicinity to water. Nest pairs are sensitive to disturbance. The species decline is associated with clearing of habitat. This species was not recorded by Lane <i>et al.</i>, (1990). There are 0 records from the Yinberrie Hills in the NT Fauna Atlas</p>
Australian bustard ( <i>Ardeotis australis</i> )		V	✓	<p>Generally a bird of open grassland and woodlands but know to frequent more heavily wooded areas. Has undergone an apparent decline in the more southerly areas of the NT, with possibly a lesser decline in the north. Hunting may be a factor in the decline. This species was recorded by Lane <i>et al.</i>, (1990) in the Yinberrie Hills. There are 6 records from the Yinberrie Hills in the NT Fauna Atlas</p>
Masked owl ( <i>Tyto novahollandiae kimberli</i> )	V	V		<p>The northern sub-species of the masked owl usually occurs in open eucalypt forests and woodlands. This species was not recorded by Lane <i>et al.</i>, (1990). There are 0 records from the Yinberrie Hills in the NT Fauna Atlas</p>



Species	EPBC Act	TPWC Act	Recorded from site	Discussion
Crested shrike-tit ( <i>Falcunculus whitei</i> )	V	V	✓	Little is known of this species other than it inhabits a variety of open forest and woodland habitats across the Top End. This species was not recorded by Lane <i>et al.</i> , (1990) in the Yinberrie Hills. There are 4 records from the Yinberrie Hills in the NT Fauna Atlas, one from inside the mine lease boundary.
Mertens monitor ( <i>Varanus metensi</i> )		V	✓	Mertens monitor experienced declines in population coinciding with the invasion of the cane toad. Populations seem to recover to variable extents. Future population levels are likely to depend on ongoing evolution of the toad-monitor interaction. The species was recorded by Lane <i>et al.</i> , (1990) in the Yinberrie Hills. There are 2 records from the Yinberrie Hills in the NT Fauna Atlas.
Yellow-spotted monitor ( <i>Varanus panoptes</i> )		V	✓	The yellow spotted monitor experienced declines in population coinciding with the invasion of the cane toad. Populations seem to recover to variable extents. Future population levels are likely to depend on ongoing evolution of the toad-monitor interaction. The species was recorded by Lane <i>et al.</i> , (1990) in the Yinberrie Hills. There is 1 record from the Yinberrie Hills in the NT Fauna Atlas.
Rainbow bee-eater ( <i>Merops ornatus</i> )	M		✓	The rainbow bee-eater is an abundant migrant very broadly distributed across the Top End and much of the Northern Territory. This species was recorded by Lane <i>et al.</i> , (1990). There are 101 records from the Yinberrie Hills in the NT Fauna Atlas
Fork-tailed swift ( <i>Apus pacificus</i> )	M		✓	This species was recorded by Lane <i>et al</i> (1990) in one of their surveys of the area. They referred to it as uncommon. There are 4 records in the NT Fauna Atlas.
Cicadabird ( <i>Coracina tenuirostris</i> )	M	-		This species was not recorded by Lane <i>et al.</i> , (1990) in the Yinberrie Hills. There is 1 record from the Yinberrie Hills in the NT Fauna Atlas
Rufous fantail ( <i>Rhipidura dryas</i> )	M	-		This is a monsoon rainforest species. Rainforests are not abundant in the development area. There are areas of <i>Allosyncarpia</i> dominated rainforest to the northwest adjacent to the Fergusson River. This species was not recorded by Lane <i>et al.</i> , (1990). There are 0 records from the Yinberrie Hills in the NT Fauna Atlas.
Migratory Wetland Species – Birds	M	-		The natural vegetation of the development site and the existing mine infrastructure do not provide habitat appropriate to migratory wetland/shorebirds other than incidental visitors.
Freshwater Crocodile ( <i>Crocodylus johnstoni</i> )	M	-		The water storage dam on the proposed development site may provide appropriate habitat for freshwater crocodiles. This species was not recorded by Lane <i>et al.</i> , (1990). There are 7 records from the Yinberrie Hills in the NT Fauna Atlas and sightings have been made in the water storage.

CE = Critically endangered, E= Endangered, V = Vulnerable, M = Migratory





### **Exotic and feral animals**

There are historic records of feral cattle (*Bos taurus*), water buffalo (*Bubalus bubalis*), donkeys (*Equus asinus*) and horses (*Equus caballus*) (Lane *et al.*, 1990) from the mineral lease. Feral pigs (*Sus scrofa*) roam the area as indicated by old wallows and 'rooting' evident in low lying areas.

Additional exotic species included in the NT Fauna Atlas are the black rat (*Rattus rattus*), feral cat (*Felis catus*) and the cane toad (*Bufo marinus*).

### **Aquatic macroinvertebrates**

The Department of Resources began monitoring of macroinvertebrates in 2003. It continued until the present. Macroinvertebrates are monitored according to the modified AUSRIVAS framework with a view to detecting impacts on mine discharge waters on the surface water biota of the Edith River.

Potential sources of polluted surface water from the mine site to Edith River during the 2003-2008 survey periods included:

- ▶ Discharge of Stow Creek into the Edith River
- ▶ Controlled siphon discharge from RP1
- ▶ Discharge from West Creek which receives overflow from RP1 via a spillway.

Monitoring sites for the latest reporting period (Vista Gold 2008) were:

- ▶ Edith River Upstream of Stow Creek Confluence (ERUS)
- ▶ Edith River Downstream of Stow Creek Confluence (ERDS)
- ▶ Edith River Downstream of Site SW4 (ERSW4)
- ▶ Fergusson River Upstream (FRUS)
- ▶ Fergusson River Downstream (FRDS).

The five sites were sampled using standard NT AUSRIVAS survey methodology.

No impact from the mine site was detected for 2008 (Vista Gold 2008). This was based on the reference sites being less similar to one another than were the Edith River sites to each other. The statistical methodology of the historical sampling program detected an impact only once. This was in 2004 when an 85.5% similarity was calculated for the reference sites and only 72% (ERUS-ERDS), 66.8% (ERSW4-ERUS) and 74.4% (ERSW4-ERDS) for the impact site locations.

### **Biting insects**

The Mt Todd area experiences relatively high numbers of mosquitoes towards the end of the wet season, with numbers apparently peaking in March. The mosquito community is dominated by *Aedes normanensis*. This species breeds in flooded areas such as borrow pits and floodout areas of small creeks. *Culex annulirostris* becomes more dominant as the dry season proceeds. This species breeds in a variety of sites, especially water in low lying grassy areas. A total of 33 mosquito species were identified at four sites sampled (Mt Todd Gold Project 1993). Three of the species are known transmitters of arbovirus (Mt Todd Gold Project 1993; Whelan 1997) (Table 14). The 33 species includes species of *Anopheles* capable of transmitting malaria. There is no malaria currently in Australia.

**Table 14 Mosquito species as vectors for disease**

Species	Ross River virus	Murray Valley encephalitis virus	Barmah Forest virus	Kunjin virus
<i>Aedes normanensis</i>	✓	✓	✓	✓
<i>Aedes notoscriptus</i>	✓	✓	✓	
<i>Culex annulirostris</i>	✓	✓		✓

A biting insect management and monitoring program was developed for the mine (Mt Todd Gold Project 1993).

### **Potential impacts and mitigation**

#### **Native fauna**

Impacts on native fauna are assessed in Table 15.

#### *Clearing for the mine pit and infrastructure expansion*

Clearing for expansion on the western edge of the existing mine pit will remove 117 ha (1.8%) of the area's *E. tintinnans* dominated woodlands (section 5.8), expanding that disturbed by mining to 362 ha or 5.7% of that prior to 1990. This is one of the vegetation types where the Gouldian finch breeds, making nests in hollows of *E. tinintans*. A larger area of the habitat (245 ha, 3.9% of that available) was cleared during the course of previous mining.

Monitoring of the Gouldian population prior to 1997 was based on occupation of nesting hollows. This covered the years 1993 to 1996. During this time there was no significant change in the frequency of occupancy of appropriate hollows (Collins *et al.*, 1993; Smith *et al.*, 1995; Bamford 1996). There was no relationship between nesting frequency and distance from the mine although available nest hollows varied in quadrats from one year to the next. Sampling included more than one *E. tintinnans* dominated woodland type. Additional monitoring from 1996 by NRETAS has been based on counts of adult and immature birds at waterholes. These data likewise demonstrate no consistent upward or downward trend in the population (NRETAS *pers comm*).

#### *Dust and noise*

Previous mining generated dust and noise from activities in and around the pit, road transport on dirt roads, and from the treatment of ore. None of these factors caused a reduction in the frequency of Gouldian finch nesting in hollows close to as opposed to further from the pit (Collins *et al.*, 1993; Smith *et al.*, 1995). Anticipated levels of mining activity and increases in levels of dust will be similar to those described in the initial EIS for the Mt Todd Gold Mine (section 5.10).

#### *Fire*

Hot wildfires late in the dry season have the potential to alter habitats and impact directly on fauna. The Yinberrie Hills has been subject to extensive late season wildfire over the past 17 years. The fires do not seem to have had a measurable impact on the Gouldian finch population. They may gradually



degrade the habitat e.g. possibly reducing the number and suitability of trees with appropriate nesting hollows.

The mine undertakes annual, early dry season control burns in the Yinberrie Hills and mine area as part of its Environmental Management Program.

#### *Assessment of impacts on native fauna and mitigation measures*

The mine's potential impacts on the fauna are not significant if standard mitigation procedures are applied.

#### **Exotic species**

The mine may assist in invasion of the communities by an additional exotic species would be poor waste management (providing food and shelter to the invader) or inadvertently providing breeding sites.

House mice and black rats are the obvious species that could colonise the mine site.

Invasion or spread of exotic animals could potentially modify, destroy, remove, isolate or decrease the availability or quality of habitat.

Wastes will be managed to avoid opportunities for exotic animal colonisation and population growth

Breeding sites for exotic animals will be managed.

Care will be taken to avoid introduction of additional exotic animal species.

#### **Aquatic macroinvertebrates**

All previous work on the aquatic macroinvertebrate community in the Edith River adjacent to the mine has focused on monitoring of possible impacts from release of polluted wastes into the Edith River. This reflects the single impact risk posed to the aquatic biota: potentially acidic water with significant concentration of metals. The impacts include loss of diversity and significant alteration in community structure and composition (refer to Table 16).

#### **Biting insects**

Impacts on biting insects are assessed in Table 17.



**Table 15 Native fauna – potential impacts and mitigation (mine site)**

An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:	Impacts on Fauna	Likelihood	Consequence	Risk	Mitigation	Residual Risk
Lead to a long-term decrease in the size of a population	<p><b>Northern quoll, <i>V. mertense</i> &amp; <i>V. panoptes</i>:</b> The mine will not exacerbate the effects of the principal cause of the species' decline (the cane toad) nor remove significant areas of its habitat.</p> <p><b>Gouldian finch:</b> Breeding sites will be reduced by an estimated 1.8% (assuming nesting frequency is constant across the <i>E tintinnans</i> woodlands e.g. Collins <i>et al.</i>, (1993)). Breeding sites will be reduced. This is not expected to cause a long-term decrease in the population.</p> <p><b>Partridge pigeon:</b> Habitat is unlikely to be reduced to a significant extent. The possible threat of fire is to be managed</p> <p><b>Bustard, shrike-tit and other fauna:</b> Minor loss of habitat is unlikely to cause a long-term decline.</p>	Rare	Moderate	Moderate	<p>Fire breaks will be built to protect vegetation from late dry season wildfires entering the site from the Stuart Highway and Edith Falls Road.</p> <p>Early dry season fuel reduction burns will continue as part of the mine EMP in collaboration with the Jawoyn Association.</p> <p>Weed management will continue to as part of the mine EMP.</p>	Low (improved habitat management is likely to compensate for the minor reduction in occupancy.)
Reduce the area of occupancy of the species	<p><b>All fauna:</b> The loss of habitat from clearing the mine is to be relatively minor in comparison with that available on the mineral lease and regionally. No other loss of habitat is anticipated.</p>	Likely	Insignificant.	Moderate	As above	Low (improved habitat management is likely to compensate for the minor reduction in occupancy.)





An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:	Impacts on Fauna	Likelihood	Consequence	Risk	Mitigation	Residual Risk
Fragment an existing population into two or more populations	<b>All fauna:</b> The mine is unlikely to increase existing levels of population fragmentation through clearing or other impacts on habitat.	Unlikely	Minor	Low	<p>The vegetation map will be reviewed prior to planned clearing to avoid impacting habitat likely to be critical to the survival of any vertebrate species.</p> <p>Impacts of the mining operation on dust levels, noise, groundwater levels and quality, and surface water quality will be spatially restricted close to the mine and will be monitored to allow management of potential impacts on vertebrate species.</p>	Low
Adversely affect habitat critical to the survival of a species	<b>All fauna:</b> Potential minor negative impacts from localised dust, noise, water table reduction, and decline in water quality are likely to be highly localised and are not known to have impacted fauna in the past.	Unlikely	Minor	Low	<p>The vegetation map will be reviewed prior to planned clearing to avoid impacting habitat likely to be critical to the survival of any vertebrate species.</p> <p>Impacts of the mining operation on dust levels, noise, groundwater levels and quality, and surface water quality will be spatially restricted close to the mine and will be monitored to allow management of potential impacts on vertebrate species.</p>	Low
Disrupt the breeding cycle of a population.	<b>All fauna:</b> The mine's impacts on dust, noise, water table reduction, and decline in water quality are likely to be highly localised and likely not impact on breeding cycles. Previous mining did not impact on Gouldian finches' nesting frequency or population size.	Unlikely	Minor	Low	<p>Impacts of the mining operation on dust levels, noise, groundwater levels and quality, and surface water quality will be spatially restricted to close to the mine and will be monitored to allow management of potential impacts on vertebrate species.</p>	Low



An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:	Impacts on Fauna	Likelihood	Consequence	Risk	Mitigation	Residual Risk
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	<b>All fauna:</b> The mines impacts on dust, noise, ground water level and water quality are highly localised and unlikely to cause a significant decline in habitat quality or extent.	Unlikely	Minor	Low	Impacts on dust levels, noise, groundwater levels and quality, and surface water quality will be spatially restricted close to the mine and will be monitored to allow management of potential impacts on vertebrate fauna.  Fire and weeds will be managed under the EMP.	Low
Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat.	<b>All fauna:</b> Exotic weeds and animals may well invade the site unless measures are implemented to lower the risk.  <b>All fauna:</b> The level of harm derived from a successful colonisation would be highly variable depending on the particular weed or exotic animal species.	Possible	Moderate	High	Wastes will be managed to avoid opportunities for exotic animal colonisation.  Care will be taken to reduce potential for introduction of exotic species (animal or plant).	Moderate
Introduce disease that may cause the species to decline.	<b>All fauna:</b> The most likely mode for introduction of disease is introduction of an exotic pest carrying a disease agent and its rapid transmission by site vectors.  <b>All fauna:</b> Impact from introduced disease would be highly variable depending on the species  <b>All fauna:</b> Vista Gold would have no capacity to influence introduction of a disease new to the NT or Australia, and could only hope to slow arrival of the disease at Mt Todd.	Possible.	Moderate	High.	Care will be taken to reduce potential for introduction of exotic species.  Wastes will be managed to reduce possible growth in exotic populations.  Breeding places for site vectors (biting insects) will be managed.	Moderate



An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:	Impacts on Fauna	Likelihood	Consequence	Risk	Mitigation	Residual Risk
Interfere with the recovery of the species.	<p><b>All fauna:</b> Recovery of the threatened species is dependent on rectification of several different and some unknown threatening processes.</p> <p>The mine seems unlikely to interfere with the rectification of the processes threatening each of the species (e.g. cane toads, an air sac mite, poor fire management at different times of years, grazing etc)</p> <p>The potential impacts deriving from the mine are not of a spatial and other scale capable of driving the future extinction of the now threatened species. Either alone or in conjunction with existing threatening processes.</p>	Rare	Major	High	Mitigation of the impacts will limit the potential for interference with recovery of the species	Low



**Table 16 Macroinvertebrates - potential impacts and mitigation (mine site)**

An action is likely to have a significant impact on aquatic macroinvertebrates if there is a real chance or possibility that it will cause a:	Impacts on aquatic macroinvertebrates	Likelihood	Consequence	Risk	Mitigation	Residual Risk
Decrease in species diversity and change in community structure	Poorly managed runoff from the mine, waste water dams or tailing could result in release of acidic waste water containing concentrations of metals potentially toxic to aquatic macroinvertebrates. This potential impact is currently mitigated.	Possible	Moderate	High	<p>Waste dams and tailing storage facilities will be renovated or re-built and expanded to minimise the chance or accidental release of wastes</p> <p>Waste water will be neutralised to lower toxic metal content prior to release</p> <p>The macroinvertebrate monitoring program will be updated.</p>	Moderate





**Table 17 Biting Insects – potential impacts and mitigation (mine site)**

An action is likely to have a significant impact on biting insects if there is a real chance or possibility that it will cause an:	Impacts on biting insects	Likelihood	Consequence	Risk	Mitigation	Residual Risk
Increase in the availability of breeding sites for mosquitoes	<p>Poorly managed construction, engineering design and poor management can lead to mosquitoes breeding in water in:</p> <ul style="list-style-type: none"> <li>Roadside puddles</li> <li>The pit floor</li> <li>Tailing and other storages</li> <li>Water tanks</li> <li>Areas on waste rock piles that collect water</li> <li>Disturbed areas.</li> </ul>	Likely	Major	Extreme	<p>Project areas to be managed to minimise ponding of water</p> <p>Storm water drainage designed and managed to avoid ponding</p> <p>Semi-aquatic plants and grasses will be minimised around all storages.</p> <p>Mosquito larvacides to be used in consultation with authorities should breeding be detected.</p> <p>Containers (drums, tyres etc) to be appropriately disposed of, stored under cover, have drainage holes</p> <p>All construction should be undertaken to avoid the establishment of areas of temporary water and be in accordance with the guidelines provided by the Department of Health and Families (Medical Entomology Branch 1997).</p>	Low
Increase in the nuisance and potential disease levels posed by mosquitoes.	Exposure to numerous mosquito bites increases the probability of acquiring an arbovirus.	Possible	Moderate	High	All personnel are to follow standard procedures from reducing mosquito bites including wearing long sleeved shirts, long trousers, and mosquito repellents.	Low



### 5.9.2 Limestone quarry

#### ***Existing environment***

##### **Native fauna**

Use of the EPBC PMST indicated that 9 threatened species and 14 migratory species may occur in the proposed exploration lease for the proposed quarry area (refer to Appendix C). This area is significantly larger than will ultimately be used to establish the quarry, and includes areas adjacent to Mt Todd.

The Parks and Wildlife Commission's Fauna Atlas contains 1174 records of fauna from within the exploration lease for the quarry. The records are for 170 species of terrestrial vertebrate: 10 mammals (17 records), 130 birds (1161 records), 18 reptiles (28 records) and 12 frogs (13 records).

Two of the total recorded species (NT Fauna Atlas 2011) are listed as threatened under the EPBC Act. Table 18 lists these species, the levels of threatened status to which they have been assigned, and documents the status of populations in the area of the proposed quarry and elsewhere in the Northern Territory.

An additional two species are listed as threatened under the *Territory Parks and Wildlife Conservation Act* (Table 18).

The majority of the migratory species identified by the EPBC search are water birds or waders relatively common regionally. The habitat of the development area does not provide significant areas of habitat appropriate for the migrant shore birds, waterbirds or ducks. Those species likely to occur or known to occur and may potentially have significant populations in the area are listed in Table 18 .

The number of threatened and migratory species can only be taken as indicative. The number is likely to be reduced once a quarry site has been defined.



**Table 18**      **Presence of EPBC listed species in the quarry proposal area**

Species	EPBC Act	TPWC Act	Recorded from site	Discussion
Bare-rumped sheathtail bat ( <i>Saccolaimus saccolaimus nudiclunatus</i> )	CE			The Northern Territory distribution of this species seems confined to the more northern area of Kakadu National Park.
Northern quoll ( <i>Dasyurus hallucatus</i> )	E	CE		<p>Rocky habitats and open eucalypt forests are the preferred habitats although a wide range of habitats is used. The Northern quoll has been recorded from the Pine Creek to Katherine area in recent times. There are 0 records from the area in the NT Fauna Atlas.</p> <p>There is no shortage of habitat for the Northern Quoll.</p> <p>Population decline was evident in the 1980s (Braithwaite and Griffiths, 1994) although the causes were not clear. Invading cane toads drastically reduced populations across the Top End. Some survive (Woinarski <i>et al.</i>, 2001; Woinarski <i>et al.</i>, 2008).</p> <p>The quoll's future population trends are largely dependent on their interaction with the cane toad.</p>
Northern brush-tailed phascogale ( <i>Phascogale pirata</i> )	V			The phascogale is usually located in tall open forests. It is uncommon and little is known of their ecology or behaviour in the Top End. There are 0 records from the area in the NT Fauna Atlas
Brush-tailed rabbit rat ( <i>Conilurus penicillatus</i> )	V			Not known from this locality. Recent records are restricted to the Tiwi islands, Cobourg Peninsula, Kakadu, the Inglis Islands and Groote Eylandt. There are no records from the area in the NT Fauna.
Gouldian finch ( <i>Erythrura gouldiae</i> )	E	E	✓	<p>The Gouldian Finch was once distributed throughout the tropical savannas of northern Australia. The species is now restricted to isolated areas mostly within the NT and the Kimberley. The finches are known to occupy two different habitats. Nesting occurs in <i>E. brevifolia</i> or <i>E. tintinnans</i> woodlands on rocky hills where they feed largely on the seed of <i>Sorghum</i> (Price 1992, Tidemann <i>et al.</i>, 1999). During the wet season they move from the hills into lowlands drainage systems and feed on seed of perennial grasses (Dostine and Franklin 2002; Zhang and C. Hempel, 2001).</p> <p>Causes of the decline remain speculative (e.g. Tidemann <i>et al</i> 1992; Bell 1996; Franklin 1999; O'Malley. 2006).</p> <p>There are 26 from the quarry area data search. The species has not been recorded from the exploration area.</p>



Species	EPBC Act	TPWC Act	Recorded from site	Discussion
Partridge pigeon ( <i>Geophaps smithii smithii</i> )	V	V	✓	The Partridge Pigeon is a ground dwelling granivore known to occur across the Top End of the NT and the Kimberley. This species has declined or disappeared from much of the lower rainfall parts of its range over the last century. It occurs in eucalypt woodlands and nests in dense assemblages of grasses. Inappropriate fire regimens may be a cause of the species decline (Fraser <i>et al.</i> , 2003). There are 2 records from the quarry area in the NT Fauna Atlas. The species has not been recorded from inside the exploration area.
Red goshawk ( <i>Erythrorhynchus radiatus</i> )	V	V		The Red Goshawk forages in open eucalypt woodland, often along the edges of rainforest or mangrove, or riparian forest margins. They nest in unusually tall trees (compared to surrounding woodlands), usually in close vicinity to water. Nest pairs are sensitive to disturbance. The species decline is associated with clearing of habitat. There are 0 records from the area in the NT Fauna Atlas
Australian bustard ( <i>Ardeotis australis</i> )		V	✓	Generally a bird of open grassland and woodlands but known to frequent more heavily wooded areas. Has undergone an apparent decline in the more southerly areas of the NT, with possibly a lesser decline in the north. Hunting may be a factor in the decline. There is one record from the quarry area in the NT Fauna Atlas
Masked owl ( <i>Tyto novahollandiae kimberli</i> )	V	V		The northern sub-species of the masked owl usually occur in open eucalypt forests and woodlands. There are 0 records from the quarry area in the NT Fauna Atlas
Crested shrike-tit ( <i>Falcunculus whitei</i> )	V	V		Little is known of this species other than it inhabits a variety of open forest and woodland habitats across the Top End. There are 0 records from the area in the NT Fauna Atlas
Mertens monitor ( <i>Varanus mertensi</i> )		V	✓	Mertens monitor experienced declines in population coinciding with the invasion of the cane toad. Populations seem to recover to variable extents. Future population levels are likely to be dependent on ongoing evolution of the toad-monitor interaction. There is one record from the area in the NT Fauna Atlas
Yellow-spotted monitor ( <i>Varanus panoptes</i> )		V		The yellow spotted monitor experienced declines in population coinciding with the invasion of the cane toad. Populations seem to recover to variable extents. Future population levels are likely to be dependent on ongoing evolution of the toad-monitor interaction. There are 0 records from the area in the NT Fauna Atlas.
Rainbow bee-eater ( <i>Merops ornatus</i> )	M		✓	The rainbow bee-eater is an abundant migrant broadly distributed across the Top End and much of the Northern Territory. There are 32 records from the quarry area in the NT Fauna Atlas
Cicadabird ( <i>Coracina tenuirostris</i> )	M	-		There are 0 records of the cicada from the area in the NT Fauna Atlas



Species	EPBC Act	TPWC Act	Recorded from site	Discussion
Rufous fantail ( <i>Rhipidura dryas</i> )	M	-		This is a monsoon rainforest species. Rainforests are not abundant in the development area. There are 0 records from the quarry area in the NT Fauna Atlas.
Migratory Wetland Species - Birds	M	-		The natural vegetation of the quarry site does not provide habitat appropriate to migratory wetland/shorebirds other than incidental visitors.
Freshwater Crocodile ( <i>Crocodylus johnstoni</i> )	M	-		There are 0 records from the quarry area in the NT Fauna Atlas
Saltwater crocodile ( <i>Crocodylus porosus</i> )	M	-	✓	There is one record from the site.

CE = Critically endangered, E = Endangered, V = Vulnerable, M = Migratory





### **Exotic and feral animals**

There are historic records of feral cattle (*Bos taurus*). Additional exotic species are likely.

### **Macroinvertebrates**

There do not appear to be recent studies of macroinvertebrates in the streams and rivers of the exploration lease.

### **Biting insects**

There do not appear to be assessments of biting insects in the exploration lease area. The Mt Todd data may be the more relevant of those available i.e. Mt Todd is close to the potential quarry site. The material presented for the Mt Todd Gold Mine is likely to be applicable.

### ***Potential impacts and mitigation measures***

#### **Native fauna**

The impacts are similar to those expected for the Mt Todd Gold Mine and can be used to provide an indication, but not definitive information of potential impacts of fauna around the proposed quarry.

Vista Gold intends to conduct a fauna survey of the quarry site once its location has been determined. This will allow a refining of existing knowledge on that area's fauna, the potential impacts and applicable mitigation of those impacts.

#### **Exotic animals**

Sources of impact, likely risk and mitigation of impacts on the exotic animal environment are as for the Mt Todd Gold Mine.

#### **Aquatic macroinvertebrates**

Water is likely to be naturally slightly alkaline and runoff from the quarry site to be equally alkaline, without significant heavy metal concentrations. The major source of impact on the aquatic macroinvertebrates is likely to come from dust contained in runoff or deposited from the air. Mitigation will be through the development and implementation of a sediment and erosion control plan; and management of dust production.

The small scale of the quarry venture and the benign and easily managed nature of potential aquatic contaminants suggest that there may be no major need for monitoring of macroinvertebrates around the quarry site.

#### **Biting insects**

Sources of impact, likely risk and mitigation of impacts on biting insects are as for the mine.

## **5.10 Air quality**

### **5.10.1 Mt Todd Gold Mine**

#### ***Existing environment***

The major sources of dust around the project area are believed to be bare or exposed ground and exposed waste rock dumps from historic mining activities.



Modelling conducted for the initial EIS for the mine estimated that the majority of dust generated by mining, processing of ore and other sources would be deposited close to the mine (NSR 1992). Increase in dust deposition immediately adjacent to the mine pit and crushers was estimated at up to 12 g/m<sup>2</sup>/month, with levels dropping quickly such that only 2 g/m<sup>2</sup> would occur at 1 km west southwest of the pit and about 0.5-0.6 km from the waste rock dump (Nigel Holmes and Associates, 1991). A review of the mine in 1997 found “several centimetres” of dust around the crusher area (The Winters Company 1997). Mine staff were reported as saying that dust emissions were “fairly heavy” during crushing. The New South Wales Department of Environment and Conservation (DEC) (DEC 2005) sets an average annual deposited dust criterion of 4 g/m<sup>2</sup>/month<sup>1</sup>.

Modelling for the initial EIS also indicated anticipated average annual dust concentrations (TSP) of less than 90 µg/m<sup>3</sup> from approximately 200m west southwest, but greater than this closer to the mine. The New South Wales Department of Environment and Conservation (DEC) (DEC 2005) sets a suspended dust criterion of 90 µg/m<sup>3</sup> for human exposure.

At the time of the EIS the nearest unoccupied residence was 5 km from the mine, and the nearest occupied residence was Werenbun 10 km from the mine. It was anticipated that the mine’s dust would have no impact on these sensitive sites.

Levels of production of other potential air pollutants are currently low. The mine is not working. Current care and maintenance activities generate little aerial pollution.

### ***Potential impacts***

#### **Dust**

Dust levels are likely to increase during mine construction and operation. Sources of dust will include:

- Drilling and blasting
- Loading/Unloading of ore and waste rock
- Hauling of ore and waste rock
- Processing of ore and waste rock
- General site movements over unsealed surfaces and
- Wind erosion from exposed surfaces e.g. waste dumps.

#### **Other emissions to air**

A range of air pollutants would be produced by the proposed:

- Gas fired power station
- Gas fired lime kiln and
- Combustion engines of equipment and vehicles.

Air pollution from these sources is not expected to be significant in the context of the mine’s location.

Refer to Table 19.

### ***Mitigation measures***

Mitigation measures are described in Table 19.



**Table 19 Air Quality – Potential impacts and mitigation (mine site)**

Impacts of air quality will be significant if increased dust levels:	Impacts	Likelihood	Consequence	Risk	Mitigation	Residual Risk
<p>At the nearest sensitive site exceed an annual average of TSP of <math>90 \mu\text{g}/\text{m}^3</math></p> <p>Are observed to negatively impact on native plants outside the mine limits.....</p> <p>Are associated with a decline in threatened fauna</p>	<p>Levels of dust predicted in the original EIS were based on an annual production of an average 10 million tonnes of ore per year. This proposal will mine approximately 10.65 million tonnes of ore per year.</p> <p>Dust levels are anticipated to be similar to those previously modelled.</p>	Rare	Major	High	<p>Potential dust levels will be modelled to ensure dust levels are not likely to be excessive</p> <p>Dust levels will be monitored during of construction and operation.</p> <p>Dust levels at a sensitive site exceeding an annual average of TSP of <math>90 \mu\text{g}/\text{m}^3</math> /month would trigger immediate action to correct the emission..</p> <p>Dust control measures will be put in place on all roads, waste dumps and in the pit.</p> <p>Dust control measures will be applied to crushers and ore transfers.</p>	Low



### **5.10.2 Limestone quarry**

#### ***Existing environment***

There are no data on existing levels of air pollution in the area where the quarry is likely to be established. No modelling has been conducted of patterns of concentration, deposition and dispersion of dust around a probable quarry site.

Dust from the quarry is likely to be above ambient levels.

#### ***Potential impacts and mitigation***

Reduction in air quality and visibility could occur from production of dust via:

- ▶ Drilling and blasting
- ▶ Loading/Unloading of limestone and waste rock
- ▶ Crushing of limestone
- ▶ Hauling of limestone and waste rock
- ▶ General site movements over unsealed surfaces
- ▶ Wind erosion from exposed surfaces.

Construction/operation of quarry, equipment and vehicles are likely to produce minor levels of atmospheric pollutants.

The quarry is not large and dust generated is likely to be alkaline and unlikely to contain significant concentrations of heavy metals. Impacts from dust are likely to be spatially confined and easily managed according to occupational health and safety criteria. Modelling and ongoing monitoring may not be required.

## **5.11 Noise and vibration**

### **5.11.1 Mt Todd Gold Mine**

#### ***Existing environment***

The mine is inactive with minimal vehicle movement on site. There are few other sources of noise and vibration in the area.

Modelling conducted from the initial EIS indicated predicted  $L_{A10}$  noise levels of 55 dB (A) adjacent to the mine, decreasing to 40 dB about 1.7 km and 35 dB 2.7 km to the southwest. These noise levels are equivalent to a rural environment with insects, birds and wind. The EIS predicted that the nearest sensitive receiver would not be impacted by mine noise. They similarly predicted an absence of blast overpressure impacts at the nearest sensitive site.

The composition of machinery, equipment and vehicles at the new mine is not finalised but will be similar in size and number to that used for the previous operation.

#### ***Potential impacts and impact mitigation***

The following activities will increase noise and vibration:



- ▶ Drilling and blasting
- ▶ Loading/Unloading of ore and waste rock
- ▶ Processing ore
- ▶ Hauling of ore and waste rock.

Potential impacts are described in Table 20.





**Table 20 Noise and Vibration – Potential impacts and mitigation (mine site)**

Impacts of noise and vibration will be significant if increased noise/vibration level:	Impacts	Likelihood	Consequence	Risk	Mitigation	Residual Risk
At the nearest sensitive site exceeds an estimated $L_{A10}$ of 40 dB	<p>Levels of noise predicted in the original EIS were based on an annual production of an average 10 million tonnes of ore per year. This proposal will mine approximately 10.65 million tonnes of ore per year.</p> <p>Noise levels are anticipated to be similar to those previously modelled, which conformed to the criterion.</p>	Unlikely	Minor	Low	<p>Potential noise /vibration levels will be modelled to ensure levels are not likely to be excessive</p> <p>Noise levels will be monitored during construction and operation.</p> <p>Excessive noise/vibration levels at a sensitive site would trigger immediate action to reduce noise/vibration emissions.</p> <p>Noise/vibration management will be put in place.</p>	Low
Causes significant concern at the Werenbun community	No concerns seem to have been expressed during previous mining	Rare	Minor	Low	As above	Low
Is associated with a decline in the resident Gouldian finch population	<p>Gouldian finch nest abundance during past mine operations did not vary with distance from the mine</p> <p>Gouldian finch population did not decline during previous mine operation</p>	Rare	Major	High	<p>As above</p> <p>NRETAS will continue to monitor the Gouldian finch population</p> <p>Detailed investigations will be implemented should there be a consistent pattern of Gouldian finch population decline</p>	Low



### **5.11.2 Limestone quarry**

#### ***Existing environment***

The precise location of the quarry is not known at this stage. It is likely to be a rural setting with the nearest sensitive receiver at least 10 km away. It is unlikely to have existing high levels of ambient noise.

The proposed quarry is small, especially compared to the Mt Todd Gold Mine. Noise emissions are likely to be significantly less than those at the mine.

#### ***Potential impacts and mitigation measures***

The following activities will increase noise and vibration:

- ▶ Construction
- ▶ Drilling and blasting
- ▶ Loading/Unloading of limestone and waste rock
- ▶ Crushing of limestone
- ▶ Hauling of limestone and waste rock.

There are possible impacts on

- ▶ Fauna
- ▶ Residential properties.

Base line sound levels will be determined and modelling undertaken to determine potential noise levels. Mitigation will follow procedures similar to those to be used at the Mt Todd Gold Mine as required.

## **5.12 Aboriginal heritage**

### **5.12.1 Mt Todd Gold Mine**

#### ***Existing environment***

##### **Culturally significant areas and sacred sites**

Two sacred sites were identified during preparation of the draft EIS (NSR 1992) for the mine's initial development. One was located in the area of the water supply dam and is now under water. This was done with approval from the Jawoyn Association and the Aboriginal Areas Protection Authority (Zapopan Undated). The other was located as being south of the waste dump containment pond and north of the Edith River.

The EIS identified an area it referred to as the Jenberri Area of Aboriginal Cultural Significance, lying immediately to the west of the existing pit, waste dump and waste containment pond.

The AAPA more recently (7 March 2011) provided information indicating an unregistered sacred site lies immediately to the west of the southern end on the water supply dam (Appendix D). This site is surrounded by a restricted work area. The unregistered site to the south of the waste containment pond



is indicated, as is another unregistered site to its immediate north west. Both sites are surrounded by relatively small restricted work areas.

A fourth sacred site is located to the immediate south of the Edith River. This site is incorporated in an extensive restricted work area that may be that identified by NSR (1992) as the Jenberri Area of Aboriginal Cultural Significance. The area recently indicated by AAPA is more extensive than shown in NSR (1992), extending east to enclose the waste dump and mine pit.

### **Archaeological sites**

Archaeological survey of the Mt Todd Gold Mine area prior to mining found 31 archaeological sites (21 scatters of surface stones in the remains of camp sites, and ten locations where stone had been quarried for the manufacture of artefacts (Lance 1990, 1991; Paton 1992). The studies emphasised that the sites gain meaning and significance from each other, and that the data were preliminary.

The quarry sites were in areas of the hornfels used for making flakes. The largest site (2 km by 2.5 km) is located in hills immediately to the west of the then proposed Batman Pit; in the contact zone between sedimentary rocks to the east and volcanic rocks to the west. The hornfels was present as boulders usually larger than 20 cm diameter.

Boulders of hornfels were found in creek lines that drain the hills. These were the source of material for five of the remaining quarry sites. The remaining four quarries were located in isolated outcrops of hornfels.

Areas of artefact scatter or campsites were defined by having a greater density of artefacts than the prevailing background scatter. Twelve of the camp sites were along creek lines with nine in the foothills. None was found in the floodplain or in the rugged hills. Larger numbers of artefacts (60-5,000) were found in the foothills than in those along the creek lines (10-150). The areas of the creek line camps were also smaller. It could not be determined whether the difference resulted from different activities conducted in the two areas, and from differences in occupancy.

It was anticipated that the mine would impact on 15 of the camp sites and four of the quarries. This was not seen by the archaeologists as an impediment to the mine's development, assuming appropriate mitigation was undertaken.

The Draft EIS's (NSR 1992) mitigation program for archaeological sites to be impacted by the mine included:

- ▶ Early and detailed consultation with Aboriginal custodians during the mitigation program
- ▶ An ethno-archaeological study investigating Aboriginal use of the sites, especially quarries
- ▶ Further detailed site recording at five quarry sites to be impacted by the development and at the large site that would not be impacted by the development
- ▶ More detailed description of a representative sample of 15 camp sites to be impacted
- ▶ Excavation of a small sample of camp sites and sterile areas along creek lines to determine time-depth of occupation of the area and any cultural change over time and
- ▶ Location and investigation of camp sites outside the project area to determine use and fate of hornfels taken to sites distant from its source.

These commitments were met prior to the initiation of construction (Paton 1993).



Commitments made in relation to sites that would not be directly impacted were:

- ▶ The marking of site locations on all master drawings to ensure they would be avoided during detailed mine planning
- ▶ Briefing of all employees on the presence, location, and significance of the unaffected sites during induction and at regular intervals thereafter and
- ▶ Flagging and signage to be used to mark sites to minimise the risk of vehicle access or inadvertent damage by the workforce or the public.

These commitments were included in the mine EMP (Bateman *et al.*, 1996) and in the more recent EMPs (Vista Gold 2010/2011).

An archaeological and heritage survey of the existing site will be undertaken.

### ***Potential impacts and mitigation measures***

#### **Culturally significant areas and sacred sites**

Expansion of the mine pit and associated infrastructure has potential to intrude on restricted work areas and there is potential for inadvertent intrusion on sacred sites during construction and operation.

#### **Archaeological sites**

Redevelopment of the mine may impact on sacred sites and/or archaeological sites during:

- ▶ Expansion of the mine pit
- ▶ Development of a new tailing storage facility near Mt Todd
- ▶ Development of other supporting infrastructure
- ▶ Inadvertent interference during construction and operation.

Refer to Table 21.



**Table 21 Aboriginal heritage –potential impacts and mitigation (mine site)**

Impacts on Aboriginal heritage will be significant if :	Impacts	Likelihood	Consequence	Risk	Mitigation	Residual Risk
A culturally significant place is disturbed	A sacred site (registered or unregistered) is damaged or destroyed)	Possible	Major	High	<p>Sacred site clearance will be sought through the Jawoyn Association and the AAPA to avoid inadvertent damage to sacred sites</p> <p>Identified areas of sacred site will be avoided and in consultation with traditional custodians, protected as appropriate</p>	Low
An archaeological significant site/item is damaged/destroyed	An archaeological site/item is damaged/destroyed during land clearing, earth works, mining or other by means	Likely	Minor/Major (depending on the site/item)	Moderate/High (depending on the site/item)	<p>The area's archaeological sites will be re-assessed and reviewed to identify sites/items potentially at risk</p> <p>Mitigation procedures will be developed in consultation with Aboriginal custodians, NRETAS and the NT Museum</p> <p>Mitigation may include detailed assessments and descriptions, collection of samples of artefacts and measures to reduce the chance of inadvertent damage to sites/artefacts</p>	Low





### **5.12.2 Limestone quarry**

#### ***Existing environment***

##### **Culturally significant areas and sacred sites**

Information received from the AAPA (7 March 2011) indicates that the area of the proposed exploration lease for limestone includes a number of registered and unregistered sacred sites. These seem to be primarily associated with water courses or elevated areas (Appendix E). Some of the sites have associated restricted work areas.

##### **Archaeological sites**

No archaeological survey has been conducted over the explorations lease.

An archaeological and heritage survey will be undertaken once the quarry location/footprint is determined.

##### ***Potential impacts and mitigation measures***

Potential impacts and mitigation measures are described in Table 22.



**Table 22 Aboriginal heritage – potential impacts and mitigation (limestone quarry site)**

Impacts on Aboriginal heritage will be significant if :	Impacts	Likelihood	Consequence	Risk	Mitigation	Residual Risk
A culturally significant place is disturbed	A sacred site (registered or unregistered) is damaged or destroyed)	Possible	Major	High	<p>The presence of known sacred sites/restricted work areas will be taken into consideration in making the choice of a quarry site</p> <p>Jawoyn or AAPA clearance will be sought so as to avoid damage to sacred sites</p> <p>Identified areas of sacred site will be avoided and in consultation with traditional custodians, protected as appropriate</p>	Low
An archaeological significant site/item is damaged/destroyed	An archaeological site/item is damaged/destroyed during land clearing, earth works, mining or other by means	Likely	Minor/Major (depending on the site/item)	Moderate/High (depending on the site/item)	<p>The area's archaeological sites will be assessed and reviewed to identify sites/items potentially at risk</p> <p>Mitigation procedures will be developed in consultation with Aboriginal custodians, NRETAS and the NT Museum</p> <p>Mitigation may include detailed assessments and descriptions, collection of samples of artefacts and measures to reduce the chance of inadvertent damage to sites/artefacts</p>	Low



## 5.13 Non-indigenous heritage

### 5.13.1 Mt Todd Gold Mine

#### ***Existing environment***

Four non-indigenous heritage sites were located in the mining area (Lance 1991). These were referred to as:

- ▶ H1 – Chinese Furnace (of a design also interpreted as being a baking/roasting oven in other locations)
- ▶ H2 – The Jones Brothers' mine
- ▶ H3 – Overland Telegraph line
- ▶ H4 – The Mt Todd battery (a ten head stamp used to crush ore).

The fates of the heritage items are as follows (Pegasus Gold 1996):

- ▶ H4 was not impacted by the mine's development and has been fenced for protection
- ▶ H3 is located under the water supply dam. Iron poles were recorded, removed and offered to the National Trust
- ▶ H2 as located inside the pit boundary. The machinery was removed and will be relocated to near the associated shaft entrance on completion of mining
- ▶ H1 was not be affected by the mine development.

The Mt Todd Battery was nominated for inclusion in the Register of National Estate (RNE) on 30 May 1995. It is now listed as an "Indicative Place" i.e. no decision was made on the nomination. Items listed on the RNE are not registered heritage items under any Commonwealth or NT Act.

None of the other sites was ever nominated for or listed as heritage under the EPBC Act or the Territory's *Heritage Conservation Act*. None of the four places has formal protection under either Act. The NT government could easily apply protection by imposing an Interim Conservation Order under the *Heritage Conservation Act*.

"Gouldian finch breeding areas" were nominated for heritage under the *Heritage Conservation Act* on 14 June 2001, and the nomination accepted 15 June 2001. The nomination was considered 5 September 2008. The nomination is currently under a process of consultation according to section 24 of the Act. The Minister makes a decision following consultation. The nomination includes the Yinberrie Hills area to the immediate west of the mine pit. The precise location of the nomination is not available.

#### ***Potential impacts and mitigation measures***

The surviving heritage items are unlikely to be impacted by the proposed developments. The proposed Yinberrie Hills Gouldian finch breeding area will be impacted by the pit expansion (section 5.9).

The area of the mine lease will be subject to an archaeological assessment prior to construction. This will confirm or otherwise the absence of non-Aboriginal heritage items from the proposed development area.



### 5.13.2 Limestone quarry

#### ***Existing environment***

No heritage survey has been conducted over the exploration lease for the quarry, or possible access roads and other infrastructure. No site registered under the NT's *Heritage Conservation Act* or the Commonwealth's EPBC Act is known to occur in the lease area.

#### ***Potential impacts and mitigation measures***

The precise locations of the quarry, its access road and associated infrastructure have yet to be determined. Placement of the quarry or associated infrastructure may impact on currently unknown heritage items.

Potential impacts on heritage places/objects:

- ▶ Will be identified from a assessment of archaeological sites in the area and
- ▶ Mitigation procedures developed in consultation with NRETAS and the NT Museum as appropriate should there be impacts, including:
  - Detailed assessments and descriptions of sites where required
  - Removal of objects if required and placed according to directions from NRETAS/National Trust
  - Development of measures to lessen the risk of inadvertent damage during construction and operation if the place/object is not directly impacted.

## 5.14 Social

### 5.14.1 Mt Todd Gold Mine and limestone quarry

#### ***Existing environment***

The area around the Mt Todd Gold Mine is sparsely populated. The nearest town is Katherine, located approximately 42 km south-southeast (56 km by road) from the Mt Todd site.

Reference to the Australian Bureau of Statistics 2006 census data (ABS, 2011) indicates Katherine had a population of 8,194 of which 1,981 (24.2%) were Indigenous persons (comprising Aboriginal and Torres Strait Islander).

In the 2006 census, there were 3,596 private dwellings of which 3,209 (89.2%) were occupied. The median dwelling rental cost was \$130 per week compared to \$190 Australia wide.

The most common occupation for the Katherine region were Technicians and Trade Workers at 20.3% followed by Professionals (15.7%), Community and Personal Service Workers (14.7%), Clerical and Administrative Works (14.0%) and Managers (12.1%).

Media releases and anecdotal evidence suggested there is negative perception of the Mt Todd Gold Mine due to the publicised negative press record regarding environmental impacts related to previous operations. The legacy environmental issues at Mt Todd motivated the NT government initiative to amend the Mining Act to provide for proponents to place 100% security bonds.

Vista Gold has ongoing detailed consultation with the Traditional Owners representative, the Jawoyn Association. This began in 2006 with Vista's assumption of responsibility for the mine site. There is an ongoing agreement between the Jawoyn Association and the company in regards to the mine.



Vista Gold is a member of a NT government consultation group, the Mt Todd Rehabilitation Reference Group. This group includes representatives from NRETAS, DoR, Jawoyn Association, the Minerals Council of Australia, the Environment Centre, Amateur Fisher's Association, Charles Darwin University, Katherine Town Council and community representatives from Pine Creek. Vista was asked to join in 2006 after acquiring the rights to the concession.

#### ***Potential impacts and mitigation measures***

Approximately 10 personnel currently work on the mine site. The operational workforce is anticipated to increase to approximately 300 when the mine becomes operational.

A social impact assessment will be undertaken as part of the EIS. Consultation will be expanded during development of the anticipated EIS.

A community consultation plan and social impact assessment will be conducted during the environmental impact assessment process.

### **5.15 Economics**

#### **5.15.1 Mt Todd Gold Mine and Limestone quarry**

##### ***Existing environment***

The Katherine Economical Profile (Northern Territory Government, 2008) indicates the NT Gross State Product (GSP) in 2007 was \$13,405 billion of which the Katherine economy contributed approximately \$1.1 billion (8%). Mining, government administration, defence, agriculture, forestry and fishing contribute the most to Katherine's economy.

Ongoing care and maintenance of the existing Mt Todd Gold Mine Site was a cost to the NT Government. For the period of agreement between Vista Gold and the NT Government, the Government is not liable for specified agreed associated costs of care and maintenance.

##### ***Potential impacts and mitigation measures***

The mine will provide positive economic stimulus to the Katherine economy. This will be felt directly through employment and purchase of locally supplied goods and indirectly through household consumption spending on goods and services.

The influx of personnel into the Katherine area has the potential to cause local economic inflationary pressure, especially in the housing market.

Once a Mine Management Plan for resumption of mining operations has been submitted and approved, Vista Gold will have an obligation of existing site conditions and will relieve the NT government of care, maintenance and rehabilitation of the Mt Todd Gold Mine site, and their subsequent cost

An economic impact assessment will be undertaken as part of the EIS.





## **5.16 Greenhouse gas emissions**

### **5.16.1 Mt Todd Gold Mine and Limestone quarry**

#### ***Existing environment***

The Department of Climate Change and Energy Efficiency (DCCEE) state the Northern Territory's 2008 greenhouse gas emissions were approximately 16.2 Mt, excluding emissions from Land Use, Land-Use Change and Forestry (LULUFC). When the exclusions for LULUFC are taken into account greenhouse gas emissions are approximately 16.3 Mt (DCCEE, 2010). The principal source of emissions in the NT is Agriculture, predominately the burning of savannas.

Greenhouse gas emissions within the mine area vicinity are largely limited to bush fires.

#### ***Potential impacts and mitigation measures***

The modification and operation of the mine will increase greenhouse gas emissions, predominantly primarily from greenhouse engines, burning of natural gas for power generation and manufacture of lime, and emissions from limestone during manufacture of lime. The greenhouse gases of concern are carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>) and nitrous oxide (N<sub>2</sub>O).

A greenhouse gas emission study will be undertaken as part of the EIS.

## **5.17 Rehabilitation and decommissioning**

Refer to section 3.11 for an overview of rehabilitation and decommissioning of the mine site.

The NT Government acknowledges responsibility to rehabilitate the Mt Todd Gold Mine site. Vista Gold has no rehabilitation obligations for pre-existing environmental conditions until it submits and receives approval of a Mine Management Plan for resumption of mining operations (Vista Gold 2011). This Notice of Intent is submitted to DoR to initiate the environmental permitting process. It does not indicate that Vista Gold wishes to commence mining activity at Mt Todd. The liability and responsibility for rehabilitation of the existing disturbance at Mt Todd will remain with the NT Government until after the environmental permitting process has been concluded i.e, until the approval of a Mine Management Plan.

Closure plans and rehabilitation strategies will be developed to provide ongoing remediation of the site and good environmental stewardship as part of Vista Gold's mining operations.



## 6. Summary

Mt Todd Gold Mine site is a brownfield/disturbed site. The site was mined for gold in the 1990's. Mining ceased around the year 2000. The site remains disturbed, it has not been rehabilitated and environmental concerns such as water management are ongoing.

Vista Gold Australia is proposing to:

- ▶ Re-establish and operate the Mt Todd Gold Mine, located approximately 55km north of Katherine, NT
- ▶ Establish and operate a limestone quarry, approximately 20km west of the mine site and north west of Katherine.

The project is at the prefeasibility stage. Information on some elements of the project development is limited to that normally available from a prefeasibility study at this time of preparation of the NOI.

This NOI is submitted to the DoR for possible referral by the Minister for Primary Industry, Fisheries and Resources to Minister for Environment for assessment under the NT *Environmental Assessment Act 1982*. The Minister for the Environment will determine whether and what form of additional assessment is required i.e. a draft environmental impact statement (EIS) or public environment report (PER). The Minister for the Environment would be responsible for the conduct of any required additional assessment, and the provision of recommendations to the Minister for Primary Industry, Fisheries and Resources.

Key findings of the environmental assessment in the NOI indicate the potential project may:

- ▶ Positively impact on the environmental condition of the site through progressive rehabilitation of existing disturbed areas
- ▶ Reduce potential for adverse impacts on the quality of groundwater in the area by the development of new and rejuvenation of old mining infrastructure, and treatment of waste water to eliminate acidity and reduce metal levels to within acceptable standards
- ▶ Reduce the potential for adverse impacts on the biota and quality of water in the Edith River by the development of new and rejuvenation of old mining infrastructure, and treatment of waste water to eliminate acidity and reduce metal levels to within acceptable standards
- ▶ Reduce the extent of Gouldian finch breeding habitat resulting from expansion of Batman Pit to the west
- ▶ Have negligible impact on noise, air quality and visual amenity
- ▶ Turn the possibly negative community perception of mining and the mine site to positive
- ▶ Relieve the NT government of the care and maintenance and possible rehabilitation costs of the site.



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Appendix A

## Pit and Tailing Storage Facility 1 Stages



## Appendix B

# EPBC Protected Matters Search Tool Report & Flora and Fauna Species List (Mine Site)



## Appendix C

# EPBC Protected Matters Search Tool Report & Flora and Fauna Species List (Limestone Quarry Site)



Appendix D

## AAPA Search Results (Mine Site)





Appendix E

## AAPA Search Results (Limestone Quarry Site)



## GHD

Level 5, 66 Smith Street Darwin NT 0800



GPO Box 351 Darwin NT 0801

T: (08) 8982 0100 F: (08) 8981 1075 E: [drwmail@ghd.com.au](mailto:drwmail@ghd.com.au)

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