

MAUD CREEK GOLD MINE KATHERINE Terrestrial Fauna Assessment

April/May 2007

Final Report

Prepared for
URS Australia/Terra Gold Mining Ltd
June 2007



Project

Maud Creek Gold Project

Terrestrial Fauna April/May 2007

Report Author/s

Paul Barden, Ecological Management Services Pty Ltd

Field Surveys

Ecological Management Services Pty Ltd

Paul Barden, Dr Stan Bellgard

Client

URS Australia/Terra Gold Mining Ltd.

Client Contact

Carrie Doncon, URS Australia, Darwin NT

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PO Box 580

Coolumb Beach QLD 4573

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MAUD CREEK GOLD MINE, KATHERINE

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Final Report

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1. Introduction

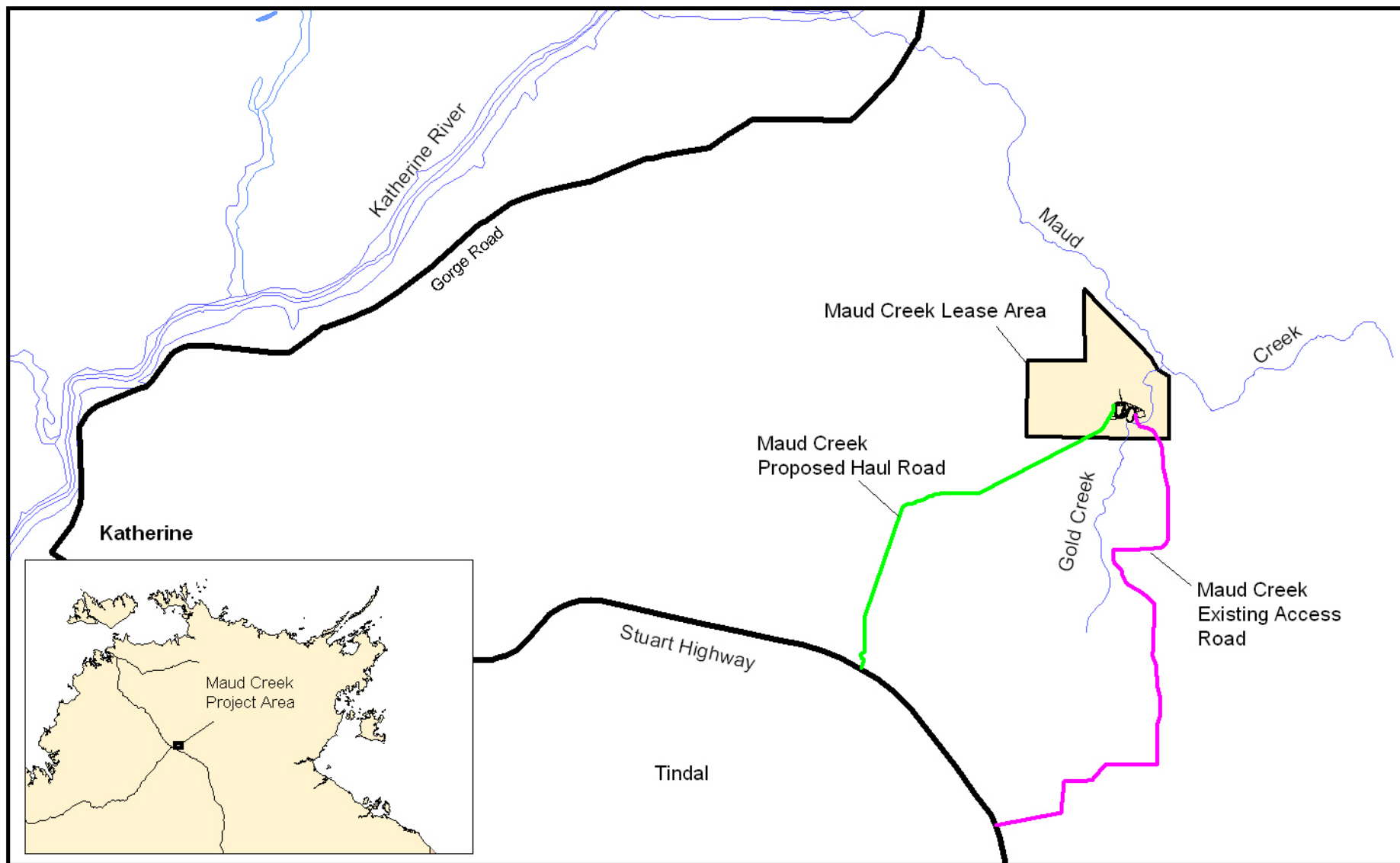
Ecological Management Services Pty Ltd was commissioned by URS Australia Pty Ltd (URS) to prepare a report documenting the terrestrial vertebrate fauna of the Maud Creek Gold Mine area and proposed access routes. The study area is located within the Maud Creek South Station, 275 km south-east of Darwin and 20 km east of Katherine. The main surveys were conducted within two mineral tenements (MLN 1978 and MCN 4219) and along two proposed access routes (Figure 1). The project proposal is documented in URS (2006).

Dry season fauna surveys have been previously conducted for the Environmental Impact Assessment for the Maud Creek project prepared by Dames and Moore Pty Ltd (URS) during September 1994, May 1996 and July 1997 (Martin 1997). A fauna survey of a proposed access route into the site in was also conducted in 1997 (Martin 1997). During August 1998 Dames & Moore conducted a review of extension areas surrounding the original Maud Creek site, however this assessment did not include field surveys (Martin 1998). Results of these surveys are documented in Dames & Moore (1994) and the project EIS (Dames & Moore 1999).

1.1. Objectives and Scope

The objectives of the fauna study were to:

- Review and update existing terrestrial fauna data for the local area and previous fauna assessments conducted within the Maud Creek Gold Mine study area;
- Conduct a survey of the terrestrial fauna of the study area during the run-off period (April – May), to compliment data from previous dry season fauna surveys of the study area: and
- Provide an assessment of feral animals and vertebrate pest species.



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Plan Note:
Base mapping provided by URS Australia

Project:
Maud Creek Gold Project
Terrestrial Fauna Survey 2007

Title:
Study Area Location

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Figure 1

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2. Methodology

2.1. Study area

In this report the “lease area” refers to MLN 1978 and MCN 4219 and the “study area” refers to the lease areas and two proposed access route options (Figure 1). Two proposed access routes linking the lease area and the Stuart Highway were assessed. One of the proposed access routes follows the existing access road to the south of the lease area with minor deviations and is referred to as the “existing access road” (EA in tables). The second proposed access route links the lease area and the Stuart Highway to the south-west, and is referred to as the “proposed haul road” (NA in tables).

2.2. Field Survey Methods

The fauna survey of the study area was undertaken between 28 April and 13 May 2007. Six survey sites were systematically sampled. Additional fauna survey methods were applied along the two proposed access routes identified by URS/GBS Gold and general observations from the study area were also compiled. Standard biological survey techniques were used during field surveys, including a number of live capture/release trapping techniques, standard and general observational (birds and mammals) and habitat searches (reptiles, amphibians and invertebrates), as well as methods to indirectly detect the presence of terrestrial fauna. The survey focussed on terrestrial vertebrate taxa, however searches for terrestrial snails were conducted in limestone outcrops on the access routes. Terrestrial snails were targeted due to the presence of at least one threatened species listed in NT threatened species legislation (*Setobaudinia victoriana*) in limestone habitats in the Katherine region. Fauna surveys were conducted under NT Parks and Wildlife Permit No. 26144 and CDU Animal Ethics Clearance No. A06026

The survey was based on a linear transect method designed to maximise the number of species recorded. The number and type of traps generally conforms with or exceeds the minimum effort used for each site as specified by the NT Government Biodiversity Unit fauna survey methodology (DIPE 2002) and includes a number of additional sampling methods (eg hair funnels, call playback, remote overnight ultrasonic bat detection).

Table 2-1 provides a summary of the standard methods and survey effort undertaken for this study. A detailed description of the survey methods is included in section 2.3 and 2.4.

Table 2.1 Summary of Survey Effort

	Survey Method	Survey Effort Per Site	No of Sites	Total Effort
Standard Sites	Ground Mammal Elliott Trapping Type A	20 traps x 3 nights	6	360 trap nights
	Ground Mammal Elliott Trapping Type B	2 traps x 3 nights	6	36 trap nights
	Wire Cage Traps	2 traps x 3 nights	6	36 trap nights
	Pitfall Trapping	4 x buckets + drift fences x 4 nights	6	96 PF trap nights
	Hair Funnels (1 - 13 May)	5 funnels (3 tree, 2 ground) x 12 nights	6	360 funnel nights
	Diurnal Bird Counts	5 x 20 minute counts (1hour 40 mins)	6	10 hours
	Diurnal Searches	3 x 20 minute searches (1hour)	6	6 hours
	Spotlight Survey	1 person hour	6	6 hours
	Nocturnal Call Play Back	1 x ~1 hour call playback session	6	6 hours
	Ultrasonic Microbat Detection	1 overnight remote detection	6	69 hours
	Additional Ultrasonic Microbat Detection	1 overnight remote detection (Pit + diversion)	3	34.5 hours
	Nocturnal Searches	3 x 20 minute searches (1hour)	6	6 hours
Access Route Corridors	Hair Funnels (Access) 10 - 13 May	10 funnels x 3 nights (30 nights)	2 Options	60 funnel nights
	Diurnal Bird Counts (Access)	10 x 20 minute counts (3 hours 20 mins)	2 Options	6 hours 40 mins
	Diurnal Searches (Access)	3 x 20 minute searches (1 hour)	2 Options	2 hours
	Nocturnal Searches (Access)	3 x 20 minute searches (1 hour)	2 Options	2 hours
	Nocturnal Call Play Back (Access)	3 x 20min call playback sessions (1 hour)	2 Options	2 hours
	Spotlight Survey (Access)	3 x 20 minute surveys (1 hour)	2 Options	2 hours
	Spotlighting Driven Transect (Access)	3 x 20 minute driven spotlight transects (quad bike + 4wd) (1 hour)	2 Options	2 hours vehicle spotlighting
	Ultrasonic Microbat Detection (Access)	3 x overnight remote detection sites	2 Options	69 hours
Non-standard Methods	Red Goshawk Survey: Additional bird survey + raptor nest searches/CPB x borrow pit/diversion/existing pit areas	10 x 20 minute counts/Raptor nest searches/Call Play Back	3 Areas	3 hours 20 mins (counts) 6 person hours (searches)
	Bat Roost Searches	Targeted survey at potential bat roost sites on access routes + 1 night remote bat call detection at limestone sink		Opportunistic + 11.5 hours Anabat
	Harp trapping	20 harp trap nights at 4 sites		Total 20 trap nights
	Vehicle spotlighting	No standard effort		Opportunistic
	Predator and non-predator scat collection	No standard effort		Opportunistic
	Assessment of animal tracks, scats + signs	No standard effort		Opportunistic
	Incidental fauna observations	No standard effort		Opportunistic

2.3. Standard Methods Used at Systematic Sites & Access Routes

At each standard systematic survey site, the following standard methods were conducted:

Elliott Trapping for Small Mammals

At each systematic site 22 traps (20 Elliott 'A' type & 2 Elliott 'B' type) were set approximately eight metres apart along a 200 m transect. Traps were baited with a peanut butter and oat mixture and left open for three nights. Traps were cleared early each morning and trapped animals were temporarily marked so that recaptures could be identified.

Wire Cage Trapping

At each systematic site, two wire cage traps were set along a 200 m transect. Traps were baited with apple/sweet potato and chicken wings and left open for three nights. Traps were checked early each morning and late afternoon.

Pitfall Trapping

Pitfall traps were used to capture frog, reptile and small mammal species that are cryptic and difficult to detect, such as burrowing frogs and fossorial skinks. Pitfall traps were used at six systematic sites. Two pitfall systems consisting of one 15 litre bucket and one 20 litre bucket, with a 10 m drift fence for each pitfall line were set at the six systematic sites. Pitfall lines were left open for four nights, and were checked early each morning and late afternoon/early evening for captures, which were identified and released.

Hair Funnels for Small to Medium-sized Mammals

Two ground and three tree based hair funnels (Faunatech) were set approximately 40 m apart along a 200 metre transect at six systematic sites. The funnels were baited with a honey, peanut butter and oat mixture and left on site for 12 nights. All hair samples obtained were sent to B. Triggs, Victoria, for analysis. Samples were identified and classified into the reliability categories, definite and probable.

The proposed access routes were sampled with five ground and five tree based hair funnels spaced along each proposed alignment. The funnels were left on-site for 3 nights (30 hair funnel nights per proposed access route).

Diurnal Bird Counts

Five 20-minute/2 hectare timed area (1 hour 40 mins per site) diurnal bird counts were undertaken at each systematic site within representative habitat (total 10 hours). Timed/area searches involved walking through a habitat area for 20 minutes actively pursuing calling birds and recording all bird species seen or heard within the broad habitat type. Bird counts were conducted between dawn and 0900 hours, with a minimum of one additional count in the late morning or late afternoon at each site. Birds observed incidentally during time spent within habitats or sites were recorded as incidental records.

The proposed access routes were sampled with ten 20-minute/2 hectare timed area counts spaced along each proposed alignment (total 3 hrs 20 mins per proposed access route). Birds observed opportunistically while travelling along each proposed access route were also recorded as incidental records.

Diurnal Searches

An active diurnal search was conducted at each systematic site for one person-hour (3 x 20 minute searches). Active searching involved recording all individuals (small mammals, reptiles, amphibians) found active or sheltering underneath or within fallen woody debris, rocks, litter and peeling bark. Frogs heard calling during the search were also recorded. Active searches were undertaken between 0830 and 1400 hours when reptiles were active.

Active diurnal searches were undertaken at three locations on each proposed access route (3 x 20 minute searches for a total of one diurnal search hour per proposed access route). Sites were selected to sample specific habitat features (eg water-bodies, limestone outcrops).

Nocturnal Searches

An active nocturnal search was undertaken at each systematic site for one person-hour (3 x 20 minute searches). Active searches involved the use of headlamps and low watt spotlights, and recording all individuals (small mammals, reptiles, amphibians) found active on the ground or up trees, or underneath fallen debris, rocks, litter and peeling bark. Frogs heard calling at each site were also recorded during this time.

Active nocturnal searches were undertaken at three locations on each proposed access route (3 x 20 minute searches for a total of one diurnal search hour per proposed access route). Sites were selected to sample specific habitat features (eg water-bodies, limestone outcrops).

Nocturnal Call Play Back

One nocturnal call playback session was conducted at each systematic survey site. Calls were broadcast remotely from a centre-point, while observers conducted spotlighting and listened for responses in the surrounding habitat. Each call playback session involved an initial 10-minute listening period, recording any calls from arboreal mammals and nocturnal birds. The initial listening period was followed by the broadcasting of pre-recorded calls of the sugar glider (*Petaurus breviceps*) and the following birds; barking owl (*Ninox connivens*), rufous owl (*Ninox rufa*), southern boobook (*Ninox novaeseelandiae*), barn owl (*Tyto alba*), masked owl (*Tyto novaehollandiae*), grass owl (*Tyto capensis*), Australian owllet-nightjar (*Aegotheles cristatus*) and spotted nightjar (*Eurostopodus mystacalis*). Each call was played for three minutes, followed by a two-minute listening period. After the calls were played, each observer scanned the immediate area by spotlight for five minutes.

Nocturnal call playback sessions were repeated at three sites on each of the two proposed access route options (20 minutes per location for a total of one hour call playback per proposed access route option).

Spotlighting

A spotlighting census involved an observer within the study area with a 50-Watt spotlight for one person-hour per site at six sites (6 spotlight hours).

Spotlight searches were undertaken at three locations on each proposed access route (3 x 20 minute spotlight searches for a total of one spotlight search hour per proposed access route). Sites were selected to sample specific habitat features (eg water-bodies, limestone outcrops).

Ultrasonic Microbat Call Detection

Ultrasonic microbat call detection was used to sample microchiropteran bats. The ultrasonic detection was conducted at each systematic site for one night of remote sampling using Anabat CF ZCAIM systems commencing at dusk with effective sampling for approximately 11.5 hours per night. Additional incidental hand held recordings were collected during the spotlight survey period at each site. Recorded calls were analysed by Paul Barden, Ecological Management Services (refer to Appendix 1).

Overnight remote sampling was also conducted at three sites on each proposed access route (total 69 remote survey hours).

2.4. Non-standard Methods

Red Goshawk Searches

Specific searches for the red goshawk were conducted to incorporate the proposed borrow pit area, Gold Creek in the vicinity of the proposed mine area and the proposed access route south-east of the existing borrow pit. The searches included additional timed area searches for birds focussing on raptors (10 x 20 minute/2 hectare counts), specific searches for raptor nest sites (6 person hours), call playback broadcasting red goshawk calls within these areas and general observations during time spent within these areas.

Microbat Roost Searches

Opportunistic searches of potential microbat roost searches were conducted at limestone outcrop sites in areas adjacent to proposed access route options. One additional remote Anabat detection night was conducted at a limestone sinkhole adjacent to the proposed access route at site 6. Suitable bat roost sites (caves or sinkholes) were not identified in the main lease areas.

Harp Trapping for Microbats

Harp traps were used to capture low flying microchiropteran bats. Where possible, harp traps were set on systematic sites. However harp trapping was not undertaken at some sites due to an absence of suitable flyways or trapping sites. Harp trapping was undertaken at sites 1, 3, 5 and 6 and in the vicinity of limestone sink holes on the proposed access route to the south-west of the main lease area.

Vehicle Spotlighting

Vehicle spotlighting was conducted along tracks in the study area and while driving between survey sites at night.

Predator Scat Search

Predator scats found at sites and in the general study area were collected for identification through analysis of grooming hairs by B. Triggs. The analysis included identification of prey items. Scat samples were classified as definite or probable depending upon the reliability of the identification.

Non-Predator Scat Collection, Tracks & Signs

Searches were conducted for non-predator scats. Scats collected within the study area were collected for identification through analysis of grooming hairs by B. Triggs. Tracks and other signs noted during the survey were inspected and identified where possible.

2.5. Existing Data Review

Existing data on fauna of the Maud Creek study area was obtained from a number of sources (Appendix 2).

These included:

- Fauna records held in the NRETA wildlife database (co-ordinate search TL 14.328725°S /132.284643° E; BR 14.687182° S/ 132.723573° E, NRETA 2007);
- Dry season terrestrial fauna surveys of the Maud Creek Gold Mine study area (Dames & Moore 1999).
- An EPBC Act protected matters report with a centre-point located on the study area (DEWR 2007a);
- Fauna species list for the Nitmiluk National Park management area (Parks & Wildlife Commission of the Northern Territory 2002) and Cutta Cutta Caves Nature Park management area (Parks & Wildlife Commission of the Northern Territory 2000);
- Birds Australia Bird Data database search (10 minute grid cell containing -14.49355°S, 132.4143°E).

Critically Endangered, Endangered and Vulnerable species that are listed in databases and reports reviewed for this project and considered to potentially occur in the vicinity of the study area and surrounding areas (based on known habitat and distribution) are listed in Table 2.2.

Table 2.2 Critically endangered, Endangered & Vulnerable Fauna Species: Existing Local & Regional Records

Scientific/Common Name	EPBC Act 1999	TPWC Act 2000	Data Source	Potential Habitat
Red Goshawk <i>Erythrorchis radiatus</i>	V	V	EPBC Protected Matters Report (5km buffer) Nitmiluk NP	Riverine forest, open forest and woodlands
Australian Bustard <i>Ardeotis australis</i>		V	Nitmiluk NP Birds Australia Bird Data	Open grassland and grassy woodlands
Partridge Pigeon <i>Geophaps smithii</i>	V	V	Nitmiluk NP	Eucalypt forest and woodland with grassy understorey
Northern Shrike-tit <i>Falcunculus frontatus whitei</i>	V	V	EPBC Protected Matters Report (5km buffer) Nitmiluk NP Birds Australia Bird Data	Eucalypt forests and woodlands
Gouldian Finch <i>Erythrura gouldiae</i>	E	E	Nitmiluk NP Birds Australia Bird Data	Wooded hills and lowland grassy woodlands
Northern Quoll <i>Dasyurus hallucatus</i>	E	CE	Cutta Cutta Caves NP Nitmiluk NP	Open forest and woodlands
Yellow-spotted Monitor <i>Varanus panoptes</i>		V	Nitmiluk NP	Open forests and woodlands, grasslands, floodplains
Merten's Water Monitor <i>Varanus mertensi</i>		V	Dames & Moore (1999) Nitmiluk NP	Riverine/riparian habitats
Victoria's Land Snail <i>Setobaudinia victoriana</i>		V	Wilson <i>et al.</i> 2006	Open eucalyptus woodland, limestone boulders and sinkholes west of Katherine

Fauna recorded for Nitmiluk National Park includes 25 amphibian, 78 reptile, 206 bird and 44 mammal (including 10 introduced) species (Parks & Wildlife Commission of the Northern Territory 2002). Fauna recorded for Cutta Cutta Caves Nature Park includes 11 amphibian, 29 reptile, 78 bird and 18 mammal (including 4 introduced) species (Parks & Wildlife Commission of the Northern Territory 2000). Due to the type of habitat and vegetation present and its proximity to the study area the fauna of the Cutta Cutta Nature Park is likely to be more representative of that occurring within the Maud Creek study area.

2.6. Site Selection and Habitats

The vegetation of the study area is described in a separate flora report (URS in prep). At the time of the fauna survey the revised (2007) vegetation mapping was not available. Consequently, terrestrial fauna habitats and survey sites within the study area were selected following consultation with URS Australia, and consideration of previous vegetation mapping (URS 2006), site inspections and the location proposed impact areas provided at the time of the field survey (URS Australia). Other factors that influence the distribution of fauna were considered when selecting sites, including sampling a representation of the habitats present and sampling specific habitat features (eg drainage lines, limestone outcrops).

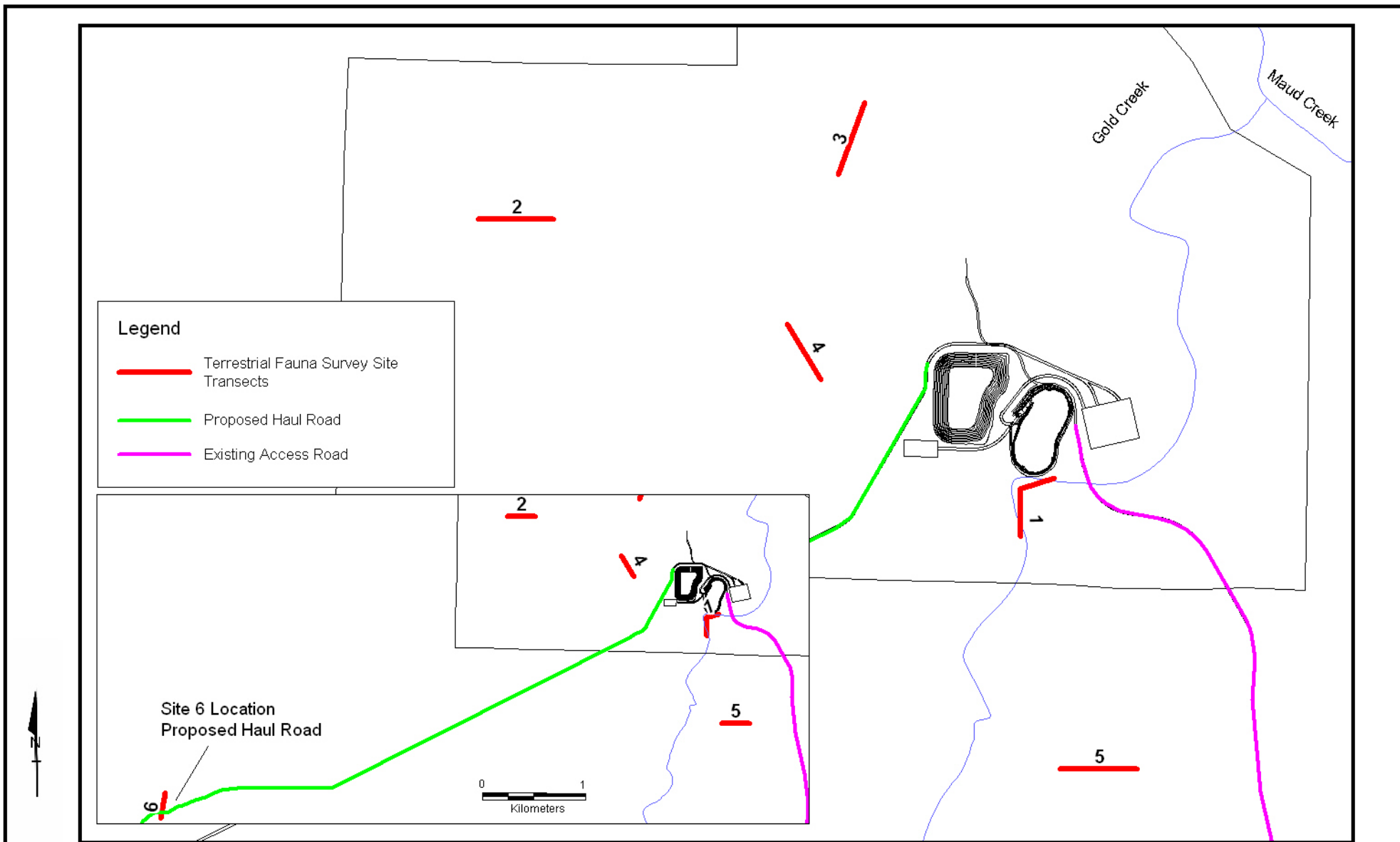
Habitats within the study area are dominated by a variety of open woodland, grassland and riparian vegetation types. The main habitats within the lease areas are *Eucalyptus foelscheana*/*E. tectifica* mid-high

open woodland and *Eucalyptus pruinosa*/*Erythrophleum chlorostachys* low open woodland. Significant areas of open grassland with occasional *Terminalia platyphylla* occur in the central lease area. Riparian vegetation characterised by *Lophostemon grandiflorus*, *Melaleuca spp*, *Terminalia platyphylla* and *Pandanus spiralis* occurs in narrow bands along the major drainage lines. Habitats occurring along the road access routes were generally similar to those found around the lease area with the exception of the limestone karst formations that occur to the west of the leases. Fauna sampling sites selected for the road route survey were the same as those for the vegetation survey. An additional distinctive habitat type occurs to the east of Maud Creek in the form of the dissected Kombolgie Sandstone ranges. While this area is likely to support most of the sandstone specialist fauna occurring in Nitmiluk National Park, none of this habitat occurs within the study area.

Six systematic sample sites were selected to sample the main habitats within the study area (Figure 2, Appendix 3). Site habitat data is presented in Appendix 3. Within the lease area sites were selected within the southern part of MLN 1978 and MCN 4219 in the vicinity of proposed mine areas and infrastructure placement, including the pit (existing), ore stockpile pad (existing, with regrowth) and proposed borrow pit. One of the systematic sites (S6) was located in limestone outcrop habitat on the proposed access route. Limestone outcrop and pavement limestone habitats are not present within the main lease area, but occur at sites to the east of the main study area and adjacent to both the existing and proposed access routes. A variety of fauna survey methods (bird counts, diurnal and nocturnal searches, Anabat detection, driven transects, spotlight searches, call playback and hair funnels) were used at sites dispersed along each of the two proposed access routes.

2.7. Seasonality & Climatic Conditions

Previous surveys of the Maud Creek study area were undertaken during seasonally dry conditions, with no surface water present in terrestrial habitats and surface water in Gold Creek limited to a few small pools (K. Martin pers comm.). During these surveys surface water was largely restricted to larger water holes on Maud Creek (K. Martin pers comm., Martin 1997). During the current survey, surface water was present in open woodland habitats in low-lying areas, dams, buffalo wallows and Gold Creek supported flowing water throughout its length within the study area. Relative humidity was at or above the Katherine wet season 9 am mean during the early component of the survey (eg the 9am relative humidity was equal to or greater than 72% on the 30th April, 5th, 12th and 13th of May 2007). Climatic conditions, moon and sunrise and moon phases encountered during the survey period are detailed in Appendix 4.



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Plan Note:
Base mapping provided by URS Australia
Site locations are approximate only.

Project:
Maud Creek Gold Project
Terrestrial Fauna Survey 2007

Title:
Terrestrial Fauna Survey
Transects

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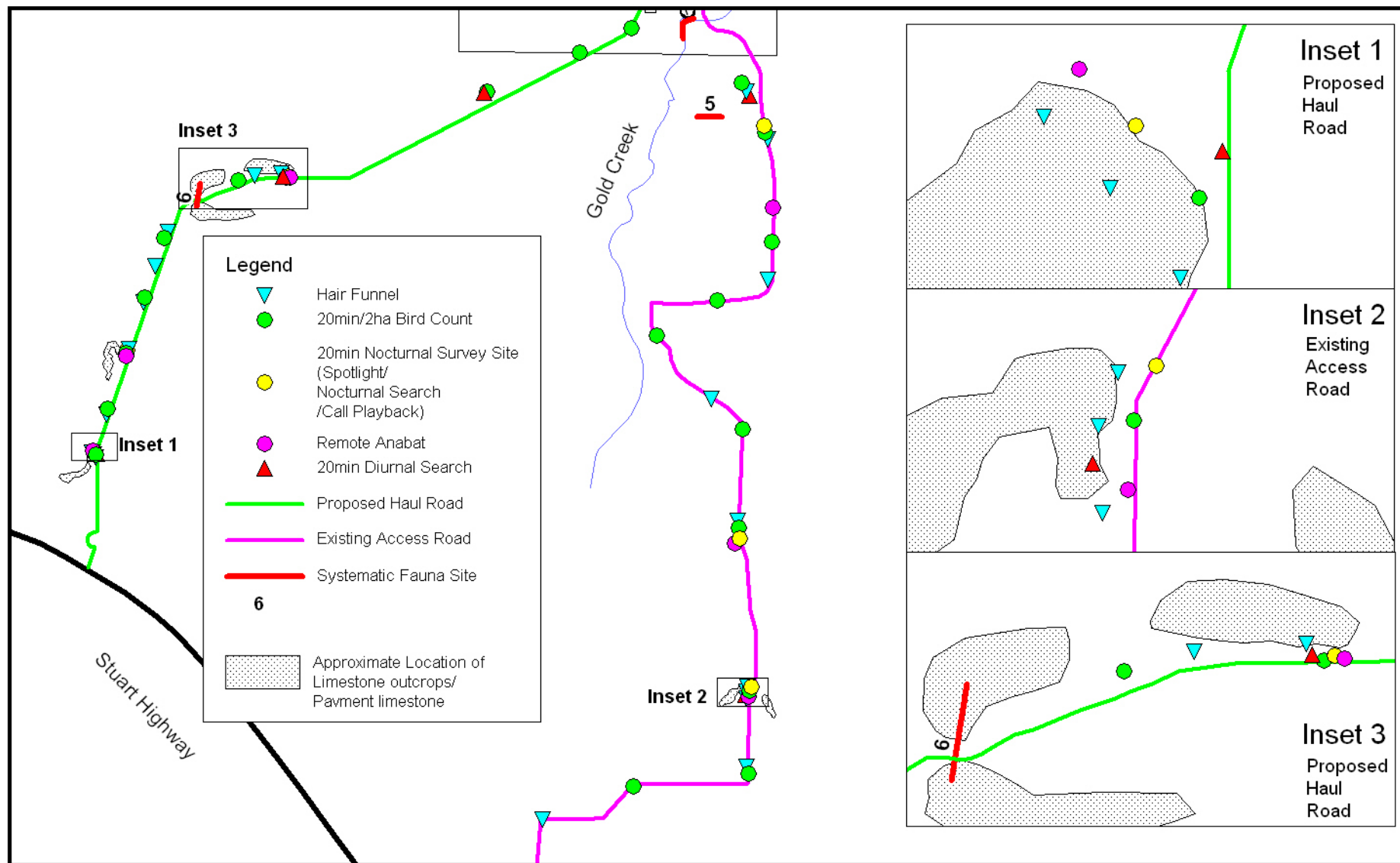
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Figure 2

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Plan Note:
Base mapping provided by URS Australia.
Locations of limestone karst areas & sites are
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Terrestrial Fauna Survey Existing Access Road & Proposed Haul Road

Figure 3

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3. Fauna Survey Results

A total of 144 native terrestrial vertebrate species were recorded during the survey, including 11 amphibian, 18 reptile, 91 bird and 24 mammal species (Appendix 5). This compares with a total of 94 native vertebrate species (5 amphibian, 12 reptile, 71 bird and 6 mammal species) recorded during the three previous dry season surveys conducted in 1994, 1996 and 1997 (URS 2006). Six introduced species were recorded within the study area.

3.1. Amphibians

Eleven native and one introduced amphibian species were observed within the study area (Table 3-1; Appendix 5). Amphibian species were generally associated with wetter microhabitats within the areas sampled, particularly along Gold Creek. However a number of native amphibian species, including the ornate burrowing frog (*Limnodynastes ornatus*), giant frog (*Cyclorana australis*) (Plate 1, Appendix 6), Roth's tree frog (*Litoria rothii*) and stonemason toadlet (*Uperoleia lithomoda*), were observed in open woodland habitats in the vicinity of dams and ponded surface water. Larvae of *Limnodynastes ornatus* were present in a swamp buffalo wallow in the western part of the lease area.

The riparian habitats along Gold Creek and Maud Creek supported the highest amphibian species diversity and abundance within the study area. Maud Creek and the lower reaches of Gold Creek supported high numbers of the rockhole frog (*Litoria meiriana*). Other common species in riparian habitat within the lease area included the bumpy rocket-frog (*Litoria inermis*), bilingual frog (*Crinia bilinguala*) and Roth's tree frog (*Litoria rothii*). This contrasts with previous dry season surveys, where no amphibians were observed along Gold Creek (Martin 1997).

The native amphibians recorded within the study area are generally common in northern Australia and all species are previously known from national parks in the region (PWCNT 2002; 2000). The arrival of the cane toad (*Bufo marinus*) in the local area in 2001 is a significant addition to the amphibian fauna. This species was not present during earlier surveys. However the cane toad was the most abundant and widespread amphibian during the 2007 sampling period, with up to 50 adults being observed in a single 20-minute nocturnal search at one site. The cane toad was the only amphibian species captured in traps (18 individuals in pitfall and Elliott traps). Numbers of cane toads were highest in the vicinity of standing water, however this species was also common in dry terrestrial habitats and along proposed access roads.

Table 3-1 Amphibians

Common Name	Scientific Name	S1	S2	S3	S4	S5	S6	EA	NA	Pit	Total
Stonemason Toadlet	<i>Uperoleia lithomoda</i>		+							+	-
Ornate Burrowing Frog	<i>Limnodynastes ornatus</i>		+								-
Bilingual Froglet	<i>Crinia bilingual</i>	0.33								+	0.04
Giant Frog	<i>Cyclorana australis</i>							0.33			0.04
Peter's Frog	<i>Litoria inermis</i>	3.67	0.17							+	0.47
Rockhole Frog	<i>Litoria meiriana</i>	+									-
Rocket Frog	<i>Litoria nasuta</i>	0.17									0.02
Roth's Tree Frog	<i>Litoria rothii</i>	0.17		0.17						+	0.04
Desert Tree Frog	<i>Litoria rubella</i>	0.17									0.02
Tornier's Frog	<i>Litoria tornieri</i>	0.33		0.17							0.06
Wotjulum Frog	<i>Litoria wotjulumensis</i>	0.67									0.08
Cane Toad*	<i>Bufo marinus</i>	2.17	10.67	4.17	+	0.17	+	2.5	+	+	2.41
Total Species	12	9	4	3	1	1	1	2	1	5	

+ = Incidental observation at site; Numbers in columns = mean no of amphibians observed/collected/heard during timed nocturnal/diurnal searches (6 x 20 minute searches per site); * = Exotic species; EA = Existing proposed access route; NA = new proposed access route; Pit = observations from the existing mine pit area and surrounds.

3.2. Reptiles

Eighteen reptile species were identified within the study area (Table 3-2, Appendix 5). Pitfall traps captured six reptile species, including the robust ctenotus (*Ctenotus robustus*), shaded-litter rainbow skink (*Carlia munda*) yellow-sided two-lined dragon (*Diporiphora magna*), Gilbert's dragon (*Lophognathus gilberti*), two-lined dragon (*Diporiphora bilineata*) and slender rainbow skink (*Carlia gracilis*). Most reptiles were recorded during active diurnal and nocturnal reptile searches of habitats and opportunistically during the course of the trapping and bird census surveys. The most commonly encountered and widespread species were the arboreal snake-eyed skink (*Cryptoblepharus plagiocephalus*), Northern dtella (*Gehyra australis*), robust ctenotus (*Ctenotus robustus*) and two-lined dragon (*Diporiphora bilineata*). Three snake species were recorded, including the children's python (*Antaresia childreni*), carpet python (*Morelia spilota*) and the common tree snake (*Dendrelaphis punctulatus*). Martin (1997) reported an additional elapid snake species (*Demansia* sp.) for the study area.

The limestone outcrop areas in the vicinity of the proposed access route options are the most significant habitat for reptiles in the project. Limestone outcrops generally supported higher abundances and numbers of species of reptiles than open woodland habitats without limestone. Limestone outcrops supported a number of species that were more common or restricted to these limestone habitats, including the northern spotted rock dtella (*Gehyra nana*), marbled velvet gecko (*Oedura marmorata*) (Plate 2, Appendix 6), Bynoe's gecko (*Heteronotia binoei*) and three-spined rainbow-skink (*Carlia triacantha*). Riparian habitats on Gold Creek supported a number of reptile species that are more abundant in moist habitats, including Gilbert's dragon (*Lophognathus gilberti*) and the slender rainbow-skink (*Carlia gracilis*). The habitats on Gold Creek appear to be unsuitable for freshwater crocodiles and freshwater turtles, however these species are present in suitable habitats on Maud Creek and could enter the study area at times (Martin 1997).

The reptile species recorded within the study area are generally common in northern Australia and all species recorded are previously known from local conservation areas (PWCNT 2002; 2000). It is notable that previous surveys within the study area recorded three varanid species, including Merten's water monitor (*Varanus mertensi*), Gould's monitor (*Varanus gouldii*) and Northern Ridge-tailed Monitor (*Varanus baritji*) (Dames & Moore 1999). These species were not observed during the current survey and it is possible that local populations of varanids may have been impacted by the relatively recent arrival of cane toads in the region.

Table 3-2 Reptiles

Common Name	Scientific Name	S1	S2	S3	S4	S5	S6	EA	NA	Total
Spiny-tailed Gecko	<i>Strophurus ciliaris</i>						0.17			0.02
Northern Dtella	<i>Gehyra australis</i>		0.17		+	0.5	0.17	0.17	0.14	0.14
Northern Spotted Rock Dtella	<i>Gehyra nana</i>						0.83		0.43	0.16
Bynoe's Gecko	<i>Heteronotia binoei</i>						1.17	0.33	0.43	0.24
Marbled Velvet Gecko	<i>Oedura marmorata</i>								0.29	0.04
Burton's Legless Lizard	<i>Lialis burtonis</i>						+			-
Two-lined Dragon	<i>Diporiphora bilineata</i>		0.33	0.33	0.17	0.17	0.5	0.33	0.14	0.24
Yellow-sided Two-line Dragon	<i>Diporiphora magna</i>		0.17				0.17			0.04
Gilbert's Lashtail	<i>Lophognathus gilberti</i>	0.33	0.17			0.17	0.33			0.12
Slender Rainbow-skink	<i>Carlia gracilis</i>	0.17								0.02
Shaded-litter Rainbow-skink	<i>Carlia munda</i>			+		0.33			1.14	0.2
Red-sided Rainbow-skink	<i>Carlia rufilatus</i>	0.17								0.02
Three-Spined Rainbow-skink	<i>Carlia triacantha</i>						0.5	0.17	0.43	0.14
Callose-palmed Shinning-skink	<i>Cryptoblepharus plagiocephalus</i>	+	0.17	0.17	0.17	0.33		0.33	0.14	0.16
Bar-shouldered Ctenotus	<i>Ctenotus inornatus</i>				0.33		0.17	0.17		0.08
Robust Ctenotus	<i>Ctenotus robustus</i>	0.17	0.33	0.17	0.17			0.17		0.12
Children's Python	<i>Antaresia childreni</i>						+	0.33		0.04
Common Tree Snake	<i>Dendrelaphis punctulatus</i>	0.33								0.04
Total Species	18	6	6	4	5	5	11	8	8	

+ = Incidental observation at site; Numbers in columns = mean no of reptiles observed/heard during timed nocturnal/diurnal searches (6 x 20 minute searches per site); EA = Existing proposed access route; NA = new proposed access route.

3.3. Birds

Ninety-one bird species were observed within the study area during the survey period (Table 3-3; Appendix 5). Of these, 84 species were recorded during the timed diurnal and nocturnal census counts, while the additional species were observed opportunistically throughout the study area. This compares with a total of 71 species recorded during the 1994, 1996 and 1997 surveys of the lease and a single access route (Martin 1997).

The most frequently recorded and widespread species (greater than 40% of counts and 100% of survey sites, in order of frequency of observations) were the peaceful dove (*Geopelia striata*), pied butcherbird (*Cracticus nigrogularis*), rufous whistler (*Pachycephala rufiventris*), rainbow bee-eater (*Merops ornatus*), red-winged parrot (*Aprosmictus erythropterus*), bar-shouldered dove (*Geopelia humeralis*), willie wagtail

(*Rhipidura leucophrys*), black-faced cuckoo-shrike (*Coracina novaehollandiae*), red-collared lorikeet (*Trichoglossus rubritorquis*) and brown honeyeater (*Lichmera indistincta*). Uncommon species (recorded from single observations) were the red goshawk (*Erythrorchis radiatus*), black-tailed treecreeper (*Climacteris melanura*), lemon-bellied flycatcher (*Microeca flavigaster*), diamond dove (*Geopelia cuneata*) and singing honeyeater (*Lichenostomus virescens*).

Riparian forest on Gold Creek and areas adjacent to the existing pit were the most species rich habitats for birds within the lease area during the survey period (Table 3-3). A number of waterbirds and small passerine species were restricted to these habitats. Waterbirds were generally uncommon along Gold Creek and within the wider study area, and a greater variety of species were present on Maud Creek. 10 x 20min/2ha surveys yielded 55 species on the existing proposed access and 40 species on the new proposed access route (Table 3-3). Limestone outcrops generally supported a higher diversity of bird species than other habitats present on the access route alignments, partly due to the presence vine thicket canopy species including fig trees.

Five nocturnal bird species were recorded within the study area: the southern boobook (*Ninox novaeseelandiae*), barking owl (*Ninox connivens*), Australian owl nightjar (*Aegotheles cristatus*), spotted nightjar (*Eurostopodus argus*) and tawny frogmouth (*Podargus strigoides*). The barking owl, southern boobook and spotted nightjar were recorded vocalising in response to call playback. The southern boobook was the most common and widespread nocturnal bird species.

The majority of the bird species recorded within the study area are typical woodland species that are widely distributed in the Northern Territory. One species recorded during the survey, the red goshawk (*Erythrorchis radiatus*), is listed as *vulnerable* in the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act 1999).

A number of the bird species recorded within the study area are listed in the *Territory Parks and Wildlife Conservation Act 2000* (TPWCA 2000), including the Australian bustard (*Ardeotis australis*) (*vulnerable*) (Plate 3, Appendix 6), bush stone-curlew (*Burhinus grallarius*) (*near threatened*) and hooded parrot (*Psephotus dissimilis*) (*near threatened*). An additional *near threatened* species, the grey falcon (*Falco hypoleucos*), was observed on Maud Creek adjacent to the study area.

Table 3-3 Birds

Common Name	Scientific Name	S1	S2	S3	S4	S5	S6	EA	NA	PIT	Total
Pacific Black Duck	<i>Anas superciliosa</i>									1	0.08
Australasian Grebe	<i>Tachybaptus novaehollandiae</i>									0.6	0.05
White-necked Heron	<i>Egretta novaehollandiae</i>	+								0.2	0.02
White-faced Heron	<i>Ardea pacifica</i>	+								0.8	0.07
Black Kite	<i>Milvus migrans</i>	+		0.4		0.2		0.3		0.2	0.13
Whistling Kite	<i>Haliastur sphenurus</i>	+									-
Spotted Harrier	<i>Circus assimilis</i>			+							-
Red Goshawk	<i>Erythrorhynchus radiatus</i>					+					-
Brown Goshawk	<i>Accipiter fasciatus</i>	+				0.1	0.4		0.3	0.2	0.12
Collared Sparrowhawk	<i>Accipiter cirrhocephalus</i>								0.1		0.02
Australian Hobby	<i>Falco longipennis</i>	0.2				0.1		0.1		0.4	0.08
Brown Falcon	<i>Falco berigora</i>			0.4	0.2				0.1		0.07
Black Falcon	<i>Falco subniger</i>				0.2					0.2	0.03
Australian Bustard	<i>Ardeotis australis</i>			0.4	0.8			0.2	0.2	0.4	0.2
Red-backed Button-quail	<i>Turnix maculosa</i>				+	0.6	0.8				0.17
Bush Stone-curlew	<i>Burhinus grallarius</i>		+	+	+			+			-
Australian Pratincole	<i>Stiltia isabella</i>									0.4	0.03
Common Bronzewing	<i>Phaps chalcoptera</i>	0.4	0.2	0.6	0.4			0.3			0.18
Crested Pigeon	<i>Ocyphaps lophotes</i>	+	0.4	0.2	0.8						0.12
Diamond Dove	<i>Geopelia cuneata</i>	+								0.2	0.02
Peaceful Dove	<i>Geopelia striata</i>	2.4	1	2.2	0.8	2.2	1.4	1.5	1.4	1.2	1.6
Bar-shouldered Dove	<i>Geopelia humeralis</i>	1.6	0.4	1.2	0.4	0.1	1	0.6	0.5	0.4	0.62
Red-tailed Black-Cockatoo	<i>Calyptorhynchus banksii</i>			0.6	0.4	0.6		0.3		0.2	0.25
Galah	<i>Eolophus roseicapilla</i>			0.4	0.6			0.3	0.1		0.15
Little Corella	<i>Cacatua sanguinea</i>									0.2	0.02
Sulphur-crested Cockatoo	<i>Cacatua galerita</i>	1	0.4		0.2	0.3		0.1		0.4	0.23
Cockatiel	<i>Nymphicus hollandicus</i>	+			0.8		0.2				0.08
Red-collared Lorikeet	<i>Trichoglossus rubritorquis</i>	0.2	1.2	1.4	2.4	0.6	1	1.2	0.2	0.2	0.87
Varied Lorikeet	<i>Psitteuteles versicolor</i>				0.6	0.4					0.12
Red-winged Parrot	<i>Aprosmictus erythropterus</i>	1.4	1.6	2.6	1	0.3	1.4	1.1	0.6	0.6	1.05
Northern Rosella	<i>Platycercus venustus</i>	+	0.4		0.2			0.5	0.7		0.25
Hooded Parrot	<i>Psephotus dissimilis</i>		1.2			0.8		1.2	+		0.43
Brush Cuckoo	<i>Cacomantis variolosus</i>	0.2						0.3			0.07
Horsfield's Bronze-cuckoo	<i>Chrysococcyx basalis</i>		+								-
Barking Owl	<i>Ninox connivens</i>			0.2*							0.02
Southern Boobook	<i>Ninox novaeseelandiae</i>	0.5*	0.83*	1.2*	0.5*	0.33*	0.17*	0.5*	0.67*		0.57
Tawny Frogmouth	<i>Podargus strigoides</i>		0.67*	0.4*				+	+		0.13
Spotted Nightjar	<i>Eurostopodus argus</i>	0.17*		1*	0.5*			0.17*		+	0.21
Australian Owlet-nightjar	<i>Aegotheles cristatus</i>		0.17*	0.4*			0.17*	0.33*	0.17*		0.15
Azure Kingfisher	<i>Alcedo azurea</i>	+								0.2	0.02

Common Name	Scientific Name	S1	S2	S3	S4	S5	S6	EA	NA	PIT	Total
Blue-winged Kookaburra	<i>Dacelo leachii</i>	0.8		0.2	0.2	0.3		0.3		0.2	0.22
Red-backed Kingfisher	<i>Todiramphus pyrrhopygia</i>		0.2	0.6		0.1				0.2	0.1
Sacred Kingfisher	<i>Todiramphus sanctus</i>	+				0.1		0.1			0.03
Forest Kingfisher	<i>Todiramphus macleayi</i>		+								-
Rainbow Bee-eater	<i>Merops ornatus</i>	0.4	1.6	0.6	0.2	0.1	0.2	0.9	0.8	1.2	0.65
Dollarbird	<i>Eurystomus orientalis</i>							0.1		0.2	0.03
Black-tailed Treecreeper	<i>Climacteris melanura</i>								0.1		0.02
Red-backed Fairy-wren	<i>Malurus melanocephalus</i>		2.8	0.6	1.2	1.1	0.6	1.2	0.3	0.6	0.92
Striated Pardalote	<i>Pardalotus striatus</i>	0.2	0.8		0.2	0.3	0.2	0.4		0.4	0.27
Weebill	<i>Smicrornis brevirostris</i>		1.2		1.2	1.2	1.6	0.5	0.8	0.4	0.78
White-throated Gerygone	<i>Gerygone olivacea</i>	0.6			0.2		0.2	0.2	0.3	0.2	0.18
Silver-crowned Friarbird	<i>Philemon argenticeps</i>	+	0.2		0.2		0.2	0.5	0.5	0.6	0.27
Little Friarbird	<i>Philemon citreogularis</i>	0.4		0.2				0.2		0.2	0.1
Blue-faced Honeyeater	<i>Entomyzon cyanotis</i>					0.3					0.05
Singing Honeyeater	<i>Lichenostomus virescens</i>								0.2		0.03
White-gaped Honeyeater	<i>Lichenostomus unicolor</i>	1.8				0.5	0.6	0.2	0.2	0.4	0.38
Yellow-tinted Honeyeater	<i>Lichenostomus flavescens</i>	1.6	1		0.2	0.5	0.2	0.7	0.6	0.6	0.6
White-throated Honeyeater	<i>Melithreptus albogularis</i>	0.4			0.6	0.8		0.7	1.2	0.2	0.55
Brown Honeyeater	<i>Lichmera indistincta</i>	0.2	1.2	0.4	1	0.4	0.6	0.7	0.2	0.2	0.52
Jacky Winter	<i>Microeca fascinans</i>						0.2		0.1		0.03
Lemon-bellied Flycatcher	<i>Microeca flavigaster</i>						0.2				0.02
Grey-crowned Babbler	<i>Pomatostomus temporalis</i>	0.4		3	1.6	0.2	1.4	2.2	0.8	0.4	1.1
Varied Sittella	<i>Daphoenositta chrysoptera</i>			0.8				0.8	0.2	0.8	0.3
Rufous Whistler	<i>Pachycephala rufiventris</i>	0.6	0.4	0.2	0.4	0.5	0.6	0.7	1	0.6	0.6
Grey Shrike-thrush	<i>Colluricincla harmonica</i>			0.2				0.1			0.03
Leaden Flycatcher	<i>Myiagra rubecula</i>	0.2	0.4	0.2		0.3	0.6	0.2	0.2		0.23
Restless Flycatcher	<i>Myiagra inquieta</i>	1.8				0.2		0.3		1	0.32
Magpie-lark	<i>Grallina cyanoleuca</i>	+	0.4	1.2	1.8	0.1	0.4	1	0.1	0.8	0.58
Northern Fantail	<i>Rhipidura rufiventris</i>	1				0.1	0.8	0.1			0.18
Willie Wagtail	<i>Rhipidura leucophrys</i>	0.6	0.2	0.4	0.8	0.7	0.6	0.4	0.4	0.6	0.52
Black-faced Cuckoo-shrike	<i>Coracina novaehollandiae</i>	0.2	0.8	1.4	1	0.3	0.2	0.3	0.4	1.2	0.57
White-bellied Cuckoo-shrike	<i>Coracina papuensis</i>		0.4	0.4	0.6	0.3	0.2	0.4	0.3	0.8	0.37
White-winged Triller	<i>Lalage tricolor</i>	0.2	0.6	1.4	5	0.1		0.9		0.8	0.83
Olive-backed Oriole	<i>Oriolus sagittatus</i>	+							0.4	0.2	0.08
Figbird	<i>Sphecotheres viridis</i>								0.2		0.03
White-breasted Woodswallow	<i>Artamus leucorhynchus</i>	2								0.2	0.18
Black-faced Woodswallow	<i>Artamus cinereus</i>	+	0.6	0.2	0.8		0.4	1.5	1.2	0.8	0.68
Little Woodswallow	<i>Artamus minor</i>									1.2	0.1
Silver-backed Butcherbird	<i>Cracticus argenteus</i>							0.1			0.02
Pied Butcherbird	<i>Cracticus nigrogularis</i>	0.4	1.2	0.8	0.6	0.9	0.8	0.3	0.5	0.6	0.65
Torresian Crow	<i>Corvus orru</i>	0.2		0.2			0.2	0.3	0.2		0.13

Common Name	Scientific Name	S1	S2	S3	S4	S5	S6	EA	NA	PIT	Total
Apostlebird	<i>Struthidea cinerea</i>						+				-
Great Bowerbird	<i>Chlamydera nuchalis</i>	0.2	0.2	0.4		0.1	1	0.2	0.4		0.27
Zebra Finch	<i>Taeniopygia guttata</i>		0.2					0.5			0.1
Double-barred Finch	<i>Taeniopygia bichenovii</i>	2.8	0.6					0.1			0.3
Masked Finch	<i>Poephila personata</i>	+				0.2		1.1			0.22
Long-tailed Finch	<i>Poephila acuticauda</i>	+		0.6	0.4			0.3		0.2	0.15
Chestnut-breasted Mannikin	<i>Lonchura castaneothorax</i>	+	0.6					0.8			0.18
Mistletoebird	<i>Dicaeum hirundinaceum</i>	0.2	0.2	0.4		0.5		0.2	0.1	0.2	0.22
Tree Martin	<i>Hirundo nigricans</i>									1.6	0.13
Tawny Grassbird	<i>Megalurus timoriensis</i>			0.2							0.02
No 20min/2ha bird counts	60	5	5	5	5	10	5	10	10	5	
Total Species	91	51	37	41	39	40	33	56	41	51	

+ = Incidental observation at site; Numbers in columns = Mean no. of birds observed during timed diurnal bird counts; * = Observations compiled during spotlight survey/nocturnal counts; Numbers in rows = Mean no of nocturnal birds observed during nocturnal search/spotlight survey (6 x 20 minute surveys) EA = Existing proposed access route; NA = new proposed access route; Pit = observations from the existing mine pit area and surrounds.

3.4. Mammals

Twenty-five native and five introduced mammal species were identified within the study area during the survey (Table 3-4; Appendix 5). Microchiropteran bats comprise the majority of the mammals detected, with sixteen species recorded. The rich bat fauna is likely to be the result of the presence of a variety of forest, woodland and riparian habitats situated between habitats with extensive roost sites for cave dwelling species, including the sandstone escarpment of the Kombolgie Sandstone to the north-east and limestone systems of the Cutta Cutta karst area to the south-west. The richest habitat for mammal species was the riparian vegetation associated with Gold Creek (17 native species) and limestone outcrops (12 native species).

A total of 432 Elliott and wire cage trap nights resulted in a single small mammal capture, the western chestnut mouse (*Pseudomys nanus*). This low trap return is similar to results from previous surveys in the study area, during which a total of 423 Elliott trap nights from three surveys failed to capture a single mammal. Martin (1997) speculated that the low mammal trapping success at Maud Creek might be attributable to low habitat diversity and general habitat degradation from high numbers of buffalo and pigs in the area. During the current survey, high numbers of swamp buffalo and to a lesser degree donkey and cattle were causing habitat degradation within the study area, particularly along drainage lines and in riparian areas. Small mammal microhabitats in woodland and riverine situations would be especially impacted by the presence of swamp buffalo, cattle and donkey (Martin 1997), particularly during the late dry season when seasonal grasses have been burnt off or heavily grazed.

The western chestnut mouse was recorded in *Eucalyptus pruinosa* low woodland with a dense black spear-grass (*Heteropogon contortus*) ground cover. Other native rodent species recorded include the water-rat (*Hydromys chrysogaster*) in riparian vegetation on Gold Creek and the common rock rat (*Zyomys argurus*) in limestone outcrops on the proposed haul road. Tracks, scats and characteristic diggings indicated the presence of the echidna (*Tachyglossus aculeatus*) in limestone areas along the new proposed access route.

Mammal species identified from scat/hair analysis and hair funnels include the dog/dingo (*Canis lupus*) and common rock rat (*Zyomys argurus*).

The euro (*Macropus robustus*) was commonly observed on the existing and proposed access routes, mainly in the vicinity of limestone outcrops. The northern nailtail wallaby (*Onychogalea unguifera*) (Plate 6, Appendix 6) was present in low numbers within open woodland and grassland habitats in the lease area, and this species was also present on the proposed access routes. Antilopine wallaroos (*Macropus antilopinus*) were regularly observed in the open grassy woodland on the south-western section of the new proposed access route and the agile wallaby (*Macropus agilis*) was also present in low numbers in the study area.

Trapping for microchiropteran bats recorded nine species: the orange leaf-nosed-bat (*Rhinonictis aurantius*) (Plate 7, Appendix 6), dusky leaf-nosed bat (*Hipposideros ater*), northern bent-wing bat (*Miniopterus orianae*), northern myotis (*Myotis moluccarum*), hoary wattled bat (*Chalinolobus nigrogriseus*), pallid long-eared bat (*Nyctophilus bifax daedalus*), pygmy long-eared bat (*Nyctophilus walkeri*), Arnhem long-eared bat (*Nyctophilus arnhemensis*) and little broad-nosed bat (*Scotorepens greyii*) (Table 3.5). Identification of the little broad-nosed bat is tentative, as this species cannot be confidently separated from *Scotorepens sanborni* without genetic analysis where the range of these two species overlaps (Churchill 1998). Most bat captures were in riparian fringing forest on Gold Creek where narrow fly-ways between dense vegetation aided the capture of free-flying bats. The orange leaf-nosed bat was only captured at one site adjacent to the new proposed access route, in a trap set adjacent to a series of fissures and sink-holes in a limestone outcrop.

Thirteen species of microchiropteran bats were recorded by echolocation call detection using Anabat detectors (Appendix 1). The most commonly detected species were the northern freetail bat (*Chaerephon jobensis*) and species in the 40kHz call group (*Chalinolobus nigrogriseus*, *Scotorepens* sp). Less common but noteworthy species included the *near threatened* orange leaf-nosed bat (*Rhinonictis aurantius*) and *near threatened* Arnhem sheathtail bat (*Taphozous kapalgensis*). The record of the Arnhem sheathtail bat (*Taphozous kapalgensis*) within the study area represents a significant inland range extension of this species. This species has not been previously recorded from the Katherine area and the study area is furthest observation from the coast (D. Milne, NRETA, pers comm.; Milne *et al.* 2003). An additional common microbat species, the Beccari's freetail bat (*Mormopterus beccarii*), was possibly detected within the study area, however its presence cannot be confirmed on the basis of the calls obtained during the survey. The highest number of bat species (thirteen) in the study area was recorded at riparian vegetation along Gold Creek and the adjacent existing mining pit.

Martin (1997) reported one additional mammal species, the sugar glider (*Petaurus breviceps*), for a proposed access route. This species potentially occurs in suitable habitat throughout the study area.

The mammal species recorded in the study area are generally common in northern Australia and, with the exception of Arnhem sheathtail bat (*Taphozous kapalgensis*), are known to occur in local conservation areas (PWCNT 2002; 2000). The northern quoll (*Dasyurus hallucatus*) was not located during current or previous surveys despite specific targeted surveys. A high abundance of cane toads across the study area is likely to have impacted any previously occurring population of this species. Several bat species present within the study area, including the orange leaf-nosed bat (*Rhinonictis aurantius*) and dusky leaf-nosed bat (*Hipposideros ater*), are of local significance due to their reliance on specific cave roost sites. A number of additional species, including the northern nailtail wallaby (*Onychogalea unguifera*), orange leaf-nosed bat

(*Rhinonictis aurantius*), Arnhem sheath-tail-bat (*Taphozous kapalgensis*) and western chestnut mouse (*Pseudomys nanus*) are listed as *near threatened* under the *Territory Parks and Wildlife Conservation Act 2000*.

Table 3-4 Mammals

Common Name	Scientific Name	1	2	3	4	5	6	EA	NA	PIT	Total
Short-beaked Echidna	<i>Tachyglossus aculeatus</i>						T/S				-
Agile Wallaby	<i>Macropus agilis</i>	+							0.04		0.01
Antilopine Wallaroo	<i>Macropus antilopinus</i>							+	0.17		0.03
Euro	<i>Macropus robustus</i>						0.07	0.09	0.08		0.03
Northern Nailtail Wallaby	<i>Onychogalea unguifera</i>			SL	SL+			0.05	SL		0.01
Orange Leaf-nosed Bat	<i>Rhinonictis aurantius</i>	U	U				H			U	-
Dusky Leaf-nosed Bat	<i>Hipposideros ater</i>	H								U	-
Northern Freetail Bat	<i>Chaerephon jobensis</i>	U		U	U	U		U		U	-
Arnhem Sheath-tail Bat	<i>Taphozous kapalgensis</i>									U	-
Common Sheath-tail Bat	<i>Taphozous georgianus</i>	U					U			U	-
Yellow-bellied Sheath-tail Bat	<i>Saccolaimus flaviventris</i>	U			U		U	U		U	-
Hoary Wattled Bat	<i>Chalinolobus nigrogriseus</i>	H/U	U			U	U	U		U	-
Gould's Wattled Bat	<i>Chalinolobus gouldi</i>	U					U	U	U	U	-
Northern Bent-wing Bat	<i>Miniopterus orianae</i>	H/U	U	U		U	U	U	U	U	-
Northern Myotis	<i>Myotis moluccarum</i>	H/U					U				-
Pallid Long-eared Bat	<i>Nyctophilus bifax daedalus</i>	H									-
Pygmy Long-eared Bat	<i>Nyctophilus walkeri</i>	H								U	-
Arnhem Long-eared Bat	<i>Nyctophilus arnhemensis</i>	H									-
Little Broad-nosed Bat*	<i>Scotorepens greyii</i>	H									-
Northern Cave Bat	<i>Vespadelus caurinus</i>								U	U	-
Inland Cave Bat	<i>Vespadelus finlaysoni</i>	U					U			U	
Water-rat	<i>Hydromys chrysogaster</i>	0.07									0.01
Western Chestnut Mouse	<i>Pseudomys nanus</i>				E						-
Common Rock Rat	<i>Zyzomys argurus</i>						S				
Dingo/Dog	<i>Canis lupus</i>	T	T				T/S	T/S			-
Donkey ^{Ex}	<i>Equus asinus</i>								0.25		0.04
Cattle ^{Ex}	<i>Bos primigenius</i>	0.33	+				+	S	+		0.03
Swamp Buffalo ^{Ex}	<i>Bubalus bubalis</i>	0.4		0.71	0.13	+		1.59	+	+	0.37
Feral Cat ^{Ex}	<i>Felis catus</i>							SL			-
Feral Pig ^{Ex}	<i>Sus scrofa</i>	T									-
Total Species	30	20	4	4	5	4	13	12	10	13	

SL = Recorded during nocturnal survey/spotlighting; + = incidental observation at site; Numbers in columns = Mean no of mammals observed during all timed counts (diurnal search, spotlight search, bird surveys); E = Elliott trap capture; HF = hair funnel; U = Ultrasonic bat call detection; H = Harp trap capture; T = Tracks; S = Scats; * probable ID, difficult to identify from *S. sanborni* in the field; EA = Existing proposed access route; NA = new proposed access route. Ex = Exotic species. Pit = observations from the existing mine pit area and surrounds.

Table 3.5 Microchiropteran Bat Trapping Results

Common Name	Scientific Name	S1	S3	S5	S6	Total
Orange Leaf-nosed Bat	<i>Rhinonictis aurantius</i>	-	-	-	2	2
Dusky Leaf-nosed Bat	<i>Hipposideros ater</i>	4	-	-	-	4
Hoary Wattled-bat	<i>Chalinolobus nigrogriseus</i>	9	-	-	-	9
Northern Bent-wing Bat	<i>Miniopterus orianae</i>	2	-	-	-	2
Northern Myotis	<i>Myotis moluccarum</i>	1	-	-	-	1
Pallid Long-eared Bat	<i>Nyctophilus bifax daedalus</i>	1	-	-	-	1
Pygmy Long-eared Bat	<i>Nyctophilus walkeri</i>	8	-	-	-	8
Arnhem Long-eared Bat	<i>Nyctophilus arnhemensis</i>	1	-	-	-	1
Little Broad-nosed Bat*	<i>Scotorepens greyii</i>	1	-	-	-	1
Total Harp Trap Nights		8	3	3	6	20
Total Captures		27	0	0	2	29
No. of Captures per Harp Trap Night		3.3	0	0	0.3	1.45
Number of Species		8	0	0	1	9

* probable ID, cannot be confidently separated from *S. sanborni* in the field

3.5. Significant Invertebrate Species

A number of terrestrial invertebrate taxa are listed as endangered, vulnerable and data deficient in the *Territory Parks and Wildlife Conservation Act 2000* (Parks & Wildlife Commission of the Northern Territory 2000). Based on available information and ecological data it is unlikely that any of the species currently listed in this Act occur within the study area. However a number of significant land snails, including the *vulnerable* camaenid species *Setobaudinia victoriana*, are known to be associated with limestone habitats in the Katherine Region. *Setobaudinia victoriana* is only known from areas to the west of Katherine and does not occur in the Cutta Cutta limestone karst area (V. Kessner pers comm. 2007). A number of other locally endemic species occur in the Cutta Cutta karst.

Land snails were collected and identified at all limestone outcrop areas on the proposed route alignments within the study area. Three camaenid taxa were present, with *Torresitrachia weaberana* being the most common species within the study area (present at most of the outcrops sampled). This species occurs sporadically in inland areas between Kununurra and Katherine, where it is moderately common in some areas and rare/uncommon in other areas (V. Kessner pers comm. 2007).

An additional camaenid species that represents an undescribed genus and undescribed species (N. gen n.sp 1) is endemic to the Tindal - Cutta Cutta limestone karst area. This species was collected at one site on the proposed haul road and is likely to be locally common in suitable limestone habitat in the access route component of the study area. While this species can be locally common it is restricted to a limited range that covers the Tindal - Cutta Cutta limestone karst, and is therefore of regional significance. It is likely that when described this species would qualify as threatened due to low area of occupancy and limited number of known sites (V. Kessner pers comm. 2007). This species is threatened in the areas where it occurs east of Katherine by clearing and disturbance for agricultural expansion, grazing pressure, destruction of habitats and inappropriate fire regimes (V. Kessner pers comm. 2007).

An additional camaenid species (*Xanthomelon sp.*) was identified from open forest areas in the study area. This species is relatively widespread but occurs at low densities within its range (V. Kessner pers comm. 2007).

3.6. Introduced Species

Five introduced vertebrate fauna species were recorded during field surveys within the study area, including cattle (*Bos primigenius*), swamp buffalo (*Bubalus bubalis*), donkey (*Equus asinus*), feral cat (*Felis catus*) and cane toad (*Bufo marinus*). While the dogs observed within the site appear to be reasonably pure dingoes (*Canis lupus dingo*), it is also likely that feral dogs are present in the local area and that local dingo populations have interbred with feral dogs.

The study area has previously been utilised as an operational buffalo and cattle property. Swamp buffalo remain relatively abundant in the study area, with up to 40 individuals recorded at one location. Swamp buffalo are more common in the vicinity of available water and grazing and wallowing impacts are particularly significant along Gold Creek. Impacts include extensive bank erosion and soil compaction, high water turbidity and disturbance to riparian vegetation. Signs indicating the presence of feral pigs (*Sus scrofa*) were observed in riparian habitats, however any environmental damage caused by pigs is largely obscured by the extensive impacts of the swamp buffalo.

Feral donkeys (*Equus asinus*) and cattle (*Bos primigenius*) are also present in the study area in lower numbers, and these species potentially contribute to habitat disturbance within the local area. A number of feral cats (*Felis catus*) were observed during spotlighting along the proposed access routes. Predation from feral cats is likely to be impacting small ground birds, small mammals and other small vertebrates in the local area.

Cane toads (*Bufo marinus*) are likely to have arrived in the Maud Creek - Cutta Cutta area in 2001 and this species is now abundant within the study area. Cane toads were found to be locally abundant in riparian habitats and are also present in open woodland and grassland components of the study area. The cane toad may have contributed to the local decline of fauna species that are known to be susceptible to the toxins produced by this species, particularly varanids and the northern quoll (*Dasyurus hallucatus*).

4. Significant Fauna Species

4.1. Overview

The majority of the species recorded or expected to occur within the study area are widespread in northern Australia, while a smaller number of species are restricted to the Top End region. Fauna species occurring within the study area are assigned threatened status according to Northern Territory and Commonwealth legislation described in the:

- Northern Territory *Territory Parks and Wildlife Conservation Act 2000*; and
- Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.

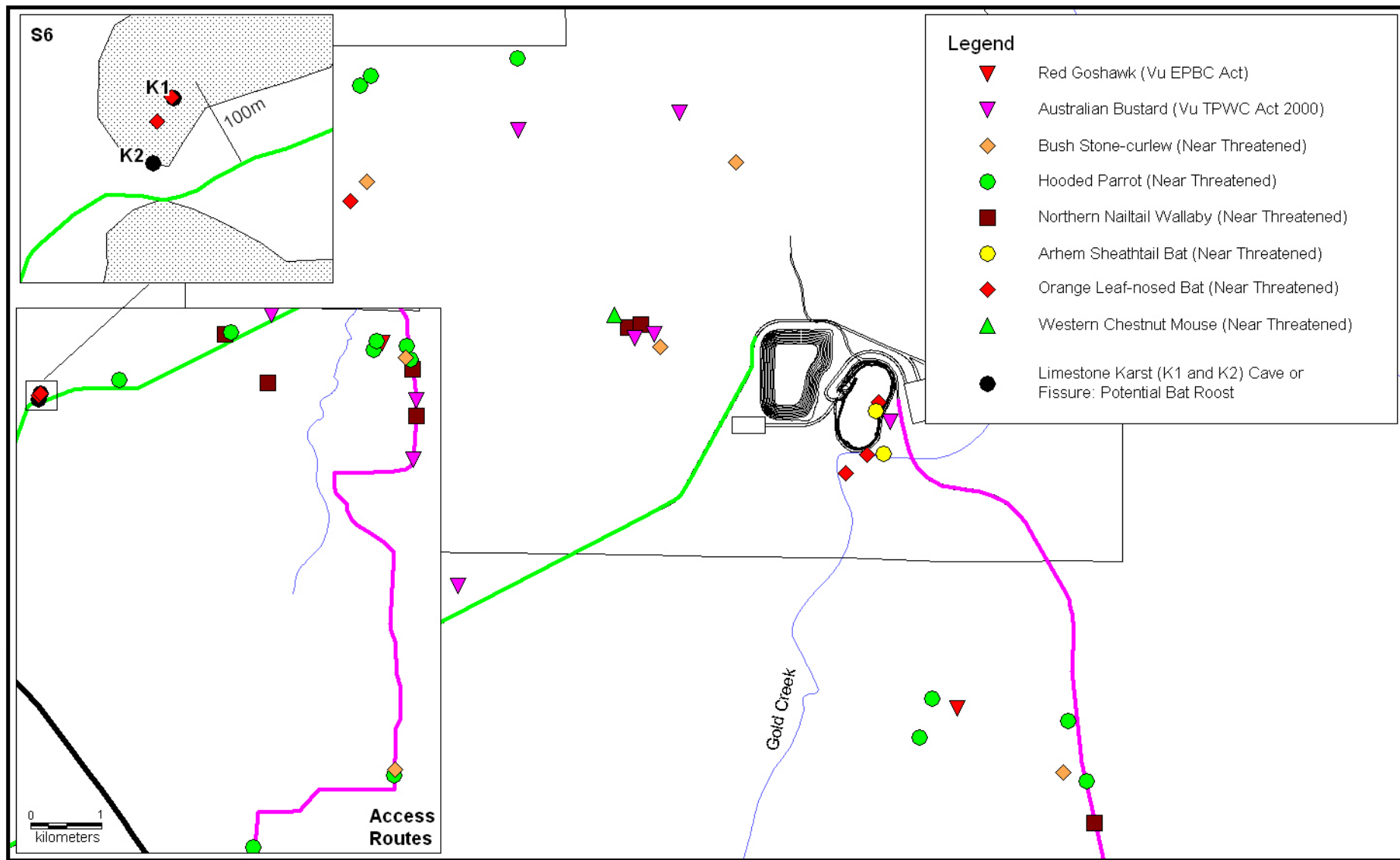
In addition to the threatened species, the *EPBC Act 1999* also includes a list of migratory species (DEWR 2007b). These species are those that are listed under international agreements to which Australia is a signatory nation.

4.2. Vulnerable and Near Threatened Species

Vulnerable and *near threatened* species known to occur within the study area are listed in Table 4-1 and mapped in Figure 4. No *endangered* or *critically endangered* species are known or expected to occur in the study area. The red goshawk (*Erythroriorchis radiatus*) is classified as *vulnerable* under the *EPBC Act 1999* and the *TPWC Act 2000*. The Australian bustard (*Ardeotis australis*) is listed as *vulnerable* under the *TPWC Act 2000*, and a number of additional species are classified in a lower risk category (*near threatened*) under the *TPWC Act 2000*.

Table 4-1 Listed Fauna Species/Site Records

Common Name	Scientific Name	EPBC Act 1999	TPWC Act 2000	Maud Ck Site Records
Red Goshawk	<i>Erythroriorchis radiatus</i>	Vulnerable	Vulnerable	5
Australian bustard	<i>Ardeotis australis</i>	-	Vulnerable	3, 4, AN, PIT
Bush Stone-curlew	<i>Burhinus grallarius</i>	-	Near Threatened	3, 4
Hooded Parrot	<i>Psephotus dissimilis</i>	-	Near Threatened	2, 5, AE, AN
Northern Nailtail Wallaby	<i>Onychogalea unguifera</i>	-	Near Threatened	3, 4 AE, AN
Orange Leaf-nosed Bat	<i>Rhinonictis aurantius</i>	-	Near Threatened	1, 2, 6, PIT
Arnhem Sheath-tail Bat	<i>Taphozous kapalgensis</i>	-	Near Threatened	1, PIT
Western Chestnut Mouse	<i>Pseudomys nanus</i>	-	Near Threatened	4



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Plan Note:
Base mapping provided by URS Australia
Fauna sighting locations are approximate.

Project:

Maud Creek Gold Project Terrestrial Fauna Survey 2007

Title:

Significant Fauna Species Records

EMS | ECOLOGICAL MANAGEMENT SERVICES
ENVIRONMENTAL CONSULTANTS

Date
July 2007

Prepared by:
PB

Client/Ref
URS/Terra Gold

Checked:
SH

0 500
meters

Datum: MGA 94 Zone 53 L

Figure 4

Version
3
A4

4.3. Red Goshawk (*Erythrotriorchis radiatus*)

The red goshawk (*Erythrotriorchis radiatus*) is classified as *vulnerable* under the *EPBC Act 1999* and the *TPWC Act 2000*. One individual was observed on the margin of the footprint of the proposed borrow pit (site 5). The habitat at this site is open woodland with a grassy understorey (Figure 4). A single bird was observed flying low over open woodland habitat and perched in a canopy eucalypt before moving out of sight to the west. Following this sighting, surveys targeting the red goshawk were conducted in the borrow pit area, along Gold Creek in the vicinity of the proposed mine area over a five day period, to determine if the bird remained in the local area and to detect any potential nesting sites. The additional surveys focussing on the red goshawk included:

- 10 additional timed area counts in the proposed borrow pit, adjacent to the existing pit and along Gold Creek (3 hours 20 mins)
- Broad observational surveys and searches for characteristic nests (6 person hours) in suitable habitats and in the vicinity of the original record. Bird surveys and nest searches were conducted throughout the proposed borrow pit footprint, along Gold Creek adjacent to, upstream and downstream of the existing mine pit and along the proposed access routes in the local area; and
- Opportunistic observations within the borrow pit, existing pit and along Gold Creek.

Red goshawks were not re-sighted within the study area and access routes and no potential nest sites were located in the search areas.

It is considered likely that the red goshawk sighted within the borrow pit area was a resident bird hunting within its home range area, however this area is likely to be extensive. Foraging/range areas of red goshawks have been measured to be up to 120 - 200km², with adult birds ranging up to 10km from nesting sites to forage (Baker-Gabb 2007). Removal of a small area of suitable foraging habitat within the study area is likely to have a small, localised effect that is considered to be insignificant in the context of the large home range of this species. Suitable foraging areas in the local area extend to the north, south, west and east of the study area, including extensive areas of habitat along Maud Creek and within Nitmiluk National Park. A significant component of the habitat within the mining and infrastructure footprint is less suitable as red goshawk foraging habitat, and includes disturbed grassland and previously disturbed mining areas.

There is a previous record of a red goshawk pair nesting within the lower gorge section of Nitmiluk NP and this species is considered likely to nest somewhere in the area east of Katherine (D. Baker-Gabb, pers comm. 2007). Red goshawks are known to occur in the area to the east of Katherine, but the number of pairs and location of nesting sites are unknown (J. Woinarski NRETA pers comm. 2007; D. Baker-Gabb, pers comm. 2007). Red goshawks generally nest in tall trees along rivers and larger creeks, indicating that the local birds are likely to be nesting in suitable habitat on Maud Creek or the Katherine River. Raptor nests were not located along Gold Creek or surrounding areas. The absence of a nest site within the borrow pit and along Gold Creek in the vicinity of the existing pit indicates that the project is likely to have a minimal impact on the red goshawk.

4.4. Australian Bustard (*Ardeotis australis*)

The Australian bustard (*Ardeotis australis*) is widespread and relatively common in the vicinity of the study area and was observed in a variety of habitats, including open grassland, grassy woodland, roadsides, modified habitats (previous mining) and disturbed agricultural land. Australian bustards are highly mobile, undertaking movements in response to rainfall, fire and availability of food resources (Ziembicki 2006). This species has been listed as vulnerable in the Northern Territory due to observed population declines, however populations are more robust in the north when compared to southern Australia (Garnett & Crowley 2000) and the NT arid zone (Ziembicki 2006). The potential threats to this species are intensive agriculture, altered fire regimes, predation, hunting, habitat alteration (eg woody weed invasion) and pesticides (Garnett & Crowley 2000; Ziembicki 2006).

Due to the wide-ranging and highly mobile nature of the Australian bustard, and the extensive amount of suitable habitat surrounding the proposed impact area, the removal of a small area of habitat for the mine development will have a very limited localised effect on this species. It should also be noted that a significant component of the habitats within the lease area have been highly disturbed by previous mining and pastoral activities. The majority of Australian bustard sightings were located outside of the proposed mining/infrastructure areas.

4.5. Near Threatened Fauna

The northern nailtail wallaby appears to be widespread in the local area and no specific or significant habitats of this species will be impacted by the project. Similarly the presence of the western chestnut mouse within the study area does not present any specific management issues for the proposal.

Potential roost sites for the orange leaf-nosed bat (*Rhinonictus aurantius*) bat were associated with sink-holes and fissures in karst landforms within 100 meters of the proposed access route at site 6 (Figure 4). Remote Anabat detectors placed at sink-holes adjacent to the proposed new proposed access route at site 6 (potential roost site K1 in inset, Figure 4) recorded orange leaf-nosed bats emerging from these sites at dusk, indicating that the bats are roosting in this area. However it is not known if these roosts are permanently occupied and the numbers of bats present could not be determined. Orange leaf-nosed bats are known to be particularly sensitive to disturbance at roost sites and the distribution of this species can be influenced by the availability of suitable roost sites, particularly in the dry season (Churchill 1998).

A number of other bat species are potentially using limestone sinkholes or fissures as roost sites, particularly *Taphozous georgianus*, *Vespadelus caurinus/finlaysoni*, *Miniopterus orianae* and *Hipposideros ater*. The location of the proposed access route in this area needs to consider the presence of bat roosts in limestone sink-holes and fissures, particularly as the location of bat roost sites has been identified by NRETA ecologists as a significant management issue. Two potential sites were located at site 6 (identified as K1 and K2 in inset, Figure 4). Anabat recordings at K1 indicated the presence of roosting bats, and this site appears to be the most suitable potential bat roost located during surveys. K1 is approximately 100m from the proposed access route (Figure 4). Site K2 (Figure 4) is a deep sinkhole that appears to be less suitable as a bat roost, and no bats were recorded at the entrance to this site. It is within 30m of the proposed access route. Suitable roost sites for cave dwelling bats have not been located within the main mining lease or proposed borrow pit area.

The record of the Arnhem sheath-tail bat (*Taphozous kapalgensis*) is of bioregional significance as this species has not been previously recorded in the Katherine region and has not been recorded as far from the coast, however the project is not likely to significantly impact this species. The roost habits of this species are not known, however it is suspected to roost in trees (Milne *et al.* 2003). The Arnhem sheath-tail bat appears to generally be a high-flying above-canopy foraging species (Milne *et al.* 2003), and foraging habitats would not be impacted by the proposal. The majority of the records of this species were from bats overflying disturbed habitats in the vicinity of the existing mining pit.

Throughout its range the hooded parrot (*Psephotus dissimilis*) occurs in open forest and woodland habitats and breeds in nests constructed in termite mounds. The hooded parrot has a restricted range, with the southern Kakadu, Pine Creek and Katherine areas representing the stronghold of the species. It is listed as *near threatened* in the Northern Territory, however it is listed as *least concern* by the Action Plan for Australian Birds (Garnett & Crowley 2000). Hooded parrots are relatively common in the Katherine area, and significant numbers are known to breed in Nitmiluk National Park (Martin 1997). Within the study area the hooded parrot was observed at a number of sites in open woodland habitats, flying over woodland and grassland habitats and near water holes. Most sightings were in the western section of the lease area, the borrow pit area and along the proposed access route alignments. A small flock of birds was observed roosting in trees adjacent to an existing house on the existing access road.

Martin (1997) searched for hooded parrot breeding sites within the lease area but did not locate any. In the local area habitats with high numbers of termite mounds are limited and all of the mounds inspected during the current assessment appear to be unsuitable as nesting sites (eg < 1m high). Concentrations of termite mounds suitable as hooded parrot breeding sites were not located within the proposed infrastructure footprints or on the proposed access alignments. A significant proportion of the habitat within the proposed infrastructure and mining areas are less suitable as foraging areas for the hooded parrot due to past mining disturbance and grazing impacts. The potential impact of the project on this species is therefore expected to be localised. Major threats to this species are listed as inappropriate fire regimes and over-grazing (Garnett & Crowley 2000).

4.6. Migratory Species

No significant migratory species were recorded within the study area. A single bird species, the rainbow bee-eater (*Merops ornatus*), is listed as a migratory species under the *EPBC Act 1999* (DEWR 2007b). This species is common and does not require specific habitat management measures. None of the habitats present within the study area represent significant habitat for migratory wetland or shorebirds.

4.7. Ecologically Outstanding Areas or Areas of Ecologically Significant Diversity

Previous surveys of the Maud Creek study area and proposed access route found that these areas had relatively low conservation value as wildlife habitat (Martin 1997). With the exception of limestone karst areas that are located outside the main lease areas, there are no habitats present that are ecologically outstanding or display high levels of fauna diversity. Significant components of the study area have been degraded by

past mining activities, weeds, grazing pressure and disturbance from swamp buffalo, cattle, pigs, feral donkey and inappropriate fire regimes.

Open Woodland Habitats

The woodland habitats that dominate the study area are very commonly represented throughout the northern region of the Northern Territory and species occurring within them tend to be unspecialised (Martin 1997). The most diverse fauna groups within the study area are highly mobile species (eg birds and bats), while sedentary ground fauna such as small reptiles and ground mammals were recorded in very low numbers and low diversity of species.

Riparian Habitats

The creeks within the lease area are non-perennial and riverine vegetation along Gold Creek and other minor tributaries is not extensive. These riparian habitats have been degraded by the presence of large numbers of swamp buffalo, greatly reducing the quality of the habitat.

Limestone Karst Habitats

The limestone karst habitats that occur along the proposed access routes are the most significant habitats within the study area. Although these areas are not as extensive or as spectacular as other examples in the Katherine region, they support specific habitat features that are of local significance as wildlife habitat. These areas represent an unusual habitat that supports specialised fauna species, including reptiles (*Gehyra nana*), mammals (cave roosting bats such *Rhinonictis aurantius*, *Zygomys argurus*) and invertebrates (e.g. land snails restricted to the Cutta Cutta limestone karst area, including one undescribed genus/species).

Limestone outcrops are protected to a degree from fires and support vegetation that does not occur in surrounding woodland habitats, providing habitat for additional species (eg frugivorous birds). They act as a refuge for fauna and are largely avoided by livestock because of the rugged terrain. A number of caves and sink-holes identified within the study area potentially support populations of roosting bats.

5. Summary of Significance/Impacts

- The overall proposed impact area is relatively small when compared to the potential impacts of other activities in the local area eg. the broad scale clearing of vegetation for agricultural expansion to the east of Katherine.
- A significant component of the mining lease area has been previously disturbed and degraded by past mining activities and grazing of swamp buffalo and cattle, and supports some areas of poor vegetation condition including areas dominated by weeds.
- The primary issue of significance is the potential impact on species that have been recorded in the study area and are listed nationally as vulnerable under the *EPBC Act 1999* and/or vulnerable in the Northern Territory under the *TPWC Act 2000* (red goshawk and Australian bustard). Impacts on these species are likely to be limited as they are wide ranging and highly mobile species, and only small areas of suitable habitat will be disturbed by the project.

- The red goshawk has a large home range, of which the study area represents a small component. The single observation of this species was on the margin of the proposed impact area to the south of the main mining area/ore body. It is unlikely that the project would have a significant impact on this species. However any raptor nests subsequently located in the study area should be investigated and identified prior to any disturbance in the vicinity of the nest.
- In general the habitats within the study area are relatively disturbed and are not regarded as ecologically outstanding areas or areas supporting significant biodiversity. Limestone outcrops on the route alignments retain ecological significance for wildlife, however disturbance to these areas can be avoided through appropriate design of the proposed access routes. Appropriate buffers (e.g. 100 m) to potential bat roost sites in these areas need to be established.

6. Management Recommendations

6.1. Habitat of Threatened or Significant Species

- Avoid disturbance of limestone karst areas, as these areas support populations of a significant land-snail with a restricted distribution (likely to be listed as threatened under NT legislation) and other regionally restricted fauna.
- Establish appropriate buffers (e.g. 100 m) between the proposed haul road and known/potential bat roost sites, particularly site K1 in Figure 4.
- Conduct pre-clearing checks for red goshawk and potential red goshawk nest sites in suitable habitats, particularly in the proposed borrow pit and in the vicinity of Gold Creek.

6.2. Limestone Karst Areas

- Avoid limestone karst areas during the design of the proposed route options (refer to 6.1).
- The existing access road is the preferred option as this access would avoid limestone karst outcrops and would have a lesser impact on significant limestone habitats.
- If the new proposed access route is considered as an option, establish a sufficient buffer (e.g. 100 m) to known bat roosts in the vicinity of S6 (site K1 in Figure 4).
- Consider fire management and feral animal management measures that will protect and enhance habitat quality in local limestone karst areas.

6.3. Riparian Habitats

- The removal of swamp buffalo and the ongoing control of feral animals (e.g. feral pigs and donkey) may improve riparian habitats and surface water quality.
- Establish controls to prevent sedimentation and erosion during construction and operational phases.

6.4. Surrounding Habitats/Rehabilitation of Disturbed Areas

- Develop guidelines for protection of areas outside mining and associated infrastructure areas.
- The rehabilitation of disturbed areas should include consideration of the requirements of fauna species that will potentially recolonise these areas. Measures should include stockpiling of deadwood and woody debris following clearing, for later return to the rehabilitation area to provide fauna microhabitat and increase the rate of faunal return.

6.5. Stock and Feral Animals

- The cessation of grazing as the main activity within the study area may enable the recovery of habitats in the balance areas of the lease and adjacent areas, with potential beneficial effects for the hooded parrot, western chestnut mouse, Australian bustard and northern naitail wallaby.
- Remove stock (e.g. swamp buffalo) and conduct ongoing management of feral species (e.g. feral pigs, donkey). This is likely to improve habitats for wildlife in the local area.
- Design infrastructure in a manner that will not encourage feral animals due to increased availability of food sources or breeding sites (e.g. cane toads).

6.6. Fire

- Many of the *vulnerable* and *near threatened* fauna species detected within the study area are negatively impacted by specific fire regimes. There is a possibility that increased activity in the local area associated with construction and operation could result in an increase in unplanned fires.
- Develop a fire management plan that considers the ecological requirements of fauna and their habitats, in consultation with site neighbours (e.g. Nitmiluk National Park).

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Appendix 1 Anabat Analysis Notes

The Anabat call analysis for this project has been conducted with consideration of the preliminary guidelines for standards in bat call analysis developed by the Australasian Bat Society. Three of the key problems with bat call identification have been identified as:

- Variation in call types and call characteristics of each species within a particular geographic area;
- Intra-specific variation in call characteristics between regions; and
- Overlap in call characteristics between some species occurring within a particular region.

These issues have been considered and local and regional reference calls used as a guide to identification where possible. Consideration has also been given to bat call data from broader areas of the Top End based on reference collection material, comments provided by other bat workers in the region and other existing keys (eg Milne 2002). Reference material includes calls from the Maud Creek site and Cutta Cutta area collected from animals captured during surveys. Species for which site based and local reference calls were available include *Hipposideros ater*, *Rhinonictis aurantius*, *Chalinolobus gouldii*, *Chalinolobus nigrogriseus*, *Taphozous georgianus*, *Chaerephon jobensis*, *Nyctophilus walkeri*, *Myotis moluccarum*, *Miniopterus orianae* and *Scotorepens* sp. Other reference material utilised included recordings from other areas in the Top End (eg Katherine, Pine Creek, Batchelor/Litchfield areas) and the Roper River/gulf regions of the Northern Territory. Potential for an overlap in call characteristics between species is reviewed in the following discussion, and calls that cannot be confidently identified due to overlapping call parameters have been recognised. In most cases no attempt has been made to distinguish between species that:

- Have limited reference calls available;
- Overlap in frequency and call characteristics and cannot be confidently separated using Anabat analysis (eg some *Nyctophilus* sp); and
- Have additional unresolved taxonomic issues.

General Comments

***Taphozous kapalgensis* (Arnhem Sheathtail Bat)**

Definite identification based on characteristic frequency, shape and pulse duration and reference calls from Litchfield/Batchelor area. Due to the significant range extension the *Taphozous kapalgensis* calls from the study area were forwarded to D. Milne (NRETA) for confirmation.

***Mormopterus beccarii* (Beccari's Freetail Bat)**

A number of calls with call shape and frequency consistent with *M. beccarii* were included in the data but could not be confidently assigned to this species. *M. beccarii* is known to occur in local conservation areas and is likely to occur in the study area.

40 kHz Group (*Chalinolobus nigrogriseus*/*Scotorepens* spp)

A significant number of calls in the overlapping 40 kHz group (eg *Chalinolobus nigrogriseus*, *Scotorepens balstoni*, *Scotorepens sanborni*) were recorded in the study area. In general no attempt has been made to separate these calls, however calls with specific characteristics (eg long characteristic section) were identified as *Chalinolobus nigrogriseus* (reference calls from the study area n=10).

***Miniopterus orianae* (Northern Bentwing Bat)**

While a number of calls were identified as *Miniopterus orianae* it should be noted that calls of this species can overlap with other species that occur in the Top End, including *Pipistrellus* spp (Milne 2002). However *Pipistrellus* spp are more likely to occur in coastal regions and all of the calls within this frequency range were considered characteristic of *Miniopterus orianae*. *Miniopterus orianae* was captured at one site during the survey.

Nyctophilus* spp/*Myotis moluccarum

Nyctophilus species (eg *Nyctophilus bifax*, *Nyctophilus arnhemensis*) and *Myotis moluccarum* were trapped within the study area. A small number of *Myotis moluccarum* calls were tentatively identified from Anabat recordings based on local reference calls and Milne (2002). These calls were mainly recorded where open water was present (eg existing pit and along Gold Creek). No attempt was made to identify *Nyctophilus* calls other than those considered characteristic of *Nyctophilus walkeri*.

***Vespadelus caurinus* (Northern Cave Bat) and *Vespadelus finlaysoni* (Inland Cave Bat)**

Vespadelus caurinus and *Vespadelus finlaysoni* both occur in the Katherine area (PWCNT 2002; 2000). Calls in the characteristic frequency ranges of both of these species were detected; with *Vespadelus finlaysoni* calls being recorded more frequently during the survey.

Table 1. Ultrasonic Microchiropteran Bat Call Sampling Results

Species	No Identification	<i>Rhinonictus aurantius</i>	<i>Chaerephon jobensis</i>	<i>Taphozous kapalgensis</i>	<i>Taphozous georgianus</i>	<i>Saccolaimus flaviventris</i>	<i>Miniopterus orianae</i>	<i>Chalinolobus nigrogriseus</i>	<i>Chalinolobus gouldii</i>	<i>Chal/Scot sp (40 kHz Grp)</i>	<i>Nyctophilus walkeri</i>	<i>Myotis moluccarum</i>	<i>Vespadelus finlaysoni</i>	<i>Vespadelus caurinus</i>	Number of Sequences/ Calls	No of Species
Existing Acc 1 Corner: 29/4/07	21					1	42	1	4	6					75	5
Existing Acc Gate 2: 29/4/07	33		3			5	18	3	4	10					76	6
S1 Gold Creek: 2/5/07	29	1	24		3	2	4	3	1	3		1			71	9
S3 Grassland: 2/5/07	-		1				1			1					3	3
S2 Water Tank: 3/5/07	6	1					5	2		4					18	4
Existing Pit: 3/5/07	222	5	688	7	35	53	11	759	34	213	3	10	34	6	2080	13
S5 Borrow Pit: 4/5/07	14		1				1	1		3					20	4
Existing Acc Karst 3: 4/5/07	16					2	3	3							24	3
S1 Gold Ck Div Dwn: 6/5/07	26		23		1		5	13		30			1		99	6
S1 Gold Ck Div Up: 6/5/07	40	1	7	3	1	2	3	98	4	916	19	11	1		1106	12
S4 <i>E. pruinosa</i> : 7/5/07	20		4			2				8					34	3
New Acc 1 East: 7/5/07	11						1			1					13	2
New Acc 2 SW: 10/5/07	1						1			1				1	4	3
New Acc 3 Sink S6: 10/5/07	10	1					3	32	2	2					50	5
S6 2 Sink W: 11/5/07	19				2	5	6	4	1	5		1	1		43	8
S6 Open Forest W: 12/5/07	3									4					7	1
Total Calls	471	9	751	10	42	72	104	919	50	1207	22	23	37	7	3723	
No of Sites/Nights	16	5	8	2	5	8	14	11	7	15	2	4	4	2		

Appendix 2 Existing Fauna Species Records

Status Codes:

CEn = Critically Endangered

En = Endangered

Vu = Vulnerable

NT = Near Threatened

DD= Data Deficient

Appendix 2

Existing Terrestrial Fauna Data Maud Creek Area

Common Name	Scientific Name	NT Status	Maud Ck Mine Lease Sep 1994	Maud Ck Mine Lease May 1996	Maud Ck Access Route July 1997	Birds Australia Bird Data 2007	Cutta Cutta Caves (PWS 2000)	NRETA Data Search 2007 2km
Amphibians								
Giant Frog	<i>Cyclorana australis</i>						X	X
Daly Waters Frog	<i>Cyclorana maculosa</i>							X
Knife-footed Frog	<i>Cyclorana cultripes</i>							X
Long-footed Frog	<i>Cyclorana longipes</i>							
Bilingual Frog	<i>Crinia bilingua</i>			X				X
Stonemason Toadlet	<i>Uperoleia lithomoda</i>			X			X	X
Floodplain Toadlet	<i>Uperoleia inundata</i>							X
Northern Spadefoot	<i>Notaden melanoscaphus</i>						X	X
Marbled Frog	<i>Limnodynastes convexiusculus</i>						X	X
Ornate Burrowing Frog	<i>Limnodynastes ornatus</i>	DD		X			X	X
Northern Dwarf Tree-frog	<i>Litoria bicolor</i>	DD						X
Green Tree Frog	<i>Litoria caerulea</i>						X	X
Copland's Rock Frog	<i>Litoria coplandi</i>						X	X
Bumpy Rocketfrog	<i>Litoria inermis</i>			X			X	X
Rockhole Frog	<i>Litoria meiriana</i>			X				X
Striped Rocketfrog	<i>Litoria nasuta</i>							X
Pale Frog	<i>Litoria pallida</i>							
Masked Rock-frog	<i>Litoria personata</i>							X
Roth's Tree Frog	<i>Litoria rothii</i>							X
Purple Tree Frog	<i>Litoria rubella</i>						X	X
Tornier's Frog	<i>Litoria tornieri</i>							X
Splendid Tree Frog	<i>Litoria splendida</i>						X	
Wotjulum Frog	<i>Litoria wotjulumensis</i>						X	
		23	2	0	5	0	11	19
Reptiles								
Diamond Head Turtle	<i>Emydura subglobosa</i>							X
Northern Snapping Turtle	<i>Elseya dentata</i>							X
Freshwater Crocodile	<i>Crocodylus johnstoni</i>							X
Estuarine Crocodile	<i>Crocodylus porosus</i>							X
Asian House Gecko	<i>Hemidactylus frenatus</i>							X
Pale-striped Ground Gecko	<i>Diplodactylus immaculatus</i>							X
Crowned Gecko	<i>Diplodactylus stenodactylus</i>							X

Common Name	Scientific Name	NT Status	Maud Ck Mine Lease Sep 1994	Maud Ck Mine Lease May 1996	Maud Ck Access Route July 1997	Birds Australia Bird Data 2007	Cutta Cutta Caves (PWS 2000)	NRETA Data Search 2007 2km
Fat-tailed Gecko	<i>Diplodactylus conspicillatus</i>							X
Nothorn Dtella	<i>Gehyra australis</i>						X	X
Rock Gecko	<i>Gehyra nana</i>				X		X	X
Arnhem Land Spotted Dtella	<i>Gehyra pamela</i>							X
Northern Knob-tailed Gecko	<i>Nephurus sheai</i>							X
Binoe's Gecko	<i>Heteronotia binoei</i>				X		X	X
Marbled Velvet Gecko	<i>Oedura marmorata</i>						X	X
Zig-zag Gecko	<i>Oedura rhombifer</i>							X
Spiny-tailed Gecko	<i>Strophurus ciliaris</i>				X		X	X
Beaked Gecko	<i>Rhynchoedura ornata</i>							X
Northern Hooded Scalyfoot	<i>Pygopus steelescotti</i>						X	X
Rusty-topped Delma	<i>Delma borea</i>							X
Black-necked Snake-lizard	<i>Delma tincta</i>							X
Burton's Legless Lizard	<i>Lialis burtonis</i>							X
Chameleon Dragon	<i>Chelosania brunnea</i>	NT					X	X
Friiled Lizard	<i>Chlamydosaurus kingii</i>						X	X
White-lipped Two-lined Dragon	<i>Diporiphora albilabris</i>						X	
Robust Dragon	<i>Diporiphora bennettii</i>							X
Two-lined Dragon	<i>Diporiphora bilineata</i>			X			X	X
Yellow-sided Two-lined Dragon	<i>Diporiphora magna</i>						X	
Gilbert's Dragon	<i>Lophognathus gilberti</i>			X				X
Northern Water Dragon	<i>Lophognathus temporalis</i>							X
Ridge-tailed Monitor	<i>Varanus acanthurus</i>							X
Black-spotted Ridge-tailed Monitor	<i>Varanus baritji</i>				X			X
Long-tailed Rock Monitor	<i>Varanus glebopalma</i>						X	X
Gould's Monitor	<i>Varanus gouldii</i>			X	X			X
Merten's Water Monitor	<i>Varanus mertensi</i>	Vu		X				X
Mitchell's Water Monitor	<i>Varanus mitchelli</i>						X	X
Northern Blunt-spined Monitor	<i>Varanus primordius</i>	NT						X
Yellow-spotted Monitor	<i>Varanus panoptes</i>	Vu						X
Spotted Tree Monitor	<i>Varanus scalaris</i>	DD						X
Black-tailed Monitor	<i>Varanus tristis</i>						X	X
Two-spined Rainbow Skink	<i>Carlia amax</i>						X	X
Slender Rainbow Skink	<i>Carlia gracilis</i>							X
Striped Rainbow Skink	<i>Carlia munda</i>			X	X			X
Red-Sided Rainbow Skink	<i>Carlia rufilatus</i>							X
Three-spined Rainbow Skink	<i>Carlia tricantha</i>						X	X

Common Name	Scientific Name	NT Status	Maud Ck Mine Lease Sep 1994	Maud Ck Mine Lease May 1996	Maud Ck Access Route July 1997	Birds Australia Bird Data 2007	Cutta Cutta Caves (PWS 2000)	NRETA Data Search 2007 2km
Arboreal Snake-eyed Skink	<i>Cryptoblepharus plagiocephalus</i>						X	X
Kinghorn's Snake-Eyed Skink	<i>Proablepharus kinghorni</i>							X
Slender Snake-Eyed Skink	<i>Proablepharus tenuis</i>							X
Cogger's Ctenotus	<i>Ctenotus coggeri</i>							X
Port Essington Ctenotus	<i>Ctenotus essingtonii</i>							X
Plain Ctenotus	<i>Ctenotus inornatus</i>			X	X			X
Robust Ctenotus	<i>Ctenotus robustus</i>							X
Rock Ctenotus	<i>Ctenotus saxatilis</i>						X	
Spalding's Ctenotus	<i>Ctenotus spaldingi</i>						X	X
Leopard Ctenotus	<i>Ctenotus pantherinus</i>							X
Scant-Striped Ctenotus	<i>Ctenotus vertebralis</i>							X
Eastern Lerista	<i>Lerista orientalis</i>						X	
Griffin's Lerista	<i>Lerista griffini</i>							X
Grey's Menetia	<i>Menetia greyii</i>						X	X
Main's Menetia	<i>Menetia maini</i>						X	X
Red-Tailed Snake-Eyed Skink	<i>Morethia ruficauda</i>							X
Storr's Snake-Eyed Skink	<i>Morethia storri</i>							X
Ornate Snake-Eyed Skink	<i>Notoscincus ornatus</i>							X
Smooth-scaled Skink	<i>Glaphyromorphus isolepsis</i>						X	X
Darwin Skink	<i>Glaphyromorphus darwiniensis</i>							X
Douglas' Skink	<i>Glaphyromorphus douglasi</i>							X
Northern Blue-tongue	<i>Tiliqua scincoides intermedia</i>	DD						X
Claw-snouted Blind-snake	<i>Ramphotyphlops unguirostris</i>						X	X
Northern Blind Snake	<i>Ramphotyphlops diversus</i>							X
Robust Blind Snake	<i>Ramphotyphlops ligatus</i>							X
Top End Blind Snake	<i>Ramphotyphlops guentheri</i>							X
Black-headed Python	<i>Aspidites melanocephalus</i>							X
Children's Python	<i>Antaresia childreni</i>	DD						X
Olive Python	<i>Liasis olivaceus</i>							X
Water Python	<i>Liasis (mackloti) fuscus</i>							X
Keelback	<i>Tropidonophis mairii</i>							X
Brown Tree Snake	<i>Boiga irregularis</i>	DD					X	X
Common Tree Snake	<i>Dendrelaphis punctulatus</i>	DD		X				X
Little Spotted Snake	<i>Suta punctata</i>						X	X
Northern Shovel-nosed Snake	<i>Brachyuophis roperi</i>							X
Northern Small-eyed Snake	<i>Cryptophis pallidiceps</i>	DD						X
Olive Whip Snake	<i>Demansia olivacea</i>	DD						X

Common Name	Scientific Name	NT Status	Maud Ck Mine Lease Sep 1994	Maud Ck Mine Lease May 1996	Maud Ck Access Route July 1997	Birds Australia Bird Data 2007	Cutta Cutta Caves (PWS 2000)	NRETA Data Search 2007 2km
Greater Black Whipsnake	<i>Demansia papuensis</i>	DD		X				X
Lesser Black Whipsnake	<i>Demansia vestigiata</i>	DD						X
Orange-naped Snake	<i>Furina ornata</i>							X
King Brown Snake	<i>Pseudechis australis</i>						X	X
Ringed Brown Snake	<i>Pseudonaja modesta</i>							X
Western Brown Snake	<i>Pseudonaja nuchalis</i>							X
Wide-banded Northern Bandy-bandy	<i>Vermicella intermedia</i>							X
Northern Bandy bandy	<i>Vermicella multifasciata</i>	DD					X	X
	84	14	0	8	7	0	28	80
Birds								
Emu	<i>Dromaius novaehollandiae</i>	Vu						X
Brown Quail	<i>Coturnix ypsilophora</i>					X		X
Stubble Quail	<i>Coturnix pectoralis</i>							X
Little Button-quail	<i>Turnix velox</i>						X	X
Chestnut-backed Button-quail	<i>Turnix castanota</i>							X
Red-backed Button-quail	<i>Turnix maculosa</i>							
Plumed Whistling-Duck	<i>Dendrocygna eytoni</i>					X		X
Wandering Whistling-Duck	<i>Dendrocygna arcuata</i>							X
Radjah Shelduck	<i>Tadorna radjah</i>					X		X
Pacific Black Duck	<i>Anas superciliosa</i>					X		X
Grey Teal	<i>Anas gracilis</i>							X
Hardhead	<i>Aythya australis</i>							X
Green Pygmy-goose	<i>Nettapus pulchellus</i>							X
Magpie Goose	<i>Anseranas semipalmata</i>							X
Darter	<i>Anhinga melanogaster</i>					X		X
Great Cormorant	<i>Phalacrocorax carbo</i>					X		X
Pied Cormorant	<i>Phalacrocorax varius</i>							X
Little Pied Cormorant	<i>Phalacrocorax melanoleucos</i>					X		X
Little Black Cormorant	<i>Phalacrocorax sulcirostris</i>							X
Great Crested Grebe	<i>Podiceps cristatus</i>							X
Australasian Grebe	<i>Tachybaptus novaehollandiae</i>							X
Hoary-headed Grebe	<i>Polioccephalus poliocephalus</i>							X
White-faced Heron	<i>Egretta novaehollandiae</i>		X			X	X	X
Little Egret	<i>Egretta garzetta</i>							X
White-necked Heron	<i>Ardea pacifica</i>					X		X
Pied Heron	<i>Ardea picata</i>							X
Great-billed Heron	<i>Ardea sumatrana</i>					X		X

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Cattle Egret	<i>Ardea ibis</i>							X
Great Egret	<i>Ardea alba</i>		X			X		X
Intermediate Egret	<i>Ardea intermedia</i>					X		X
Pacific Heron	<i>Ardea pacifica</i>			X		X	X	
Black Bittern	<i>Ixobrychus flavicollis</i>	DD						X
Rufous Night Heron	<i>Nycticorax caledonicus</i>			X				X
Black-necked Stork	<i>Xenorhynchus asiaticus</i>		X			X		
Australian White Ibis	<i>Threskiornis molucca</i>					X		X
Straw-necked Ibis	<i>Threskiornis spinicollis</i>					X		X
Glossy Ibis	<i>Plegadis falcinellus</i>							X
Royal Spoonbill	<i>Platalea regia</i>					X		X
Yellow-billed Spoonbill	<i>Platalea flavipes</i>					X		X
Pacific Baza	<i>Aviceda subcristata</i>							X
Osprey	<i>Pandion haliaetus</i>					X		X
Black-breasted Buzzard	<i>Hamirostra melanosternon</i>				X	X	X	X
Black Kite	<i>Milvus migrans</i>			X		X	X	X
Whistling Kite	<i>Haliastur sphenurus</i>			X		X	X	X
Black-shouldered Kite	<i>Elanus axillaris</i>							X
Square-tailed Kite	<i>Lophoictinia isura</i>	NT						X
Spotted Harrier	<i>Circus assimilis</i>					X		X
Swamp Harrier	<i>Circus approximans</i>							X
Brown Goshawk	<i>Accipiter fasciatus</i>					X	X	X
Grey Goshawk	<i>Accipiter novaehollandiae</i>							X
Red Goshawk	<i>Erythrorhynchus radiatus</i>	Vu						X
Collared Sparrowhawk	<i>Accipiter cirrhocephalus</i>			X		X		X
White-bellied Sea-eagle	<i>Haliaeetus leucogaster</i>							X
Wedge-tailed Eagle	<i>Aquila audax</i>			X		X		X
Little Eagle	<i>Hieraaetus morphnoides</i>							X
Black Falcon	<i>Falco subniger</i>							X
Grey Falcon	<i>Falco hypoleucos</i>	NT					X	X
Brown Falcon	<i>Falco berigora</i>		X		X	X	X	X
Peregrine Falcon	<i>Falco peregrinus</i>			X				X
Australian Hobby	<i>Falco longipennis</i>			X		X		X
Nankeen Kestrel	<i>Falco cenchroides</i>							X
Brolga	<i>Grus rubicunda</i>			X		X		X
Black-necked Stork	<i>Ephippiorhynchus asiaticus</i>							X
Purple Swamphen	<i>Porphyrio porphyrio</i>							X

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Australian Bustard	<i>Ardeotis australis</i>	Vu			X	X		X
Comb-crested Jacana	<i>Irediparra gallinacea</i>							X
Bush Stone-curlew	<i>Burhinus grallarius</i>	NT				X		X
Australian Pratincole	<i>Stiltia isabella</i>						X	X
Black-fronted Dotterel	<i>Elseyornis melanops</i>					X		X
Masked Lapwing	<i>Vanellus miles</i>					X		X
Crested Pigeon	<i>Ocyphaps lophotes</i>		X	X		X	X	X
Common Bronzewing	<i>Phaps chalcoptera</i>		X	X	X		X	X
Partridge Pigeon	<i>Geophaps smithii</i>	Vu						X
Diamond Dove	<i>Geopelia cuneata</i>			X		X	X	X
Peaceful Dove	<i>Geopelia striata</i>		X	X	X	X	X	X
Bar-shouldered Dove	<i>Geopelia humeralis</i>		X	X	X	X	X	X
Pied Imperial-Pigeon	<i>Ducula bicolor</i>					X		X
Emerald Dove	<i>Chalcophaps indica</i>							X
Red-tailed Black-Cockatoo	<i>Calyptorhynchus banksii</i>		X	X	X	X	X	X
Galah	<i>Eolophus roseicapilla</i>				X	X	X	X
Sulphur-crested Cockatoo	<i>Cacatua galerita</i>		X	X	X	X		X
Cockatiel	<i>Nymphicus hollandicus</i>		X	X	X	X	X	X
Little Corella	<i>Cacatua sanguinea</i>			X				X
Red-collared Lorikeet	<i>Trichoglossus rubitorquis</i>		X	X	X	X	X	X
Varied Lorikeet	<i>Psittuteles versicolor</i>		X			X	X	X
Red-winged Parrot	<i>Aprosmictus erythropterus</i>		X	X	X	X	X	X
Northern Rosella	<i>Platycercus venustus</i>			X		X	X	X
Hooded Parrot	<i>Psephotus dissimilis</i>	NT	X	X	X			X
Budgerigar	<i>Melopsittacus undulatus</i>							X
Brush Cuckoo	<i>Cuculus variolosus</i>						X	X
Pallid Cuckoo	<i>Cuculus pallidus</i>					X	X	X
Horsfield's Bronze-Cuckoo	<i>Chalcites basalis</i>							X
Little Bronze-Cuckoo	<i>Chalcites minutillus</i>							X
Common Koel	<i>Eudynamys scolopacea</i>					X	X	X
Channel-billed Cuckoo	<i>Scythrops novaehollandiae</i>					X		X
Black-eared Cuckoo	<i>Chalcites osculans</i>							X
Pheasant Coucal	<i>Centropus phasianus</i>						X	X
Barking Owl	<i>Ninox connivens</i>					X		X
Southern Boobook	<i>Ninox novaeseelandiae</i>					X	X	X
Masked Owl	<i>Tyto novaehollandiae</i>							X
Tawny Frogmouth	<i>Podargus strigoides</i>				X	X	X	X

Common Name	Scientific Name	NT Status	Maud Ck Mine Lease Sep 1994	Maud Ck Mine Lease May 1996	Maud Ck Access Route July 1997	Birds Australia Bird Data 2007	Cutta Cutta Caves (PWS 2000)	NRETA Data Search 2007 2km
Spotted Nightjar	<i>Eurostopodus argus</i>							X
Australian Owlet-nightjar	<i>Aegotheles cristatus</i>			X	X			X
Fork-tailed Swift	<i>Apus pacificus</i>							X
Little Kingfisher	<i>Alcedo pusilla</i>							X
Azure Kingfisher	<i>Alcedo azurea</i>			X		X		X
Blue-winged Kookaburra	<i>Dacelo leachii</i>	DD	X	X	X	X	X	X
Red-backed Kingfisher	<i>Todirhamphus pyrrhopygia</i>					X	X	X
Sacred Kingfisher	<i>Todirhamphus sanctus</i>					X		X
Forest Kingfisher	<i>Todirhamphus macleayi</i>			X				X
Rainbow Bee-eater	<i>Merops ornatus</i>		X	X	X	X	X	X
Dollarbird	<i>Eurystomus orientalis</i>					X	X	X
Black-tailed Treecreeper	<i>Climacteris melanura</i>		X			X	X	X
Red-backed Fairy-wren	<i>Malurus melanocephalus</i>		X	X	X	X	X	X
Variegated Fairy-wren	<i>Malurus lamberti</i>							X
Red-browed Pardalote	<i>Pardalotus rubricatus</i>					X		
Striated Pardalote	<i>Pardalotus striatus</i>			X		X	X	X
Weebill	<i>Smicromis brevirostris</i>		X	X	X	X	X	X
Large-billed Gerygone	<i>Gerygone magnirostris</i>					X		X
White-throated Gerygone	<i>Gerygone olivacea</i>					X	X	X
Green-backed Gerygone	<i>Gerygone chloronotus</i>							X
Helmeted Friarbird	<i>Philemon buceroides</i>					X		X
Silver-crowned Friarbird	<i>Philemon argenticeps</i>		X	X	X	X	X	X
Little Friarbird	<i>Philemon citreogularis</i>				X	X	X	X
Blue-faced Honeyeater	<i>Entomyzon cyanotis</i>			X	X	X	X	X
Yellow-throated Miner	<i>Manorina flavigula</i>					X		X
Singing Honeyeater	<i>Lichenostomus virescens</i>					X		X
White-gaped Honeyeater	<i>Lichenostomus unicolor</i>			X	X	X	X	X
White-lined Honeyeater	<i>Meliphaga albilineata</i>	NT					X	
Yellow-tinted Honeyeater	<i>Lichenostomus flavescens</i>					X		X
Black-chinned Honeyeater	<i>Melithreptus gularis</i>					X	X	X
White-throated Honeyeater	<i>Melithreptus albogularis</i>		X	X	X	X	X	X
Brown Honeyeater	<i>Lichmera indistincta</i>		X	X	X	X	X	X
Rufous-throated Honeyeater	<i>Conopophila rufogularis</i>					X	X	X
Bar-breasted Honeyeater	<i>Ramsayornis fasciatus</i>						X	X
Banded Honeyeater	<i>Certhionyx pectoralis</i>					X	X	X
Dusky Honeyeater	<i>Myzomela obscura</i>							X
Jacky Winter	<i>Microeca fascians</i>		X			X	X	X

Common Name	Scientific Name	NT Status	Maud Ck Mine Lease Sep 1994	Maud Ck Mine Lease May 1996	Maud Ck Access Route July 1997	Birds Australia Bird Data 2007	Cutta Cutta Caves (PWS 2000)	NRETA Data Search 2007 2km
Lemon-bellied Flycatcher	<i>Microeca flavigaster</i>					X	X	X
Hooded Robin	<i>Melanodryas cucullata</i>					X	X	X
Buff-sided Robin	<i>Poecilodryas cerviniventris</i>	NT						X
Grey-crowned Babbler	<i>Pomatostomus temporalis</i>		X	X	X	X	X	X
Varied Sittella	<i>Daphoenositta chrysoptera</i>			X		X	X	X
Northern (Crested) Shrike-tit	<i>Falcunculus (frontatus) whitei</i>	Vu				X		X
Rufous Whistler	<i>Pachycephala rufiventris</i>		X	X	X	X	X	X
Grey Shrike-thrush	<i>Colluricincla harmonica</i>					X	X	X
Sandstone Shrike-thrush	<i>Colluricincla woodwardi</i>							X
Leaden Flycatcher	<i>Myiagra rubecula</i>		X	X	X	X	X	X
Shining Flycatcher	<i>Myiagra alecto</i>				X	X		X
Restless Flycatcher	<i>Myiagra inquieta</i>		X	X		X	X	X
Magpie-lark	<i>Grallina cyanoleuca</i>		X		X	X	X	X
Grey Fantail	<i>Rhipidura fuliginosa</i>							X
Northern Fantail	<i>Rhipidura rufiventris</i>		X	X		X	X	X
Willie Wagtail	<i>Rhipidura leucophrys</i>			X	X	X		X
Black-faced Cuckoo-shrike	<i>Coracina novaehollandiae</i>		X	X	X	X	X	X
White-bellied Cuckoo-shrike	<i>Coracina papuensis</i>			X	X	X	X	X
Cicadabird	<i>Coracina tenuirostris</i>							X
White-winged Triller	<i>Lalage sueurii</i>		X	X	X	X	X	X
Varied Triller	<i>Lalage leucomela</i>						X	
Yellow Oriole	<i>Oriolus flavocinctus</i>					X		X
Olive-backed Oriole	<i>Oriolus sagittatus</i>					X	X	X
Figbird	<i>Sphecotheres viridis</i>					X	X	X
Great Bowerbird	<i>Chlamydera nuchalis</i>		X	X	X	X	X	X
White-breasted Woodswallow	<i>Artamus leucorhynchus</i>			X	X	X	X	X
Masked Woodswallow	<i>Artamus personatus</i>			X	X	X		X
White-browed Woodswallow	<i>Artamus superciliosus</i>					X		X
Black-faced Woodswallow	<i>Artamus cinereus</i>		X	X		X	X	X
Little Woodswallow	<i>Artamus minor</i>				X	X	X	X
Pied Butcherbird	<i>Cracticus nigrogularis</i>		X	X	X	X	X	X
Silver-backed Butcherbird	<i>Cracticus argenteus</i>			X	X			X
Australian Magpie	<i>Gymnorhina tibicen</i>					X	X	X
Torresian Crow	<i>Corvus orru</i>		X	X	X	X	X	X
Apostlebird	<i>Struthidea cinerea</i>					X	X	X
Singing Bushlark	<i>Mirafrja javanica</i>							X
Richard's Pipit	<i>Anthus novaeseelandiae</i>							X

Common Name	Scientific Name	NT Status	Maud Ck Mine Lease Sep 1994	Maud Ck Mine Lease May 1996	Maud Ck Access Route July 1997	Birds Australia Bird Data 2007	Cutta Cutta Caves (PWS 2000)	NRETA Data Search 2007 2km
Crimson Finch	<i>Neochmia phaeton</i>							X
Zebra Finch	<i>Taeniopygia guttata</i>						X	X
Double-barred Finch	<i>Taeniopygia bichenovii</i>		X	X		X		X
Long-tailed Finch	<i>Poephila acuticauda</i>					X	X	X
Masked Finch	<i>Poephila personata</i>		X	X	X	X	X	X
Chestnut-breasted Mannikin	<i>Lonchura castaneothorax</i>					X		X
Yellow-rumped Mannikin	<i>Lonchura flaviprymna</i>	NT						X
Star Finch	<i>Neochmia ruficauda</i>	NT						X
Painted Finch	<i>Emblema pictum</i>							X
Gouldian Finch	<i>Erythrura gouldiae</i>	En				X		X
Mistletoebird	<i>Dicaeum hirundinaceum</i>		X			X	X	X
Fairy Martin	<i>Hirundo ariel</i>							X
Tree Martin	<i>Hirundo nigricans</i>							X
Golden-headed Cisticola	<i>Cisticola exilis</i>							X
Tawny Grassbird	<i>Megalurus timoriensis</i>							X
	189	15	40	55	42	114	77	183
Mammals								
Echidna	<i>Tachyglossus aculeata</i>				X		X	X
Northern Quoll	<i>Dasyurus hallucatus</i>	CEn					X	
Kakadu Dunnart	<i>Sminthopsis bindi</i>							X
Common Planigale	<i>Planigale maculata</i>						X	X
Long-tailed Planigale	<i>Planigale ingrami</i>							X
Sandstone False Antechinus	<i>Pseudantechinus bilarni</i>							X
Northern Brush-tailed Phascogale	<i>Phascogale pirata</i>	Vu						X
Sugar Glider	<i>Petaurus breviceps</i>				X			X
Common Brushtail Possum	<i>Trichosurus vulpecula</i>							X
Rock Ringtail Possum	<i>Petropseudes dahli</i>							X
Northern Brown Bandicoot	<i>Isodon macrourus</i>							X
Agile Wallaby	<i>Macropus agilis</i>			X				X
Antilopine Wallaroo	<i>Macropus antilopinus</i>						X	X
Euro	<i>Macropus robustus</i>			X	X		X	X
Northern Nailtail Wallaby	<i>Onychogalea unguifera</i>	NT		X				X
Spectacled Hare-wallaby	<i>Lagorchestes conspicillatus</i>	NT						X
Short-eared Rock-wallaby	<i>Petrogale brachyotis</i>						X	X
Black Flying-fox	<i>Pteropus alecto</i>							X
Little Red Flying-fox	<i>Pteropus scapulatus</i>						X	X
Ghost Bat	<i>Macroderma gigas</i>	NT						X

Common Name	Scientific Name	NT Status	Maud Ck Mine Lease Sep 1994	Maud Ck Mine Lease May 1996	Maud Ck Access Route July 1997	Birds Australia Bird Data 2007	Cutta Cutta Caves (PWS 2000)	NRETA Data Search 2007 2km
Dusky Leaf-nosed Bat	<i>Hipposideros ater</i>						X	X
Orange Leaf-nosed Bat	<i>Rhinonicteris aurantius</i>	NT					X	X
Northern Free-tail Bat	<i>Chaerephon jobensis</i>							X
Common Sheath-tail Bat	<i>Taphozous georgianus</i>						X	X
Yellow-bellied Sheath-tail Bat	<i>Saccolaimus flaviventris</i>							X
Northern Bent-wing Bat	<i>Miniopterus (schreibersii) orianae</i>						X	X
Hoary Wattled Bat	<i>Chalinolobus nigrogriseus</i>							X
Gould's Wattled Bat	<i>Chalinolobus gouldii</i>							X
Little Broad-nosed Bat	<i>Scotorepens greyii</i>						X	X
Pallid Long-eared Bat	<i>Nyctophilus bifax daedalus</i>							X
Lesser Long-eared Bat	<i>Nyctophilus geoffroyi</i>							X
Pygmy Long-eared Bat	<i>Nyctophilus walkeri</i>							X
Northern Myotis	<i>Myotis mollucorum</i>							X
Northern Cave Bat	<i>Vespadelus caurinus</i>						X	X
Little Cave Bat	<i>Vespadelus finlaysoni</i>						X	X
Common Rock Rat	<i>Zyzomys argurus</i>						X	X
Forrest's Mouse	<i>Leggadina forresti</i>						X	
Tropical Short-tailed Mouse	<i>Leggadina lakedownensis</i>							X
Delicate Mouse	<i>Pseudomys delicatulus</i>							X
Western Chestnut Mouse	<i>Pseudomys nanus</i>	NT						X
Black-footed Tree-rat	<i>Mesembriomys gouldii</i>	NT						X
Grassland Melomys	<i>Melomys burtoni</i>							X
Feral Dog/Dingo	<i>Canis lupus</i>			X	X			X
Buffalo	<i>Bubalis bubalus*</i>			X	X			X
Cattle	<i>Bos primigenius*</i>				X			X
Donkey	<i>Equus asinus*</i>				X		X	X
Pig	<i>Sus scrofa*</i>			X				X
Cat	<i>Felis catus*</i>			X				X
	48	8	0	7	7	0	17	46

Appendix 3 Site Data

Site Area Lease: Gold Creek Near Existing Mine Pit		Site Number 1
UTM Grid 53 L	Northing 225324	Easting 8401381
		
Dominant Vegetation: <i>Lophostemon grandiflorus</i> / <i>Melaleuca</i> / <i>Terminalia platyphylla</i> mid-high woodland to tall open woodland Habitat Features: Drainage line, hollows, Pandanus Last Burnt: > 3 yrs Topography: Undulating Distance to Nearest Water: Creek flowing.		Soil: Clay Loam Ground Cover: Leaf litter (40%); Bare (15%); Seasonal Grass (45%) Rock Coverage: <2% Rock Type: Alluvial Rock size: <.6cm
Site Disturbance: Heavy impacts from swamp buffalo (<i>Bubalus bubalis</i>) and signs of feral pigs (<i>Sus scrofa</i>) <i>Hyptis suaveolens</i> present.		

Site Area Lease: Western		Site Number 2
UTM Grid 53 L	Northing 223907	Easting 8402161
		
Dominant Vegetation: <i>Eucalyptus foelscheana</i> / <i>E. tectifica</i> mid-high open woodland Habitat Features: Termite mounds and woody debris Last Burnt: > 3 yrs Topography: Flat Distance to Nearest Water: Buffalo wallows and small dam with limited water present		Soil: Red/brown sandy loam Ground Cover: Leaf litter (10%); Seasonal Grass (90%) Rock Coverage: 10% Rock Type: Sandstone Rock size: 0.6-2cm/2-6cm/6-20cm
Site Disturbance: Some impacts from cattle and buffalo wallows, dense <i>Hyptis suaveolens</i> in ground cover		

Site Area Lease: Central		Site Number 3
UTM Grid 53 L	Northing 224844	Easting 8402401
		
Dominant Vegetation: Open low grassland with occasional <i>Terminalia platyphylla</i> Habitat Features: Open low grassland w. <i>Hibiscus</i> Last Burnt: > 3 yrs Topography: Flat Distance to Nearest Water: >400m		Soil: Grey/black sandy clay/clay Ground Cover: Grass (100%) Rock Coverage: 0% Rock Type: N/A Rock size: N/A
Site Disturbance: Some impacts from cattle and buffalo. Evidence of previous clearing and disturbance. Isolated <i>Hyptis suaveolens</i> + <i>Senna obtusifolia</i>		

Site Area Lease: Central, West of Existing Pit		Site Number 4
UTM Grid 53 L	Northing 224728	Easting 8401790
		
Dominant Vegetation: <i>Eucalyptus pruinosa</i> / <i>Erythrophleum chlorostachys</i> low open woodland Habitat Features: Dense black spear-grass in ground cover, few dead stags Last Burnt: > 3 yrs Topography: Flat Distance to Nearest Water: Drying buffalo wallows		Soil: Orange/brown clay-loam Ground Cover: Bare (5%)/Rocks (5%)/Seasonal Grass (90%) Rock Coverage: 5% Rock Type: Rock size: <0.6cm to 6-20cm
Site Disturbance: Some impacts from cattle grazing and buffalo wallows, 3% <i>Hyptis suaveolens</i> and disturbance on margins		

Site Area Lease: Borrow Pit		Site Number 5
UTM Grid 53 L	Northing 225539	Easting 8400616
		
Dominant Vegetation: <i>Eucalyptus foelscheana</i> / <i>E. tectifica</i> / <i>Hakea arborescens</i> mid-high open woodland Habitat Features: Termite mounds and woody debris, dense black spear-grass, hollows, fissures Last Burnt: > 3 yrs Topography: Flat Distance to Nearest Water: 200m to creek		Soil: Orange/brown sandy loam Ground Cover: Bare 10%/Rocks 10%/Seasonal Grass (80%) Rock Coverage: 10% Rock Type: Rock size: <0.6cm to 6-20cm
Site Disturbance: Some impacts from swamp buffalo, some <i>Hyptis suaveolens</i> widespread in dense patches, disturbed areas		

Site Area Proposed Haul Road		Site Number 6
UTM Grid 53 L	Northing 221456	Easting 8400043
		
Dominant Vegetation: Open woodland with limestone karst outcrops w. vine thicket species Habitat Features: Limestone karst outcrops, limestone pavement, sink holes, rock fissures, vine thicket vegetation Last Burnt: > 3 yrs Topography: Undulating Distance to Nearest Water: None present		Soil: Orange/brown sandy loam Ground Cover: Litter (25%); Bare (5%)/ Rocks (50%)/Seasonal Grass (20%) Rock Coverage: 50% Rock Type: Limestone karst formation Rock size: 60cm to 6-20cm to >2m
Site Disturbance: Cattle present, track and fence, some weeds		

Site Area Proposed Haul Road		Site Number Proposed haul road Limestone Karst
UTM Grid 53 L	Northing 220341	Easting 8397766
		
Dominant Vegetation: Open woodland with limestone karst outcrops w. vine thicket species Habitat Features: Limestone karst outcrops, limestone pavement rock fissures, vine thicket vegetation Last Burnt: > 3 yrs Topography: Flat Distance to Nearest Water: None present		Soil: Orange/brown sandy loam Ground Cover: Litter (25%); Bare (5%)/ Rocks (50%)/Seasonal Grass (20%) Rock Coverage: 50% Rock Type: Limestone karst formation Rock size: 60cm to 6-20cm to >2m
Site Disturbance: Cattle present, track and fence, some weeds. Collection site of camaenid (land snail) taxa <i>Torresitrachia weaberana</i> and undescribed genus/species (N. gen n.sp 1)		

Site Area Existing access road		Site Number Existing Access Road Limestone Karst
UTM Grid 53 L	Northing 225900	Easting 8395800
		
Dominant Vegetation: Open woodland with limestone karst outcrops Habitat Features: Limestone karst outcrops, limestone pavement rock fissures Last Burnt: > 3 yrs Topography: Flat Distance to Nearest Water: None present		Soil: Orange/brown sandy loam Ground Cover: Bare (5%)/ Rocks (55%)/Seasonal Grass (40%) Rock Coverage: 55% Rock Type: Limestone karst formation Rock size: 60cm to 6-20cm to >2m
Site Disturbance: Cattle present, track and fence, some weeds. Adjacent to main access track. Collection site of camaenid (land snail) taxa <i>Torresitrachia weaberana</i>		

Appendix 4 Climatic Data

Table 1 Survey Period Climate Data: BOM Tindal April - May 2007

Date	Temps		Rain	Max wind gust			9:00 AM					3:00 PM				
	Min	Max		Dir	Spd	Time	Temp	RH	Dir	Spd	MSLP	Temp	RH	Dir	Spd	MSLP
	°C	°C	mm	km/h		local	°C	%	km/h		hPa	°C	%	km/h		hPa
Apr-07																
28	18	35.5	0	SSE	30	14:51	27.1	60	NNE	9	1011	35	27	ESE	15	1006.5
29	19.1	35.7	0	SE	28	15:34	27.2	67	NNW	6	1011	35.3	29	ESE	13	1007.7
30	20.2	35.6	0	SE	24	15:14	27.3	75	NW	11	1013	34.2	36	SE	15	1008.9
May-07																
1	21.1	35.7	0	SE	26	14:37	27.8	69	NNW	2	1014	35.2	33	SE	17	1009.3
2	21.3	34.6	0	SE	24	14:53	28.9	66	NNE	7	1013	34.1	39	SE	13	1008.6
3	18.9	36.4	0	ESE	33	14:18	26.8	67	Calm		1012	36	25	E	13	1008.5
4	17.6	35.7	0	ESE	46	16:01	26.2	58	SSE	6	1014	35	26	E	22	1010.3
5	17.4	36	0	ESE	44	15:14	25.6	72	ESE	13	1014	35.1	25	ESE	28	1009.9
6	17.9	34.9	0	ESE	43	12:54	26.5	59	SE	9	1013	34.1	29	ESE	22	1009.7
7	17.6	33.7	0	SE	41	13:10	25.4	62	SSE	7	1014	32.6	31	ESE	20	1010.3
8	16.5	34.5	0	ESE	43	13:56	25.2	66	SE	9	1014	34	27	E	20	1010.4
9	16.5	34.6	0				25.7	48	SE	7	1014	33.6	25	E	17	1010
10												33.1	23	E	19	1009.3
11	19.5	32.3		ESE	35	12:48	26.3	58	SE	17	1014	31.2	41	ESE	13	1009.1
12	19	32.8	0	ESE	31	12:33	23.3	81	ESE	11	1015	31.8	40	SE	15	1010.6
13	19.5	32.4	0	E	31	10:01	25.3	75	E	13	1015	30.9	46	SE	17	1009.9

Table 2 Survey Period Moonrise, Moon Phase and Sunrise Data

Date	Moonrise	Moonset	Moon Phase	Sunrise	Sunset
28/04/2007	15:50:58	3:22:03		6:48:47	18:26:13
29/04/2007	16:23:17	4:06:55		6:48:59	18:25:44
30/04/2007	16:56:41	4:51:58		6:49:11	18:25:16
1/05/2007	17:31:45	5:38:09		6:49:23	18:24:48
2/05/2007	18:08:47	6:25:12	Full	6:49:36	18:24:21
3/05/2007	18:49:52	7:15:25		6:49:49	18:23:55
4/05/2007	19:35:32	8:07:23		6:50:02	18:23:30
5/05/2007	20:24:52	9:01:40		6:50:15	18:23:05
6/05/2007	21:19:02	9:56:32		6:50:29	18:22:42
7/05/2007	22:14:59	10:50:14		6:50:43	18:22:19
8/05/2007	23:12:43	11:42:00		6:50:58	18:21:57
9/05/2007		12:29:45		6:51:13	18:21:36
10/05/2007	0:09:35	13:15:09	3Q	6:51:28	18:21:15
11/05/2007	1:06:11	13:57:36		6:51:43	18:20:56
12/05/2007	2:01:51	14:38:35		6:51:59	18:20:37
13/05/2007	2:57:49	15:20:17		6:52:15	18:20:19

Latitude -14.442857°S Longitude -132.461822°E, Timezone +9.5, Central Standard Time

Appendix 5 Maud Creek Terrestrial Vertebrate Fauna Species

Appendix 5

Maud Creek Terrestrial Fauna Species

	Habitat Type	Open Woodland	Karst/Limestone Outcrops	Open Woodland	Grassland	Riparian	Route Existing	Route New	
	Canopy	Mid-high	Mid-high	Low	Low	Mid-high	Various	Various	
	Dominant Canopy Species	<i>Eucalyptus foelscheana/E. tectifica</i>	Open woodland/ vine thicket species	<i>E. pruinosa/ Erythrophleum chlorostachys</i>	Grassland/ occasional <i>T. platyphylla</i>	<i>L. grandiflorus/ Melaleuca/ Terminalia/ Pandanus</i>	Open woodland/ Limestone outcrops	Open woodland/ Limestone outcrops	No of Habitats/ Areas
Common Name	Scientific Name								
Amphibians									
Stonemason Toadlet	<i>Uperoleia lithomoda</i>	+				+			2
Ornate Burrowing Frog	<i>Limnodynastes ornatus</i>	+							1
Bilingual Froglet	<i>Crinia bilingual</i>					+			1
Giant Frog	<i>Cyclorana australis</i>						+		1
Peter's Frog	<i>Litoria inermis</i>	+				+			2
Rockhole Frog	<i>Litoria meiriana</i>					+			1
Rocket Frog	<i>Litoria nasuta</i>					+			1
Roth's Tree Frog	<i>Litoria rothii</i>				+	+			2
Desert Tree Frog	<i>Litoria rubella</i>					+			1
Tornier's Frog	<i>Litoria tornieri</i>				+	+			2
Wotjulum Frog	<i>Litoria wotjulumensis</i>					+			1
Cane Toad	<i>Bufo marinus</i>	+		+	+	+	+	+	6
	12	4	0	1	3	10	2	1	
Reptiles									
Spiny-tailed Gecko	<i>Diplodactylus ciliaris</i>		+						1
Northern Dtella	<i>Gehyra australis</i>	+	+				+	+	4
Northern Spotted Rock Dtella	<i>Gehyra nana</i>		+					+	2
Bynoe's Gecko	<i>Heteronotia binoei</i>		+				+	+	3
Marbled Velvet Gecko	<i>Oedura marmorata</i>							+	1
Burton's Snake-lizard	<i>Lialis burtonis</i>		+						1
Two-lined Dragon	<i>Diporiphora bilineata</i>	+	+	+	+		+	+	6
Yellow-sided Two-line Dragon	<i>Diporiphora magna</i>	+	+						2
Gilbert's Lashtail	<i>Lophognathus gilberti</i>	+	+			+			3
Slender Rainbow-skink	<i>Carlia gracilis</i>					+			1
Shaded-litter Rainbow-skink	<i>Carlia munda</i>	+	+	+	+			+	5
Red-sided Rainbow-skink	<i>Carlia rufilatus</i>					+			1
Desert Rainbow-skink	<i>Carlia triacantha</i>		+				+	+	3
Callose-palmed Shinning-skink	<i>Cryptoblepharus plagiocephalus</i>	+		+	+		+	+	5
Bar-shouldered Ctenotus	<i>Ctenotus inornatus</i>		+	+			+		3

	Habitat Type	Open Woodland	Karst/Limestone Outcrops	Open Woodland	Grassland	Riparian	Route Existing	Route New	
Robust Ctenotus	<i>Ctenotus robustus</i>	+		+	+	+	+		5
Children's Python	<i>Antaresia childreni</i>						+		1
Common Tree Snake	<i>Dendrelaphis punctulata</i>					+			1
	18	7	11	5	4	5	8	8	
Birds									
Pacific Black Duck	<i>Anas superciliosa</i>					+			1
Australasian Grebe	<i>Tachybaptus novaehollandiae</i>					+			1
White-necked Heron	<i>Egretta novaehollandiae</i>					+			1
White-faced Heron	<i>Ardea pacifica</i>					+			1
Black Kite	<i>Milvus migrans</i>	+			+	+	+		4
Whistling Kite	<i>Haliastur sphenurus</i>					+			1
Spotted Harrier	<i>Circus assimilis</i>				+				1
Red Goshawk	<i>Erythrorhynchus radiatus</i>	+							1
Brown Goshawk	<i>Accipiter fasciatus</i>	+	+			+		+	4
Collared Sparrowhawk	<i>Accipiter cirrhocephalus</i>							+	1
Australian Hobby	<i>Falco berigora</i>	+				+	+		3
Brown Falcon	<i>Falco longipennis</i>			+	+			+	3
Black Falcon	<i>Falco subniger</i>			+		+			2
Australian Bustard	<i>Ardeotis australis</i>			+	+	+	+	+	5
Red-backed Button-quail	<i>Turnix maculosa</i>	+	+	+					3
Bush Stone-curlew	<i>Burhinus grallarius</i>	+		+	+		+		4
Australian Pratincole	<i>Stiltia isabella</i>					+			1
Common Bronzewing	<i>Phaps chalcoptera</i>	+	+	+	+	+	+		6
Crested Pigeon	<i>Ocyphaps lophotes</i>	+		+	+				3
Diamond Dove	<i>Geopelia cuneata</i>					+			1
Peaceful Dove	<i>Geopelia striata</i>	+	+	+	+	+	+	+	7
Bar-shouldered Dove	<i>Geopelia humeralis</i>	+	+	+	+	+	+	+	7
Red-tailed Black-Cockatoo	<i>Calyptrorhynchus banksii</i>	+		+	+	+	+	+	6
Galah	<i>Eolophus roseicapilla</i>			+	+		+	+	4
Little Corella	<i>Cacatua sanguinea</i>					+			1
Sulphur-crested Cockatoo	<i>Cacatua galerita</i>	+		+	+	+	+		5
Cockatiel	<i>Nymphicus hollandicus</i>		+	+			+		3
Red-collared Lorikeet	<i>Trichoglossus rubritorquis</i>	+	+	+	+	+	+	+	7
Varied Lorikeet	<i>Psitteuteles versicolor</i>	+		+					2
Northern Rosella	<i>Aprosmictus erythropterus</i>	+		+			+	+	4
Hooded Parrot	<i>Platycercus venustus</i>	+					+	+	3
Red-winged Parrot	<i>Psephotus dissimilis</i>	+	+	+	+	+	+	+	7
Brush Cuckoo	<i>Cacomantis variolosus</i>					+	+		2
Horsfield's Bronze-Cuckoo	<i>Chrysococcyx basalis</i>	+							1

	Habitat Type	Open Woodland	Karst/Limestone Outcrops	Open Woodland	Grassland	Riparian	Route Existing	Route New	
Barking Owl	<i>Ninox connivens</i>				+				1
Southern Boobook	<i>Ninox novaeseelandiae</i>	+	+	+	+	+	+	+	7
Tawny Frogmouth	<i>Podargus strigoides</i>	+			+		+	+	4
Spotted Nightjar	<i>Eurostopodus argus</i>			+	+	+	+	+	5
Australian Owlet-nightjar	<i>Aegotheles cristatus</i>	+	+		+		+	+	5
Azure Kingfisher	<i>Alcedo azurea</i>					+			1
Blue-winged Kookaburra	<i>Dacelo leachii</i>	+		+	+	+	+		5
Forest Kingfisher	<i>Todiramphus macleayii</i>	+							1
Red-backed Kingfisher	<i>Todiramphus pyrrhopygia</i>	+			+	+			3
Sacred Kingfisher	<i>Todiramphus sanctus</i>	+					+		2
Rainbow Bee-eater	<i>Merops ornatus</i>	+	+	+	+	+	+	+	7
Dollarbird	<i>Eurystomus orientalis</i>					+	+		2
Black-tailed Treecreeper	<i>Climacteris melanura</i>							+	1
Red-backed Fairy-wren	<i>Malurus melanocephalus</i>	+	+	+	+	+	+	+	7
Striated Pardalote	<i>Pardalotus striatus</i>	+	+	+		+	+		5
Weebill	<i>Smicromis brevirostris</i>	+	+	+		+	+	+	6
White-throated Gerygone	<i>Gerygone olivacea</i>		+	+		+	+	+	5
Little Friarbird	<i>Lichenostomus flavescens</i>				+	+	+		3
Silver-crowned Friarbird	<i>Melithreptus albogularis</i>	+	+	+	+	+	+	+	7
Blue-faced Honeyeater	<i>Lichmera indistincta</i>	+							1
Singing Honeyeater	<i>Philemon citreogularis</i>							+	1
White-gaped Honeyeater	<i>Entomyzon cyanotis</i>	+	+			+	+	+	5
Yellow-tinted Honeyeater	<i>Lichenostomus virescens</i>	+	+	+		+	+	+	6
White-throated Honeyeater	<i>Lichenostomus unicolor</i>	+	+	+		+	+	+	6
Brown Honeyeater	<i>Philemon argenticeps</i>	+	+	+	+	+	+	+	7
Jacky Winter	<i>Microeca fascinans</i>		+					+	2
Lemon-bellied Flycatcher	<i>Microeca flavigaster</i>		+						1
Grey-crowned Babbler	<i>Pomatostomus temporalis</i>	+	+	+	+	+	+	+	7
Varied Sittella	<i>Daphoenositta chrysoptera</i>	+			+	+	+	+	5
Rufous Whistler	<i>Pachycephala rufiventris</i>	+	+	+	+	+	+	+	7
Grey Shrike-thrush	<i>Colluricincla harmonica</i>				+		+		2
Leaden Flycatcher	<i>Myiagra rubecula</i>	+	+		+	+	+	+	6
Restless Flycatcher	<i>Myiagra inquieta</i>	+				+	+		3
Magpie-lark	<i>Grallina cyanoleuca</i>	+	+	+	+	+	+	+	7
Northern Fantail	<i>Rhipidura rufiventris</i>	+	+			+	+		4
Willie Wagtail	<i>Rhipidura leucophrys</i>	+	+	+	+	+	+	+	7
Black-faced Cuckoo-shrike	<i>Coracina novaehollandiae</i>	+	+	+	+	+	+	+	7
White-bellied Cuckoo-shrike	<i>Coracina papuensis</i>	+	+	+	+	+	+	+	7
White-winged Triller	<i>Lalage tricolor</i>	+		+	+	+	+		5

	Habitat Type	Open Woodland	Karst/Limestone Outcrops	Open Woodland	Grassland	Riparian	Route Existing	Route New	
Olive-backed Oriole	<i>Oriolus sagittatus</i>					+		+	2
Figbird	<i>Sphecotheres viridis</i>		+					+	2
White-breasted Woodswallow	<i>Artamus leucorhynchus</i>					+			1
Black-faced Woodswallow	<i>Artamus cinereus</i>	+	+	+	+	+	+	+	7
Little Woodswallow	<i>Artamus minor</i>					+			1
Silver-backed Butcherbird	<i>Cracticus argenteus</i>						+		1
Pied Butcherbird	<i>Cracticus nigrogularis</i>	+	+	+	+	+	+	+	7
Torresian Crow	<i>Corvus orru</i>		+		+	+	+	+	5
Apostlebird	<i>Struthidea cinerea</i>		+						1
Great Bowerbird	<i>Chlamydera nuchalis</i>	+	+		+	+	+	+	6
Zebra Finch	<i>Taeniopygia guttata</i>	+					+		2
Double-barred Finch	<i>Taeniopygia bichenovii</i>	+				+	+		3
Masked Finch	<i>Poephila acuticauda</i>	+					+		2
Long-tailed Finch	<i>Poephila personata</i>			+	+	+	+		4
Chestnut-breasted Mannikin	<i>Lonchura castaneothorax</i>	+					+		2
Mistletoebird	<i>Dicaeum hirundinaceum</i>	+			+	+	+	+	5
Tree Martin	<i>Hirundo nigricans</i>					+			1
Tawny Grassbird	<i>Megalurus timoriensis</i>				+				1
	91	54	36	39	43	60	57	43	
Mammals									
Short-beaked Echidna	<i>Tachyglossus aculeatus</i>		+						1
Agile Wallaby	<i>Macropus agilis</i>					+		+	2
Antilopine Wallaroo	<i>Macropus antilopinus</i>							+	1
Common Wallaroo	<i>Macropus robustus</i>		+				+	+	3
Northern Nailtail Wallaby	<i>Onychogalea unguifera</i>			+			+	+	3
Dusky Leaf-nosed Bat	<i>Hipposideros ater</i>					+			1
Orange Leaf-nosed Bat	<i>Rhinonycteris aurantius</i>	+	+			+			3
Yellow-bellied Sheath-tail Bat	<i>Saccolaimus flaviventris</i>		+	+		+	+		4
Common Sheath-tail Bat	<i>Taphozous georgianus</i>		+			+			2
Arnhem Sheath-tail Bat	<i>Taphozous kapalgensis</i>					+			1
Northern Freetail Bat	<i>Chaerephon jobensis</i>	+		+	+	+	+	+	6
Gould's Wattled Bat	<i>Chalinolobus gouldii</i>		+			+	+	+	4
Hoary Wattled Bat	<i>Chalinolobus nigrogriseus</i>	+	+			+	+	+	5
Common Bent-wing Bat	<i>Miniopterus schreibersii</i>	+	+		+	+	+	+	6
Northern Myotis	<i>Myotis moluccarum</i>		+			+			2
Northern Long-eared Bat	<i>Nyctophilus arnhemensis</i>					+			1
Pallid Long-eared Bat	<i>Nyctophilus bifax daedalus</i>					+			1
Pygmy Long-eared Bat	<i>Nyctophilus walkeri</i>					+			1
Little Broad-nosed Bat	<i>Scotorepens greyii</i>					+			1

	Habitat Type	Open Woodland	Karst/Limestone Outcrops	Open Woodland	Grassland	Riparian	Route Existing	Route New	
Western Cave Bat	<i>Vespadelus caurinus</i>					+		+	2
Finlayson's Cave Bat	<i>Vespadelus finlaysoni</i>		+			+			2
Water-rat	<i>Hydromys chrysogaster</i>					+			1
Western Chestnut Mouse	<i>Pseudomys nanus</i>			+					1
Common Rock Rat	<i>Zyzomys argurus</i>		+						1
Dingo/Dog	<i>Canis lupus</i>		+				+		2
Donkey	<i>Equus asinus</i>			+	+	+		+	4
Cattle	<i>Bos primigenius</i>				+	+		+	3
Swamp Buffalo	<i>Bubalus bubalis</i>			+	+	+	+		4
Feral Cat	<i>Felis catus</i>						+		1
Feral Pig	<i>Sus scrofa</i>								0
	30	59	49	46	49	82	67	55	

Appendix 6 Plates



Plate 1

Cyclorana australis (Existing proposed access route)



Plate 2

Oedura marmorata (Proposed access route, limestone karst)

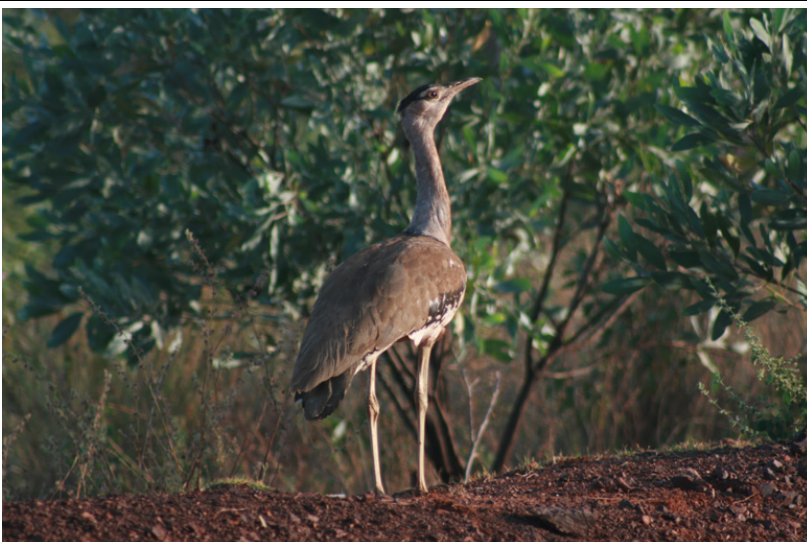


Plate 3

Australian Bustard (Pit area)



Plate 4

Red-backed button-quail (S4)



Plate 5

Australian Pratincole (Pit area)



Plate 6

Northern nailtail wallaby (Existing access route)



Plate 7

Orange Leaf-nosed Bat (S6)



Plate 8

Swamp buffalo (Gold Creek)



Plate 9

Swamp buffalo damage (Gold Creek)



Plate 10

Pulmonata: Camaenidae

New genus, new species -

Proposed haul road: H: 4.4
mm, W: 9.4 mm

V. Kessner.



Plate 11

Pulmonata: Camaenidae

Torresitrachia weaberana –

Existing access road. H: 6.2
mm, W: 10.0 mm

V. Kessner.