TERRESTRIAL FAUNA STUDY REPORT
BATCHELOR MAGNESIUM PROJECT
BATCHELOR, NORTHERN TERRITORY

Prepared For

URS Australia Pty. Ltd.
&
Mt Grace Resources NL

E·M·S ECOLOGICAL MANAGEMENT SERVICES

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EXECUTIVE SUMMARY

Survey Results

- A dry season terrestrial fauna survey was undertaken within the study area between July and August 2001. Six survey sites were systematically sampled, with observations from two additional areas. Sites were selected to represent the range of terrestrial habitats and vegetation communities and to include areas of potential impact from the proposed mining and processing activities.

- Standard biological survey techniques were used during field surveys, including a number of live capture/release trapping techniques, remote detection techniques, standard and general observational and habitat searches.

- Prior to the current assessment, fauna surveys had not been undertaken in the vicinity of the project area. Regional fauna records have been compiled in a number of databases, museum collections and survey reports, with surveys cantered primarily in the Litchfield and Adelaide River areas.

- A total of one hundred and twenty-two native terrestrial vertebrate species were recorded during field surveys in the study area. Terrestrial vertebrates recorded within the study area include six amphibian, twenty-one reptile, seventy-four bird and twenty-one native mammal species. Four introduced mammal species occur within or adjacent to the study area.

- The fauna species present within the study area during the survey period are generally common and widespread in the region, and the taxa recorded have not been listed as critically endangered, endangered or vulnerable in relevant legislation (*Territory Parks and Wildlife Conservation Act 2001;* Commonwealth *Environment Protection & Biodiversity Conservation Act 1999)*. Two of the species present within the study area, the northern quoll (*Dasyurus hallucatus*) and the pale field-rat (*Rattus tunneyi*), are listed as 'lower risk - near threatened' in the *Territory Parks and Wildlife Act 2001.*

Habitat Significance

- Based on field survey results, dry vine-forest near Coomalie Creek supports the highest terrestrial fauna species diversity (including the highest diversity for amphibians, reptiles, birds and mammals) in the study area.

- Riparian vegetation also provides habitat for a high diversity of the fauna species in the study area. The highest ground mammal abundance in the study area was recorded in this riparian habitat.

- *Melaleuca* woodland supported a significant diversity of birds and one mammal species, the dusky rat, was not recorded in any other habitat throughout the study area.

- *Lophostemon* woodland supported a significant diversity of mammals, including insectivorous bats, and one 'lower risk - near threatened' species, the northern quoll.

- *E. tetrodonta/E. miniata* woodland and mixed eucalypt woodland provides habitat for two species listed as 'lower risk - near threatened' in the *Territory Parks and Wildlife Conservation Act 2001*, the northern quoll and the pale field-rat. The pale field-rat was only recorded in this habitat type within the study area.

Management Recommendations

Management recommendations for fauna have been prepared, based on a dry season survey only and relate to the potential impacts of the proposed development, including the pit and creek diversion. Other recommendations relate to the management of significant fauna habitats, fire and feral animals.

- Development, clearing, modification or disturbance should be avoided in habitats that support the highest species diversity in the study area. These habitats include dry vine-forest and the riparian vegetation associated with Coomalie Creek.

- Habitat connectivity along Coomalie Creek should be maintained and enhanced where possible. Canopy breaks and disturbance along this riparian corridor should be minimised and the riparian area should be revegetated with the objective of re-establishing a continuous riparian corridor.

- The design of the proposed site development should minimise clearing, disturbance and indirect impacts to habitats that support two species listed under the act and habitats that support a range and diversity of fauna within the study area.

- Fauna habitat should be retained where possible and the area of the development footprint should be minimised during the design stage. Mitigation measures should aim to minimise habitat disturbance, habitat modification, the loss of vegetation cover and riparian habitats across the study area.

- The design should minimise the overall area of disturbance and reduce clearing for infrastructure associated with the project by careful planning of road networks, equipment dumps, associated works and operational areas. Impacts on the habitat value and condition should be minimised by preventing indirect impacts associated with drainage, waste contamination and the spread of weeds.

- A fire management plan should be developed and implemented to address wildlife and habitat issues in remnant and refuge habitat.

- A management program for the control of feral pigs should be considered, as feral pigs appear to be relatively common in riparian habitats in the study area. This feral animal is likely to be the most numerous and destructive introduced species in the study area.

Ecological Management Services Pty Ltd
October 2001

TERRESTRIAL FAUNA STUDY REPORT
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Prepared For
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1.0 INTRODUCTION

Ecological Management Services has been commissioned by URS Australia Pty. Ltd. to conduct a dry season fauna survey for the proposed Batchelor Magnesium Project (MLN 1984). The fauna assessment has been prepared as a component of an Environmental Impact Assessment for the proposed project. The study area is located approximately 85km south of Darwin, east of Batchelor and south of Batchelor Road.

This report documents the methodology and findings of the terrestrial vertebrate fauna survey conducted in July and August 2001, identifies significant fauna species and habitats, identifies the potential impacts and provides management recommendations for the proposal. The report has been prepared in accordance with the guidelines provided by the Department of Lands Planning and Environment (DLPE 2001).

1.1 SCOPE OF THE ASSESSMENT

The objectives of the vertebrate fauna study were to:

- Review existing terrestrial fauna data for the local area and region;
- Provide baseline data on fauna and habitats occurring within and near the study area with reference to existing information and results from field surveys;
- Describe the methodologies used to gather data, survey and sampling techniques;
- Identify the occurrence or expected occurrence of any significant wildlife species, or any sites or habitats of significance to wildlife;
- Describe feral animal species in the study area; and
- Assess the value of the study area for wildlife, both in a local and regional context.

1.2 EXISTING ENVIRONMENT

The Batchelor Magnesium Project site is located along the upper reaches of the "right branch" of Coomalie Creek, which has its headwaters near the town of Batchelor. Coomalie Creek flows a further 20 km before entering the Adelaide River downstream of Tortilla Flats. In the western portion of the Project Area, the stream is intermittent, and flows through a series of braided channels (URS 2001). Further downstream, the banks are clearly defined, and water flows appear to be nearly permanent (URS 2001). The site is characterised by alluvial plains (black soil floodplain alluvium) in the vicinity of Coomalie Creek, gently undulating plains (weathered lateritic red earth soils) and low hills and rises (weathered lateritic red and yellow soils/red brown siltstone scree) in the southern portion of the study area. Occasional rock outcrops and scree occur throughout the study area.

The vegetation in the study area has been described in the flora survey (Metcalfe 2001). Vegetation coverage is predominately *Eucalyptus* dominated woodland and open woodland/savannah. Six vegetation types have been identified by Metcalfe (2001), including *Eucalyptus tetrodonta - Eucalyptus miniata* open woodland, mixed eucalypt woodland, riparian corridor, *Lophostemon* open woodland, *Melaleuca* woodland and dry vine-forest on rock outcrops.

Fire, disturbance, agriculture and the introduction of weeds, have impacted on the condition and structure of the vegetation. Sixteen introduced species were identified in the study area, with weeds noted primarily in disturbed areas and the weed Gamba Grass identified as a serious environmental weed and fire management hazard (Metcalfe 2001).

2.0 FAUNA SURVEY METHODOLOGY

The fauna survey was designed to sample the major vegetation communities and habitat types present within the study area. Sites were selected with reference to the draft vegetation mapping (Metcalfe 2001) and the proposed mine pit, slag dump, rom pad, fines dump and plant and crusher impact areas as provided at the time of the field assessment by Mt Grace Resources NL (June 2001). Sampling was designed to provide baseline fauna and habitat data for the vegetation communities present within the study area based on the proposed site layout (Mt Grace Resources NL June 2001). Existing terrestrial fauna data for the local area was reviewed prior to conducting the field survey.

Comments regarding the potential impacts and the management recommendations have been prepared with reference to the revised proposed site layout, provided during the reporting phase of this study by Mt Grace Resources NL (September 2001) as displayed in Figure 1.

2.1 FAUNA SURVEY METHODS

A dry season survey was undertaken within the study area between July 18 and August 5, 2001. Six survey sites were systematically sampled (Figure 2). Observations from two additional areas (designated as sites 7 and 8) and the general study area were also compiled. Sites were selected to represent the range of terrestrial habitats and vegetation communities in the study area and to include areas of potential impact from the proposed mining and processing activities.

Standard biological survey techniques were used during field surveys, including a number of live capture/release trapping techniques, standard and general observational and habitat searches, as well as methods to indirectly detect the presence of terrestrial fauna. The survey focussed on terrestrial vertebrate taxa, with incidental observations aimed at identification of any significant terrestrial invertebrate species. The following survey methods were employed for the main fauna groups. A summary of the survey effort and site details is included in Table 1.

Figure 1 Proposed Site Layout

Mt Grace Resources NL September 2001

Figure 2 Fauna Survey Sites

Ecological Management Services October 2001

2.1.1 Live Capture/Release Trapping

Small mammals and reptiles were surveyed using a number of live trapping methods, conducted under Parks and Wildlife Commission of the Northern Territory Permit Number 10907. Live capture/release methods included aluminium type A Elliott box traps for small mammals, tree mounted traps for arboreal small to medium sized mammals, hair tubes for ground mammals and arboreal mammals, aluminium type B Elliot box traps for small to medium sized mammals and pitfall traps with drift fences. Elliott traps were placed at ten metre intervals along transects at survey sites (14 Elliott traps per transect) and tree traps were placed at suitable sites at 20m intervals along transects (4 tree traps per transect). Traps were baited with a standard bait mixture and were operated over a four-night period at each trap site.

Pitfall trap systems incorporated three 50cm PVC buckets with a screen drift fence (12 m long x 0.4 m high). Pitfall trapping was undertaken at 3 sites and traps were operated over four nights (36 pitfall trap nights). Pitfall traps were cleared of captures in the morning, late afternoon and during spotlight surveys. Small microchiropteran and megachiropteran bats were sampled using mist nets, harp traps and trip lines. Mist nets and harp traps were situated along potential flyways in riparian habitats and adjacent to rock outcrops, and trip lining was conducted for one hour at dusk at a number of waterbodies within the study area.

2.1.2 Avifauna

Diurnal birds were sampled using timed area searches, broad observational surveys and remote audio recording stations. Timed area searches included identification of all bird species seen or heard with 100 x 200 metre area during a 20-minute search period, commencing at dawn and including other survey periods (afternoon and dusk). Search areas were chosen to represent specific habitat/vegetation types, with each search area a minimum of 200m apart (3 x 20 minute counts per site at 8 sites). Additional bird species records were compiled incidentally, during spotlight survey and from vocalisations. Nocturnal species were recorded during spotlight surveys and identified from characteristic calls. A remote audio recorder was used to record dawn chorus birdcalls for 45 minutes from dawn at a number of sites, with birdcalls identified from the tape.

2.1.3 Microchiropteran Bat Call Detection & Trapping

Microchiropteran bat echolocation calls were recorded using ultrasonic bat call detectors (Anabat II; Titley Electronics). Anabat detection was conducted from fixed points during spotlight survey at survey sites and from remote detection points using monitor mode or delay switches. Echolocation call detection was undertaken at all systematic survey sites for a period of 30 minutes in the period between dusk and 10.00pm (30 minutes x 6 sites). In addition a remote Anabat unit was set for one night at each systematic survey site to record microchiropteran bat activity in the period from ~2200 hours to dawn. Thirty minute Anabat recordings were compiled at three additional habitat features within the study area, including major water bodies (mining pits) and two sites on the Coomalie creek corridor. Mist netting and harp trapping for small bat species (microchiropteran or small megachiropteran taxa) was undertaken at a number of suitable sites.

2.1.4 Active Searches

Active diurnal searching for reptiles, amphibians and small mammals included scanning of trees and ground, removal of cover such as rocks and fallen logs and peeling the bark from trees (1 hour per systematic site). Large mammals were recorded when encountered during trapping, bird survey and spotlight survey, and along roads and tracks throughout the study area. Observations made of wildlife recorded outside of the main sampling sites were noted according to the habitat in which they were observed.

2.1.5 Spotlight Survey

Spotlighting on foot using 50-watt spotlights and low-watt hand-held torches was undertaken in representative habitat types (1 hour per sample site over two nights between dusk and 2200 hours). Spotlight survey incorporated searching for larger species on the ground and in trees with spotlights and searches for small nocturnal mammals, reptiles and frogs on the ground, deadwood, trees and rock surfaces. Spotlighting from a slow moving vehicle was undertaken along the main tracks and gridlines between survey sites and on the boundary of the study area.

2.1.6 Hair Funnels, Scat Analysis and Signs

Hair funnels were baited and placed in trees and on the ground to target ground, scansorial and arboreal mammals at systematic survey sites throughout the study area (8 funnels x 6 sites). Each transect consisted of four ground and four tree mounted hair funnels at 20 metre intervals. Hair tubes were operated for 14 nights for a total of 672 hair funnel nights, with hair samples analysed for species identifications. Fauna species identifications were also compiled from evidence of fauna presence, including tracks, scats and other signs. Predator and other scats encountered within the study area were collected for analysis.

2.2 TAXONOMY AND NOMENCLATURE

Scientific nomenclature and common names used in this report generally follow Stanger *et al.* (1999) with the exception of recently published taxonomic revisions. Additional texts utilised for species identifications and ecological data include Cogger (2000) and Wilson & Knowles (1988) for reptiles, Slater *et al.* (1989) for birds, Strahan (1995) for mammals and Thomson (1991) and Churchill (1998) for bats.

2.3 HABITATS

Terrestrial habitats within the study area were defined with reference to topography, vegetation communities and soils. The distribution of fauna may also depend on other factors, such as the availability of open water, fire history and availability of microhabitat and other resources. These factors were considered when assessing the fauna habitats present.

Six vegetation communities have been identified within the study area and are described in detail in the flora component of EIS (Metcalfe 2001). The vegetation consists of eucalypt dominated woodland, *Lophostemon* woodland, *Melaleuca* woodland, riparian vegetation and dry vine-forest on rocky outcrops. Anthropogenic activities within the study area have created a number of artificial habitats, including mine pits, tailings areas, plant areas and artificial dams. A summary of the habitats and the trapping methods used at sample sites within the study area is included in Table 1. Site locations are shown in Figure 2.

TABLE 1
FAUNA SURVEY SITE LOCATIONS AND EFFORT

Survey methods: A = Hair funnel nights; B = Ground/tree mounted trap nights; C = Anabat survey hours (fixed point); D = Anabat survey hours (remote detection); E = Pitfall trap nights; F = Harp trap nights; G = Mist net hours; H = trip line hours (microbats); I = Spotlight survey hours; J = Timed area bird observations; K = remote audio recording sessions (45 minutes); L = Diurnal active search hours

Site	Location/ Proposed Mine Site Feature	UTM Coords	Habitat Type	Landform/ Geology	A	B	C	D	E	F	G	H	I	J	K	L
T1	Slag Dump, Waste Dump, Flood Channel Rom Pad	52 7 **24** 104 E 85 **56** 230 N	2. Mixed eucalypt woodland	Gently undulating plain/Weathered lateritic red earth soils	112	68	0.5	~6	-	-	-	-	1	1	-	0.5
T2	Plant & Crusher, Fines Storage and Diversion Channel	52 7 **24** 186 E 85 **56** 376 N	1. *E. tetrodonta/E. miniata* open woodland	Gently undulating plain/Weathered lateritic red earth soils	112	68	0.5	~6	12	-	-	-	1	1	-	0.5
T3	Coomalie Creek, Pit and Diversion Bund	52 7 **23** 423 E 85 **56** 881 N	3. Riparian corridor	Alluvial plain and creek margins/ Black soil floodplain alluvium	112	68	0.5	~6	12	3	2	2	1	1	-	0.5
T4	Flood Channel & Bund, Pit Diversion Bund	52 7 **23** 615 E 85 **56** 944 N	4. *Lophostemon* open woodland	Alluvial plain with shallow open drainage depression/Black soil floodplain alluvium	112	68	0.5	~6	-	1	-	-	1	1	-	0.5
T5	ROM Pad	52 7 **24** 242 E 85 **56** 716 N	5. *Melaleuca* woodland	Alluvial plain with shallow open drainage depression/Black soil floodplain alluvium	112	68	0.5	~6	-	-	-	-	1	1	1	0.5
T6	'Janie Rocks' Sacred Site 0087	52 7 **24** 281 E 85 **56** 966 N	6. Dry vine-forest on rock outcrops/ riparian corridor	Alluvial plain, creek margins, with dolomite outcrops	112	68	0.5	~6	12	2	2	-	1	1	1	0.5
T7	Flood Channel	52 7 **22** 993 E 85 **56** 215 N	*Melaleuca* woodland/ riparian corridor/mine pit/rock outcrops	Alluvial plain with shallow open drainage depression/Black soil floodplain alluvium/Magnesite - dolomite outcrops			0.5			2	6	-	1	1	-	0.5
T8	Southern component of study area, Waste & Slag Dump	52 7 **23** 533 E 85 **55** 650 N	Mixed eucalypt woodland to open forest/rock outcrops and scree	Low hills and rises/weathered lateritic red and yellow soils/red brown siltstone scree			0.5			-	-	-	1	1	-	0.5
				Total	**672**	**408**	**4**	**~36**	**36**	**10**	**10**	**2**	**8**	**8**	**2**	**4**

3.0 TERRESTRIAL FAUNA SURVEY RESULTS

3.1 PREVIOUS STUDIES AND EXISTING TERRESTRIAL FAUNA DATA

Prior to the current assessment fauna surveys have not been undertaken in the vicinity of the project area. Regional fauna records have been compiled in a number of databases, museum collections and survey reports, with surveys primarily located in the Litchfield and Adelaide River areas. Griffiths *et al.* (1997) provides a detailed summary of historical biological surveys in the region. Regional fauna data includes surveys within the Litchfield National Park and adjacent areas, including Parks & Wildlife Commission surveys by McKean & Martin (1984) and Griffiths *et al.* (1997), impact assessment surveys for the Union Reef Gold Mine EIS (ERA Environmental Services 1993) and surveys in the Mount Bundey area (Griffiths *et al.* 1997). Griffiths *et al.* (1997) also provide regional records for fauna from the Royal Australian Ornithological Society database, records from collections of various Museums and records held in the Biological Records Scheme of the Northern Territory.

3.2 FAUNA SURVEY RESULTS FOR THE STUDY AREA

A total of one hundred and twenty-two native and four introduced terrestrial vertebrate species were recorded during field surveys in the study area (Appendix A). Terrestrial vertebrates recorded within the study area include six amphibian, twenty-one reptile, seventy-four bird and twenty-one native mammal species. Four introduced mammal species occur within or adjacent to the study area.

3.2.1 Amphibians

Six native amphibian species were observed within the study area, including representatives of two families (Myobatrachidae; Hylidae). During the survey period amphibian species were generally associated with wetter microhabitats within the areas sampled, including drainage areas, creek margins and in the vicinity of other water-bodies and mine pits. Species most frequently observed during the survey include the bilingual frog (*Crinia bilingua*), javelin frog (*Litoria microbelos*), striped rocket frog (*Litoria nasuta*) and the wotjulum frog (*Litoria wotjulumensis*). The majority of amphibians were encountered during spotlight survey on creek and waterbody margins, with two species (*Crinia bilingua* and *Litoria nasuta*) captured in pitfall traps on the

margin of Coomalie Creek (Site 3). At the time of survey the amphibian species richness and abundance was highest at sites along Coomalie Creek and within *Lophostemon* woodland associated with this drainage line. It is likely that wet season surveys would record additional amphibian species within the study area.

3.2.2 Reptiles

Twenty-one reptile species were identified during the survey, including representatives of seven families. The reptile taxa identified included four gecko (Gekkonidae), three dragon lizard (Agamidae), three monitor (Varanidae), eight skink (Skincidae), one python (Boidae) and one elapid snake (Elapidae) species. Pitfall traps captured five skink species and one dragon lizard (*Diporiphora bilineata*). One reptile species, the Mitchell's water monitor (*Varanus mitchelli*), was captured in an Elliott trap set on the margins of Coomalie Creek. The majority of the reptiles identified within the study area were encountered during active searches of habitats during the day, during spotlight survey and incidentally within bushland areas and rock outcrops.

Reptile species richness and abundance was highest at Site 6, which reflects the variety of microhabitat (creek margins, rock outcrops, vine-forest on rocks and open forest) and the presence of permanent water at this site. Survey sites that included riparian habitats and fringing habitats associated with Coomalie Creek supported high reptile abundance and species richness when compared to sites situated in open forest and woodland sites. A number of reptile species, including *Gehyra nana, Diporiphora albilabris* and *Liasis olivaceus*, were associated with rock outcrops and scree areas.

The Merten's water monitor (*Varanus mertensi*), Mitchell's water monitor (*Varanus mitchelli*), swamplands lashtail (*Lophognathus temporalis*) and the freshwater crocodile (*Crocodylus johnstoni*) were recorded in riparian forest and instream habitat on Coomalie Creek and/or in and around water filled test and mine pits in the local area. Reptile species frequently observed in dry open forest and woodlands within the study area include *Heteronotia binoei*, *Oedura rhombifer, Diporiphora bilineata, Carlia munda* and *Menetia greyii.*

3.2.3 Avifauna

Seventy-four bird species were observed within the study area during the survey period (Appendix A). This figure represents approximately 36% of the bird species known from the region (Griffiths *et al.* 1997). Bird species richness is relatively high given the limited duration of the survey, absence of seasonal sampling and nature and extent of the habitats present. The majority of the species (n~60) primarily inhabit dry open forest and woodland habitats and are widely distributed in northern Australia. The remaining species include birds

associated with wetlands and freshwater habitats and a limited number of species that primarily occur in riparian forests and vine thickets.

Open *Eucalyptus tetrodonta - Eucalyptus miniata* and mixed eucalypt forest and woodlands displayed a low richness and abundance of birds during the survey period when compared to riparian vegetation, dry vine-forest remnants, *Melaleuca* woodland and vegetation associated with permanent water.

The highest number of bird species at any survey site (n = 36) was recorded in mixed eucalypt forest, vine thicket and riparian/wetland habitat at site 6, and other sites on Coomalie Creek (sites 3 and 7) registered high numbers of bird species (29 and 26 species respectively). These results are indicative of the importance of riparian habitat and forests adjacent to permanent water for birds in the dry season. While fewer species were recorded at sites some distance from the main drainage line these areas supported significant numbers of forest birds. A number of waterbirds were observed on the larger pools on Coomalie Creek and at mining pits within the local area.

Three nocturnal bird species, the tawny frogmouth (*Podargus strigoides*), southern boobook owl (*Ninox boobook*) and the barking owl (*Ninox connivens*), were recorded during spotlighting within the study area. While five diurnal raptor species were recorded across the study area, only two species (the black kite *Milvus migrans* and the brown goshawk *Accipiter fasciatus*) were commonly encountered.

3.2.4 Mammals

Twenty-five mammal species were identified during the survey, including representatives of fourteen families and four introduced (exotic) taxa (Section 3.3). Microchiropteran bats (eight species) and rodents (five species) were the most species rich mammal groups within the study area. Mammals were identified using live capture/release, characteristic tracks and signs, scat and hair analysis, call identification, observations during spotlight surveys and from diurnal observations. Hair and scat analysis identified a number of species that were not recorded using other survey methods.

Two dasyurid species, the northern quoll (*Dasyurus hallucatus*) and the red-cheeked dunnart *(Sminthopsis virginiae nitela*), were identified within the study area. The northern quoll was captured in Elliott traps and identified from hair analysis/scats at a number of sites in a range of habitats, including *E. tetrodonta/E. miniata* and mixed species eucalypt woodland (Site 1 and Site 2), *Lophostemon* woodland (Site 4) and vine thicket on rock outcrops (Site 6). The red-cheeked dunnart *(Sminthopsis virginiae nitela)* was present in grassland adjacent to magnesite/dolomite outcrops at Janie Rocks (Site 6).

The northern brown bandicoot *(Isoodon macrourus)* was common in all habitats within the study area, and was frequently recorded during spotlight survey, from hair analysis, from Elliott trap captures and was occasionally flushed from dense grass during diurnal surveys. Diggings and tracks characteristic of this species were noted at a number of sites, and diggings were common in riparian areas and black soil floodplain areas.

Five native murid (rodent) species were recorded within the study area. The grassland melomys (*Melomys burtoni*) was the most commonly captured rodent, and was observed or captured in the riparian corridor along Coomalie Creek (Site 3), *Lophostemo*n woodland in the vicinity of the existing pit (Site 4) and in dry vine-forest south of Janie Rocks (Site 6). The common rock-rat (*Zyzomys argurus*) was common in dry vine thicket on rocky outcrops in the vicinity of Janie Rocks (Site 6), and burrows, runs and caches of *Terminalia microcarpa* seeds attributed to this species were noted in the vicinity of the rocks. The pale-field rat (*Rattus tunneyi*) was captured in *E. tetrodonta/E. miniata* woodland (Sites 1), and characteristic burrows and runs were noted throughout *E. tetrodonta/E. miniata* woodland and mixed eucalypt woodland habitats. The dusky rat (*Rattus colletti)* was less common and appears to be restricted to floodplain areas dominated by grassy understorey and *Melaleuca* woodland (Site 5).

Two species of macropod were recorded within the study area. The agile wallaby (*Macropus agilis*) was recorded in mixed eucalypt woodland and *Melaleuca* woodland (Sites 1 & 7). The antilopine wallaroo (*Macropus antilopinus*) was also recorded in *E. tetrodonta/E. miniata* woodland (Site 2) and riparian forest (Site 3). These species are likely to be widespread in the local area and tracks and scats indicated frequent utilisation of riparian and upland forest habitats.

The dingo (*Canis lupus dingo*) was recorded in the study area from direct observations and indirect methods (tracks, scats) in woodland communities. The small number of dingo/dog scats obtained within the study area at sites 4 and 6 contained northern brown bandicoot hairs, indicating that bandicoots may be locally important prey.

Survey using bat echolocation call detection and analysis recorded eight species. Species recorded include the yellow-bellied sheathtail bat (*Saccolaimus flaviventris*), northern freetail-bat (*Chaerephon jobensis*), Beccari's freetail-bat (*Mormopterus beccarii*), Gould's wattled bat (*Chalinolobus gouldii*), northern bentwing bat (*Miniopterus oceanensis*) and the pygmy long-eared bat (*Nyctophilus walkeri*). The most common call type within the study area has been assigned to either the hoary wattled bat (*Chalinolobus nigrogriseus*) or the little broad-nosed bat (*Scotorepens greyi*). Calls from Top End populations of these two taxa cannot be confidently separated (D. Milne *pers com.* 2001). A number of additional calls characteristic of long-eared

bats (*Nyctophilus sp.*) could not be identified to species level and may represent one or more additional bat species within the study area. In addition to the pygmy long-eared bat, three *Nyctophilus* species that cannot be separated by echolocation call characteristics occur in similar habitats in the Top End (*Nyctophilus bifax, Nyctophilus geoffroyi* and *Nyctophilus arnhemensis*).

Mammal species present within the study area during the survey period are generally common and widespread in the region, and none of the taxa recorded are listed as endangered or vulnerable by relevant conservation legislation (*Territory Parks and Wildlife Conservation Act 2001*; Commonwealth *Environment Protection & Biodiversity Conservation Act* 1999). Two of the species present within the study area, the northern quoll (*Dasyurus hallucatus*) and the pale field-rat (*Rattus tunneyi*), are listed as 'lower risk - near threatened' in the *Territory Parks and Wildlife Conservation Act 2001* (*TPWC Act 2001*).

3.3 INTRODUCED SPECIES

Three introduced vertebrate fauna species, the feral horse (*Equus caballus*), feral cat (*Felis catus*) and feral pig (*Sus scofra*), were recorded during field surveys within the study area. An additional species, the feral European cattle (*Bos taurus*), also occurs in the local area. The dingo (*Canis lupus dingo*) was observed within the study area, and it is likely that feral or domestic dogs (*Canis lupus familiaris*) also occur within the local area.

Feral pigs appear to be relatively common within the study area, with signs and tracks indicating frequent use of riparian habitats. Signs of disturbance caused by feral pigs was noted at all sites associated with permanent water or major drainage lines, and this species is likely to be the most numerous and significant introduced species in the local area. Small numbers of feral horse are known to occur in the local area and signs of the presence of this species were noted in riparian vegetation in the vicinity of Site 7. One feral cat was observed on the main access track during spotlight survey and this species is expected to be moderately common in the local area.

4.0 SIGNIFICANT TERRESTRIAL FAUNA SPECIES AND HABITATS

4.1 REGIONAL SETTING

The majority of the species recorded within the study area are widespread in either tropical northern Australia or other areas of the Australian mainland, while a small number of species are restricted to the region or have disjunct populations in northern Australia. None of the invertebrate species listed in the *Territory Parks and Wildlife Conservation Act 2001* were observed within the study area during the field survey.

4.2 SIGNIFICANT TERRESTRIAL FAUNA SPECIES

4.2.1 Definitions

Relevant legislation includes the *Territory Parks and Wildlife Conservation Act 2001* (Parks & Wildlife Commission of the Northern Territory 2001) and the Commonwealth *Environment Protection & Biodiversity Conservation Act 1999* (*EPBC Act 1999)*(Commonwealth of Australia 1999). Action plans for particular fauna groups were also reviewed, including Cogger *et al.* (1993) for reptiles, Tyler (1997) for frogs, Maxwell *et al.* 1996) for marsupials and monotremes, Duncan *et al.* (1999) for bats and Garnett & Crowley (2000) for birds.

4.2.2 Amphibians

The frog species recorded within the study area are predominantly species which have their known distribution centred on the sub-humid tropical and semi-arid tropical regions of northern Australia, including the Top End, the Kimberly region of western Australia and the southern western Gulf of Carpentaria. The amphibians recorded within the study area are generally common and widespread throughout areas of the western Top End and have been recorded in conservation reserves in the region. Griffiths *et al*. (1997) note the presence of one significant amphibian, the microhylid frog *Sphenophryne adelphe*, within the Litchfield area. This species was not recorded within the study area. None of the amphibian species recorded within the study area are listed as significant (*TPWC Act 2001*; *EPBC Act* 1999; Tyler 1997).

4.2.3 Reptiles

Habitats within the study area support reptile species that are generally common in the region, and none of the taxa recorded are considered to be regionally significant (Griffiths *et al.* 1997) or threatened by relevant conservation authorities (*TPWC Act 2001*; *EPBC Act 1999*; Cogger *et al.* 1993).

4.2 4 Avifauna

Bird species present within the study area during the survey period are generally common in the region, and none of the taxa recorded are considered to be regionally significant (Griffiths *et al.* 1997) or threatened by relevant conservation authorities (*TPWC Conservation Act 2001*; *EPBC Act 1999*; Garnett & Crowley 2000). Existing regional records for birds listed as 'vulnerable' in the *Territory Parks and Wildlife Conservation Act 2001* and/or the Action Plan for Australian Birds (Garnett & Crowley 2000) include the Gouldian finch (*Erythrura gouldiae*), partridge pigeon (*Geophaps smithii*) and the painted snipe (*Rostratula benghlensis*). The Gouldian finch is known to occur in the southwest of Litchfield National Park (Griffiths *et al.* 1997) habitat within the study area is likely to be unsuitable for this species. A number of birds that may be regionally uncommon were recorded within the study area, including the red-backed button-quail (*Turnix maculosa*) and the black-breasted buzzard (*Hamirostra melanosternon*).

Partridge Pigeon *(Geophaps smithii smithii)* Vulnerable

Although the partridge pigeon was not recorded in the field survey, this species is considered likely to make occasional use of woodland habitats within the area as it is locally common in Litchfield National Park and widespread in the region (Griffiths *et al.* 1997). The partridge pigeon has undergone severe range contraction from the western, eastern and southern components of its former distribution, and this decline may be ongoing (Garnett & Crowley 2000). Its current range is restricted to sub-coastal areas of northern Northern Territory, principally from Kakadu and between Katherine and Darwin, and in the Daly and Finniss River catchments (Garnett & Crowley 2000). Habitat is mainly mixed eucalypt woodland and *E. tetrodonta/E. miniata* woodland and forest with a structurally diverse understorey (Garnett & Crowley 2000). The major threat to the partridge pigeon is the alteration of fire regimes and intensity, with late season fires, which promote uniform regeneration of vegetation causing loss of suitable habitat (Garnett & Crowley 2000).

4.2.5 Mammals

Mammal species present within the study area during the survey period are generally common and widespread in the region, and none of the taxa recorded are listed as critically endangered, endangered or vulnerable by relevant conservation legislation (*TPWC Act 2001; EPBC Act 1999*). Two species present within the study area, the northern quoll (*Dasyurus hallucatus*) and the pale field-rat (*Rattus tunneyi*), are listed as 'lower risk - near threatened' in the *Territory Parks and Wildlife Conservation Act 2001.*

Northern Quoll (*Dasyurus hallucatus*) Lower Risk - Near Threatened

Local records for the northern quoll indicate that this species is widespread in the region, with records from Litchfield NP, Tipperary, Elizabeth Downs and Mt Bundey Stations and Pethericks rainforest (Griffiths *et al.* 1997). Although the northern quoll is considered locally common and widespread in the Litchfield area its distribution in Northern Australia has been substantially reduced, becoming increasingly restricted and disjunct (Braithwaite & Griffiths 1994). Analysis of its distribution indicates a 75% range reduction in northern Australia and possible causes for decline and/or potential threats include impacts associated with grazing, the expansion of the cane toad and exotic disease (Braithwaite & Griffiths 1994). Research suggests that this substantial reduction in range is directly related to habitat disturbance, suggesting that this species cannot maintain populations in sub-optimal environments that have been disturbed (Griffiths *et al.* 1997).

The northern quoll (Plate 7) was recorded in four habitat types within the study area, *E. tetrodonta/E. miniata* woodland to open forest, mixed eucalypt woodland, *Lophostemon* woodland and dry vine-forest on rocky outcrops. Disturbance to these woodland, open forest and dry vine-forest communities is likely to have an impact on the habitat quality for the northern quoll within the study area.

Pale Field-rat (*Rattus tunneyi*) Lower Risk - Near Threatened

Regional records for pale field-rat include Litchfield NP, Tipperary, Elizabeth Downs Stations and Pethericks rainforest (Griffiths *et al.* 1997). Although the pale field-rat is locally common and widespread in the Litchfield area, Museum records indicate a contraction in its overall distribution in the last 100 years. An decline in distribution of 85% has reduced its distribution from a continental distribution to fragmented distribution, with the north-western and central east coast of Australia/southern Queensland coast, remaining as the most significant habitat and/or refuge habitat (Braithwaite & Griffiths 1996). Impacts primarily relate to habitat modification, loss of local refuges, loss of vegetation cover, and impacts associated with the low level of

groundwater reducing the availability of refuge riparian habitat, the additional impact of introduced mammals including grazing impacts and soil compaction (Braithwaite & Griffiths 1996; Watts & Aslin 1981).

The Pale-field rat was recorded in mixed eucalypt woodland and *E. tetrodonta/E. miniata* woodland. Hair tube records and observations of characteristic burrows and runs indicate that it is relatively common in these habitats across the study area.

Brush-tailed Phascogale (northern mainland) (*Phascogale tapoatafa pirata*) Lower Risk - Near Threatened

The 'northern' brush-tailed phascogale (*Phascogale tapoatafa pirata*) occurs in habitat across the northern Australia, from the Kimberly region to Cape York Peninsula. In the Top End there are few recent records for this species, with specimens collected from the Pellew Islands, Kakadu NP and Litchfield NP (Maxwell *et al.* 1996). Griffiths *et al.* (1997) collected one individual within Litchfield NP and states that it is uncommon in the Park. The Parks and Wildlife Commission also recorded the brush-tailed phascogale in bushland to the west of the study area prior to the area being cleared.

Suitable habitat for this species occurs across the study area. The majority of recent records in the Top End are from tall open forest of *Eucalyptus tetrodonta - Eucalyptus miniata* forest (Maxwell *et al.* 1996). All sightings are from drier forest types although there are records from riparian/woodland interface and deciduous vine thicket (Maxwell *et al.* 1996). The typical home range for individuals of this species is large (up to 150 hectares for males), suggesting that a local population is likely to utilise habitat within the study area.

Threats to the brush-tailed phascogale include bushland clearance and changes to frequency and intensity of fires (Maxwell *et al.* 1996). Maxwell *et al.* (1996) and the Parks and Wildlife Commission (2001) list the northern subspecies *Phascogale tapoatafa pirata* as 'lower risk - near threatened'. The conservation status for this species may be revised due to recent genetic and morphological analysis indicating that the northern phascogale is a distinct species (*Phascogale pirata*).

4.3 SIGNIFICANCE OF HABITATS TO TERRESTRIAL WILDLIFE

4.3.1 Dry Vine-Forest on Rock Outcrops

Small areas of dry vine-forest occur in association with dolomite, rock and scree outcrops within the study area (Plate 6). At some sites, larger areas of this vegetation type occur (Site 6), while at other sites fire has reduced this vegetation to a number of remnant trees associated with larger rock outcrops. Based on field survey results, dry vine-forest in the vicinity of Coomalie Creek supports the highest terrestrial fauna species diversity (including the highest diversity for reptiles, birds and mammals) in the study area. A range of fauna species were associated with this habitat type during the survey period, including saxicoline taxa such as the common rock rat (*Zyzomys argurus*) and the northern spotted rock dtella (*Gehyra nana*), and several birds associated with vine-forest. These areas are likely to act as significant refuge for open forest and woodland species and may be seasonally significant to particular species.

4.3.2 Riparian and Floodplain Woodland

Riparian and floodplain woodland represent a restricted habitat distinct from the eucalypt dominated communities that cover a large percentage of the study area. These communities, although limited in size, support unique microhabitats, act as refuge habitat and facilitate movement of fauna species in the local landscape. Field surveys indicated that these areas supported a high percentage of the fauna species observed within the study area, a result indicative of the significance of this habitat to wildlife during the dry season. These floodplain communities mapped as drainage areas by Metcalfe (2001) consists of riparian vegetation, *Lophostemon* woodland and *Melaleuca* woodland.

Riparian vegetation provides habitat for a high percentage of the fauna species in the study area and a significant diversity of species was recorded in this habitat during the field survey. The highest species diversity, particularly for birds and reptiles within these floodplain communities, was recorded in the riparian corridor (Plate 3). The highest ground mammal abundance in the study area was also recorded in riparian vegetation.

Melaleuca woodland (Plate 5) supported a significant diversity of birds and one mammal species, the dusky rat, which was not recorded in any other habitat in the study area. *Lophostemon* woodland (Plate 4)

supported a significant diversity of mammals including one 'near threatened' species, the northern quoll. The highest diversity of insectivorous bats within these floodplain communities was recorded in this habitat.

4.3.3 Eucalypt Dominated Communities

E. tetrodonta/ E. miniata woodland and mixed eucalypt woodland communities (Plates 1 & 2) are the most extensive habitat types in the study area and support a diverse range of forest mammals, birds and reptiles. This vegetation also provides habitat for two species listed as 'lower risk - near threatened' in the *Territory Parks and Wildlife Conservation Act 2001,* the northern quoll (*Dasyurus hallucatus*) and the pale field-rat (*Rattus tunneyi*). The pale field-rat was only recorded in this habitat type within the study area.

In addition a number of significant species that are known to occur in the local area, including the brush-tailed phascogale and the partridge pigeon, are considered likely to make occasional or more frequent use of woodland habitats within the study area. Within the study area, these communities displayed an apparent absence of arboreal marsupials that is potentially related to past clearing and fire regimes. However these areas of forest represent significant habitat for a range of bird, bat, reptile and ground/scansorial mammal species and are likely to attract larger numbers of birds and bats during mass flowering of canopy trees.

5.0 POTENTIAL IMPACTS AND MANAGEMENT RECOMMENDATIONS

5.1 POTENTIAL IMPACTS

A number of potential impacts on fauna have been identified, particularly in relation the proposed development and the impacts of the pit and creek diversion on terrestrial fauna and significant fauna habitats. The potential impacts are outlined below.

Impacts on habitats with the highest species diversity in the study area

The primary impact of the proposed development includes clearing, modification and disturbance to habitats that support the highest species diversity in the study area. Habitats that support the highest fauna species diversity include dry vine-forest and riparian vegetation associated with Coomalie Creek. Although the current proposed site layout (Figure 1, September 2001) does not impact on dry vine forest near Coomalie Creek, the proposed development consists of a pit, creek diversion and diversion bund in the Coomalie Creek riparian corridor.

Major impacts associated with this proposal include the loss of riparian habitat and severance to the riparian corridor and habitat connectivity along the Coomalie Creek corridor, downstream habitat disturbance and modification to the natural hydrology. The pit, creek diversion and bund will impact on approximately 1200m of riparian vegetation (Metcalfe 2001) and the inundation and redirection of creek flow will have a direct impact on the habitat quality, condition and the availability of significant riparian habitat for fauna.

Impacts on other fauna habitats in the study area

Impacts relate to clearing, modification and disturbance associated with the proposed development will also impact on other significant fauna habitats in the study area. These habitats include *Melaleuca* woodland and *Eucalyptus tetrodonta* - *Eucalyptus miniata* woodland, mixed eucalypt woodland and *Lophostemon* woodland.

The pit, diversion bund, flood channel and bund, waste and slag dumps, rom pad, plant and crusher and fines storage will impact on these habitats and the inundation and redirection of creek flow will have a direct impact on the habitat quality, condition and the availability of these habitat types for fauna.

The loss of a large percentage of habitat will also occur in the southern component of the study area associated with the waste and slag dumps located in eucalypt woodland communities. The proposed development will significantly reduce the area of this habitat type, having a direct impact on the availability of this habitat for fauna. The waste and slag dumps are also likely to have an impact on the habitat quality and condition of the remaining habitats in surrounding areas.

Impacts on habitats that support species listed under the *TPWC Act 2001*

Clearing, modification or disturbance to habitats that support two fauna species, the northern quoll (*Dasyurus hallucatus*) and the pale field-rat (*Rattus tunneyi*), listed as 'lower risk - near threatened' in the *Territory Parks and Wildlife Conservation Act 2001.*

Significant habitats in the study area for the northern quoll includes *Eucalyptus tetrodonta - Eucalyptus miniata* woodland, mixed eucalypt woodland and *Lophostemon* woodland. As the northern quoll cannot maintain populations in sub-optimal environments that have been disturbed, the proposed development and associated habitat disturbance to these woodland communities, is likely to have an impact on the habitat quality, population and distribution of the northern quoll within the study area. Impacts associated with the pit and creek diversion may also affect this population, as Strahan (1995) states that the most successful breeding for this species occurs near creeklines.

Although the Pale-field rat was only recorded in eucalypt woodland, characteristic burrows and runs indicate that it is relatively common in this habitat across the study area. Impacts of the proposed development primarily relate to the loss of vegetation cover and refuge riparian habitat, habitat modification, soil compaction and the loss of refuge habitat in the local area.

General Impacts

General impacts include the clearing, modification and disturbance to several fauna habitat types during the construction and operational phases of the project associated with and surrounding the mining pit, creek diversion, flood channel, settling ponds, waste and slag dumps, rom pad, plant and crusher, fines storage and diversion channel. Impacts also include the clearing of refuge habitat for fauna and impacts to the structure and condition of vegetation from controlled fires.

5.2 MANAGEMENT RECOMMENDATIONS

Management recommendations for fauna have been prepared, based on a dry season survey only and relate to the potential impacts of the proposed development, including the pit and creek diversion. Other recommendations relate to the management of significant fauna habitats, fire and feral animals.

Habitats with the highest species diversity in the study area

Development, clearing, modification or disturbance should be avoided in habitats that support the highest species diversity in the study area. These habitats include dry vine-forest and the riparian vegetation associated with Coomalie Creek. Habitat connectivity along Coomalie Creek should be maintained and enhanced where possible. Canopy breaks and disturbance along this riparian corridor should be minimised and the riparian area should be revegetated with the objective of re-establishing a continuous riparian corridor.

Other Fauna Habitats within the study area

The design of the proposed site development should minimise clearing, disturbance and indirect impacts to habitats that support a range and diversity of fauna within the study area, including the *Melaleuca* woodland, eucalypt woodland and *Lophostemon* woodland communities.

Habitats that support species listed under the *TPWC Act 2001*

Fauna habitat should be retained where possible and the area of the development footprint should be minimised during the design stage. The proposed layout, construction and operational phases of the project should aim to minimise habitat disturbance to woodland, open forest and dry vine-forest communities that support the northern quoll and minimise habitat modification, the loss of vegetation cover and riparian habitats across the study area.

During the construction and operational phases of the project, habitat should be protected from disturbance, in order to maintain habitat values in surrounding areas associated with the mining pit, waste and slag dumps, rom pad, plant and crusher and fines storage. The design should minimise the overall area of disturbance and reduce clearing for infrastructure associated with the project by careful planning of road networks, equipment dumps, associated works and operational areas. Impacts on the habitat value and

condition should be minimised by preventing indirect impacts associated with drainage, waste contamination and the spread of weeds.

General Recommendations

A fire management plan should be developed and implemented to address wildlife and habitat issues in remnant and refuge habitat. This should include an appropriate fire regime and sequence for the protection and maintenance of dry vine-forest, riparian forest and *Melaleuca* woodland communities. The fire management plan should consider the requirements of fauna species that are favoured by early dry season low intensity fires, maintaining a mosaic of vegetation with varying fire seasons, intensities, between-fire intervals and structural development, and development of a spatial diversity of vegetation structures.

A management program for the control of feral pigs should be considered, as feral pigs appear to be relatively common in riparian habitats in the study area. Signs of disturbance caused by feral pigs were noted at all sites associated with permanent water or major drainage lines. This feral animal is likely to have the highest impact as it is the most numerous and destructive introduced species in the study area. The disturbance caused by pigs may also result in an increase in the spread of weeds. Therefore the control of this feral animal may also assist in weed management, by preventing such disturbance and the spread of weeds.

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Appendix A

Terrestrial Fauna Species List

Appendix B

Plates

Plate 1 *E. tetrodonta/ E. miniata* open woodland to open forest. Habitat of two significant species, the pale field rat (*Rattus tunneyi*) and the northern quoll (*Dasyurus Hallucatus*).

Plate 2 Mixed Eucalypt woodland. Habitat of the northern quoll (*Dasyurus Hallucatus*).

Plate 3 Riparian corridor at Site 3. A high abundance of ground mammals was recorded in this habitat.

Plate 4 *Lophostemon* woodland at Site 4. northern quoll (*Dasyurus Hallucatus*) habitat.

Plate 5 *Melaleuca* woodland at Site 5. Habitat of the dusky rat (*Rattus colletti*).

Plate 6 Dry vine-forest on rock outcrop at Site 6. This habitat supports the highest diversity of mammals in the study area including the northern quoll and common species including the Short beaked echidna, Red- cheeked dunnart, northern brown bandicoot, common rock rat, grassland melomys and several bat species.

Plate 7 The Northern Quoll (*Dasyurus hallucatus*) recorded at sites 1, 2, 4 and 6. This species is listed under the *Territory Parks and Wildlife Conservation Act 2001* as Lower Risk - Near Threatened.

Plate 8 Olive python (*Liasis olivaceus*) at Site 6.