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TERRESTRIAL FAUNA SURVEY AND ASSESSMENT

Dhupuma Plateau

PREPARED FOR LandRoc
July 2015

Dhupuma Plateau

Terrestrial Fauna Survey and Assessment

July 2015

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DOCUMENT CONTROL

Name of Project:	Dhupuma Plateau
Project Number:	LDR_1401
Project Manager:	Mark Sanders
Document Author(s):	Mark Sanders, Angus McNab, Nick Kilvert
Name of Document:	Terrestrial Fauna Survey Report
File Name:	T:\Projects\Active Projects\Landroc\LDR_1401 (Gove)\Reports\Dhupuma Plateau Report.docx
Version:	Final

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1.0 INTRODUCTION AND BACKGROUND

The following report details the findings of a terrestrial fauna survey commissioned by Gulkula Mining Pty Ltd and carried out by EcoSmart Ecology during the 13th-19th November 2014 and the 20-26th of May 2015 (inclusive). The work was focused on a 500 ha area of land on the Dhupuma Plateau, approximately 30km southwest of the township of Nhulunbuy Arnhem Land, in northeast Northern Territory. The study fulfils the requirements of a terrestrial fauna survey and assessment, informed by the following relevant Territory and Federal legislation and policy, where appropriate:

- Territory Parks and Wildlife Conservation Act (1977) (TPWC Act),
- Guidelines for Assessment of Impacts on Terrestrial Biodiversity (2013),
- Environmental Assessment Guidelines for the Northern Territory: Terrestrial Fauna Survey (2011),
- Guidelines on Environmental Offsets and Associated Approval Conditions (2013),
- Environmental Protection and Biodiversity Conservation Act (1999) (EPBC Act),
- Relevant survey guidelines for MNES frogs, reptiles, mammals and bats (DEWHA 2010; 2010; 2010; DSEWPC 2011; 2011), and EPBC Act Environmental Offset Policy (2012).

The survey is a component of a Mine Management Plan being compiled by LandRoc for Gulkula Mining in accordance with Northern Territory and Federal requirements prior to development approval. The dry season field surveys were carried out by Nicholas Kilvert and Terry Reis, and the post-wet season field surveys by Mark Sanders and Angus McNab.

1.1 STUDY AIMS AND RATIONAL

The fauna works undertaken on the Dhupuma Plateau aims to capture information necessary inform future environmental planning requirements. Accordingly, this study describes terrestrial fauna values in areas potentially affected by future works, with a specific focus on Endangered, Vulnerable and/or Near Threatened species under the Federal EPBC Act 1999 and/or state TPWC Act.

The specific aims are to:

- Review existing relevant desktop information relating to terrestrial fauna values in the region surrounding the Dhupuma Plateau,
- Undertake field surveys, considering the seasonal requirements fauna species and communities, and provide information sufficient to fulfill the requirements of the survey, and
- Identify the faunal values of the site providing a specific assessment of their legislative significance,
- Document potential impacts to fauna values, outline mitigation measures, and evaluate residual impacts,
- Provide mitigation, such as offsets, for any identified significant residual impacts.

The primary focus of the fauna component has been terrestrial vertebrates; vertebrates associated with aquatic environs such as turtles, were not targeted during surveys. The survey did consider, and in appropriate habitats target, the Gove Crow Butterfly (*Euploea alcathoe enastri*), though systematic sampling of butterfly communities across the Project Site was not undertaken.

1.2 SITE LOCATION AND DESCRIPTION

The Project Site is approximately 500 ha in area, intersected on the northern boundary by the Central Arnhem Road and to the east by Port Bradshaw Road (Figure 1.1). In recent history (between the late 1950's and early 1970's), the site was the location of the European Launcher Development Organisation (ELDO) research station. The construction of the ELDO research station required the clearing of

approximately 500 hectares of vegetation across the site. While advanced native vegetation has since reclaimed much of the area, older senescing trees and large hollows are less abundant. Remnants of this historic activity are evident, concrete, sheet iron, and remnants from the abandoned settlement are strewn across hundreds of square metres. The ELDO site was then utilised for the Dhupuma College. The Project Site currently contains a working sawmill that occupies about 2500m^2 at the northeast confluence (-12.372349; 136.818179). Adjacent to the sawmill is the site of the GARMA festival.

Surface water within or immediately adjacent the Project Site is scarce, restricted to a few small discrete locations. Within the historic ELDO is an abandoned swimming pool, which during the dry season holds a small amount of water. It is likely to be the only permanent or long-term water on site. Two small spring-fed soaks, representing the only natural water sources, are located just outside the boundary of the area (Figure 1.1). At least one soak (closest to the Port Bradshaw Road, hereafter referred to as the 'east soak') had water during the dry season, restricted to a number of shallow pools and may be permanent during most years. Vegetation fringing the soak was dominated by Pandanus (Pandanus sp.), while the second soak (the 'west soak') was surrounded by monsoonal rainforest. How permanent the second soak remains during dry conditions is unclear. Both soaks had considerable running water during the post-wet season surveys.

There is less than twenty metres variation in altitude across the entire site area, with the highest point – 104m above sea level (ASL) - located in the northwest corner. The Giddy River lies approximately 12km west of the site; this relatively small river system flows north into Melville Bay.

The vegetation on site and in the immediate surrounds is predominantly open woodland, with sparse understory and moderate leaf litter and grasses across most habitats. There appears to be no significant geomorphological features such as caves or significant rock outcrops.

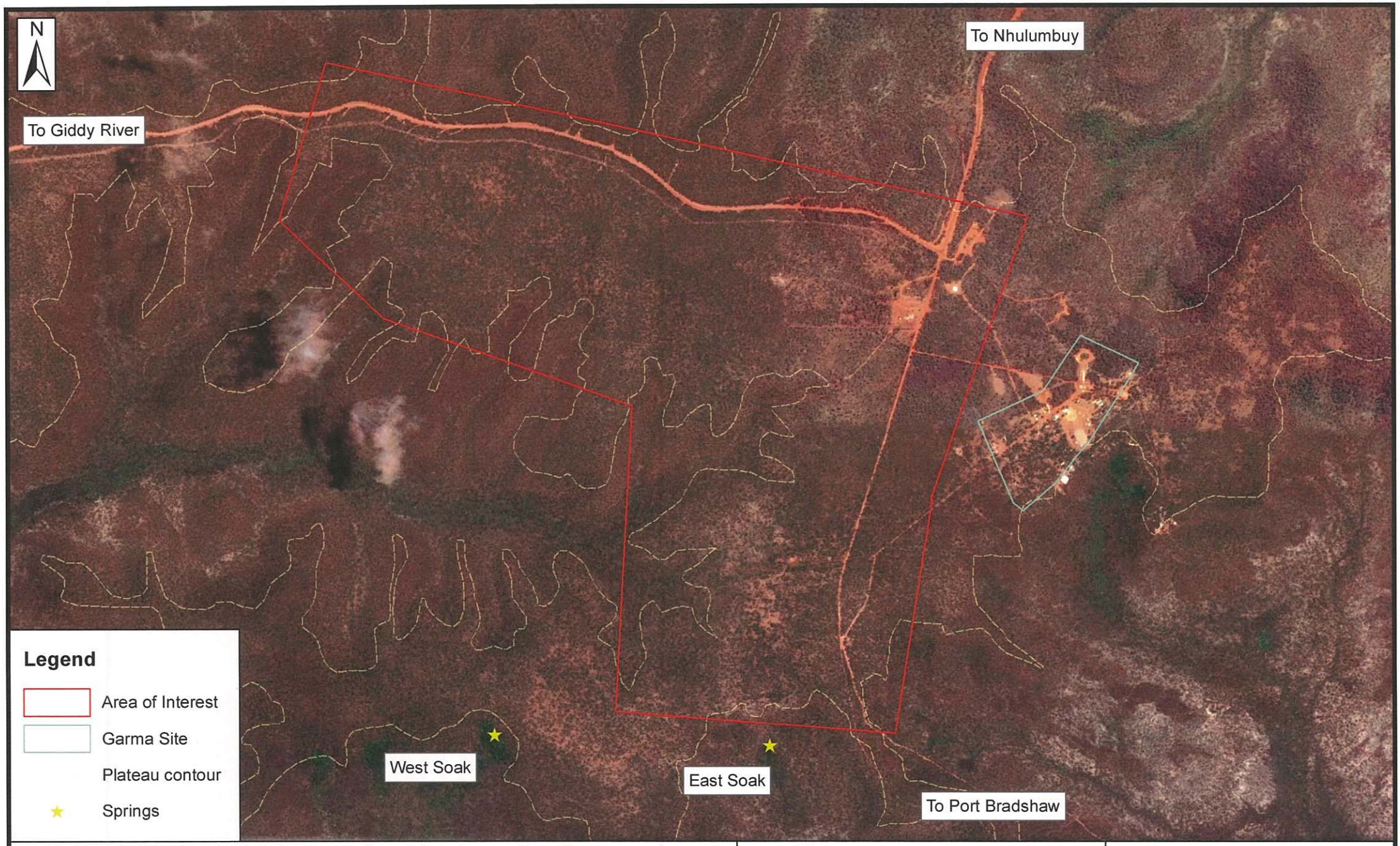

Figure 1.1

Project Site and notable features

Scale:

1:16,765

0 0.1 0.2 0.4 0.6

Kilometers

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1.3 Proposed Development Actions

The proposed development will see the construction of a small bauxite mine (the Gulka Mine) with an estimated production in the first two years of 150,000 tonnes per annum, increasing to a total of 250,000 tonnes over the 15 year life of mine. The proposed activities are expected to have a footprint of 40 hectares annually or a total extent of 600 ha (Figure 1.2). These actions will largely overlap with the area previously cleared for the ELDO project, and therefore only a small amount of remnant vegetation will be lost.

Mine related infrastructure (e.g. mine plant, equipment maintenance sheds, offices, and workshops) would be established in the previously cleared sawmill site. Mine training and accommodation facilities would be located at the Garma Festival site, utilising existing infrastructure with the addition of further accommodation (dongas) as required. The training and accommodation facilities would be located in previously cleared areas, reducing vegetation loss.

Bauxite will be trucked via existing public road infrastructure until the Rio Tinto haul road, at which point the haulage will connect to the Rio haul system and integrated into existing Rio mining operations. Expected increase in vehicle traffic from mining operations is unknown at this point in time.

1.4 Study Team and Qualifications

Table 1.1 below outlines the study team, their qualifications and respective tasks for the ecological assessment.

Table 1.1 Study team and qualifications

Personnel	Qualifications	Experience	Tasks
Mark Sanders	BSc (hons)	15+ years	Field surveys, report preparation, data analysis, project management
Angus McNab	MSc	7+ years	Field surveys, data entry, report preparation
Terry Reis	BSc (hons)	17+ years	Field surveys
Nick Kilvert	BSc (hons)	4+ years	Field surveys, report preparation

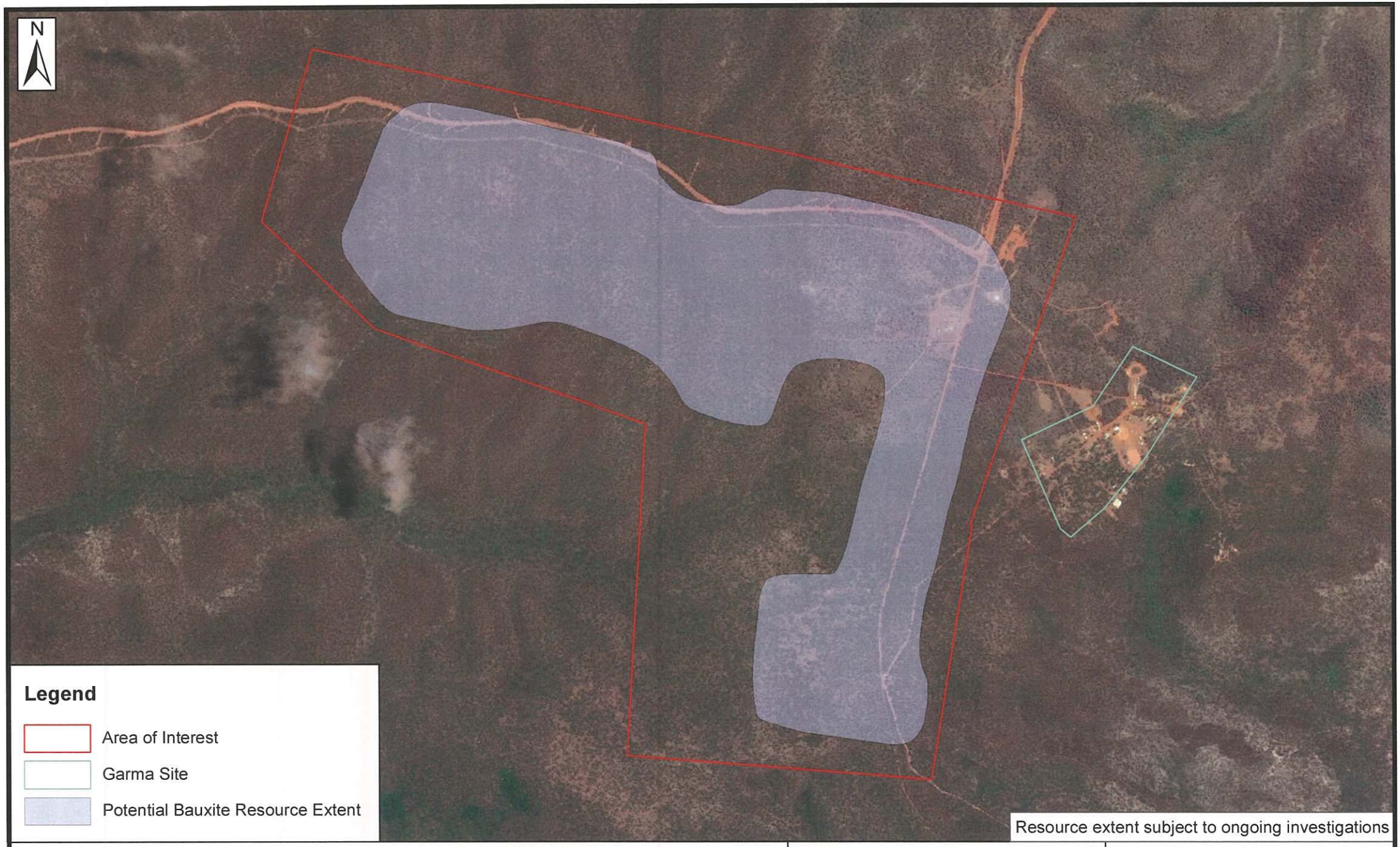

Figure 1.2

Potential Mining Resource Extent

Scale:

1:15,403

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Kilometers

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2.0 STUDY METHODS

2.1 DESKTOP DATA COLLECTION

Databases

Inspection of public available databases and relevant reports provide a species inventory for the local area (up to 50km buffer) as well as indications as to the presence and distribution of known fauna species listed under legislation. This includes fauna species listed as Critically Endangered, Endangered, Vulnerable, and Near Threatened under either the EPBC Act or TPWC Act. Given the connectivity of habitat across northeast Arnhem Land, it is possible that many of the recognised species could be found at the Project Site, provided suitable habitat is present. As such, the inventory highlights priority taxa which can be targeted or specifically considered during the subsequent site-based assessments.

Sources of information inspected or reviewed for this work are outlined in Table 2.1.

Table 2.1 Desktop Data Sources

Source	Type	Location/Buffer
Atlas of Living Australia	Online database (all vertebrates)	10km
Birds Australia Atlas	Database (birds only)	50km
Department of Land Resource Management Species Atlas	Database	~ 40km
Gambold et al. (1995)	Fauna survey report	Nanydjaka Reserve
Dhimmuru Land Management Aboriginal Corporation (2009)	Fauna survey report	Study area and Cape Arnhem coastline
Vanderduys (2012)	Fauna survey report	Dhimurru Indigenous Protected Area

In addition to creating a list of listed species, compiling the desktop data provides record frequency, which may later assist in evaluating the likelihood of a listed species actually occurring at the Project Site. While useful, record frequency must be used cautiously as databases are biased towards obvious taxa such as birds and can be affected by survey effort.

It is also important to note that a species' presence in a database does not mean the species is regularly observed at the Project Site. Single, unusual records may represent transient individuals which do not represent breeding populations and are of little value in the environmental planning process. Such records need to be carefully evaluated against the species' current known distribution and habitat requirements.

The desktop assessment was also used to review aerial photography and the preliminary flora/vegetation mapping to characterise possible habitat types prior to field works. These habitats were later visually verified and contributed to positioning of trap sites (i.e., stratification of sample sites across habitat variability).

2.2 FIELD SURVEY

Field surveys were undertaken under NT license 51606 and Animal Ethic License CA 2012/07/624. Data collection was broadly consistent with relevant guidelines for baseline assessment (NTG 2011) although variation may have occurred due to logistical constraints.

2.2.1 Survey Design and Stratification

Prior to establishing trap sites, the Project Site was broadly traversed to visually assess topography, vegetation, and other natural features which might influence vertebrate species abundance and composition. Habitat within the Project Site was found to be uniform, dominated by a woodland/forest of Darwin Stringybark (*Eucalyptus tetrodonta*). Only two minor areas which might be considered different habitats were located, both outside the area of focus and associated with two spring soaks. Vegetation surrounding the West Soak consisted of tall remnant monsoonal vine forest, while Paperbark (*Melaleuca* sp.) and Pandanus (*Pandanus spiralis*) dominated vegetation in the immediate surrounds of the East Spring. Access to both these locations required traversing some distance on foot.

Trap Site: The dry season fauna survey was undertaken by two observers over a five day period (i.e., four nights trapping). Five trap sites (TR01-TR05), each including pitfall, funnel, Elliot and camera traps (see Section 2.2.2), were operational during the survey (Figure 2.1).

The post-wet season survey was undertaken by two observers over a seven day period (i.e., six nights trapping). The five dry season traps sites were reused in the post-wet season surveys (Figure 2.1).

Observation Sites: Observation sites (OBS01-OBS07) are used to supplement data gathered from trapping sites. Repetitive sampling and labour intensive methods (e.g., pitfall, Elliots, etc) are not used at observation sites, but rather methods include active searches, bird survey, spotlighting and habitat assessment (see Section 2.2.2). These sites assist in:

- Evaluating habitat suitability for listed species,
- Increasing sampling effort for the detection of listed species,
- Evaluating habitat similarity to trapping transects (thereby allowing extrapolation or comparison),
- Determining habitat condition,
- Insuring the assessment samples and considers habitats too small to trap or in locations which inhibit detailed trapping (e.g., due to access, features not conducive to the trapping methods [rock, water/wetlands] etc), and
- Increasing sample intensity and spatial distribution.

Seven observation sites were used on and adjacent to the Project Site. Observation sites are visited only once and at any time during the day.

2.2.2 Fauna Sampling Techniques

Fauna sampling methods are outlined below. All methods were used at the five trapping sites, while only bird survey, active searching, spotlighting and habitat assessment was used at the seven observation sites. Anabat detection and an IR Camera was also deployed at OBS06.

Pitfall and funnel trapping: Five trap sites each including pitfall, funnel and a single camera trap were established during the survey. Pitfall trapping arrays consisted of four twenty-litre buckets buried to the ground surface and connected with a 25m long drift fence. During the dry season survey two funnel traps were placed at each end of the fence-line, one on either side. An additional two funnels were placed, independent of fencing, at each site adjacent to logs. During the post-wet season surveys all six funnel traps were positioned along the drift fence, two at either end and two near the center. During the dry season survey forty-five Elliot traps were set out in lots of fifteen at trap-sites TR01, TR02, and TR04, located in vegetation around each pitfall configuration, positioned approximately five to ten meters apart. During the post-wet season 20 Elliot traps were used at each of the five trapping

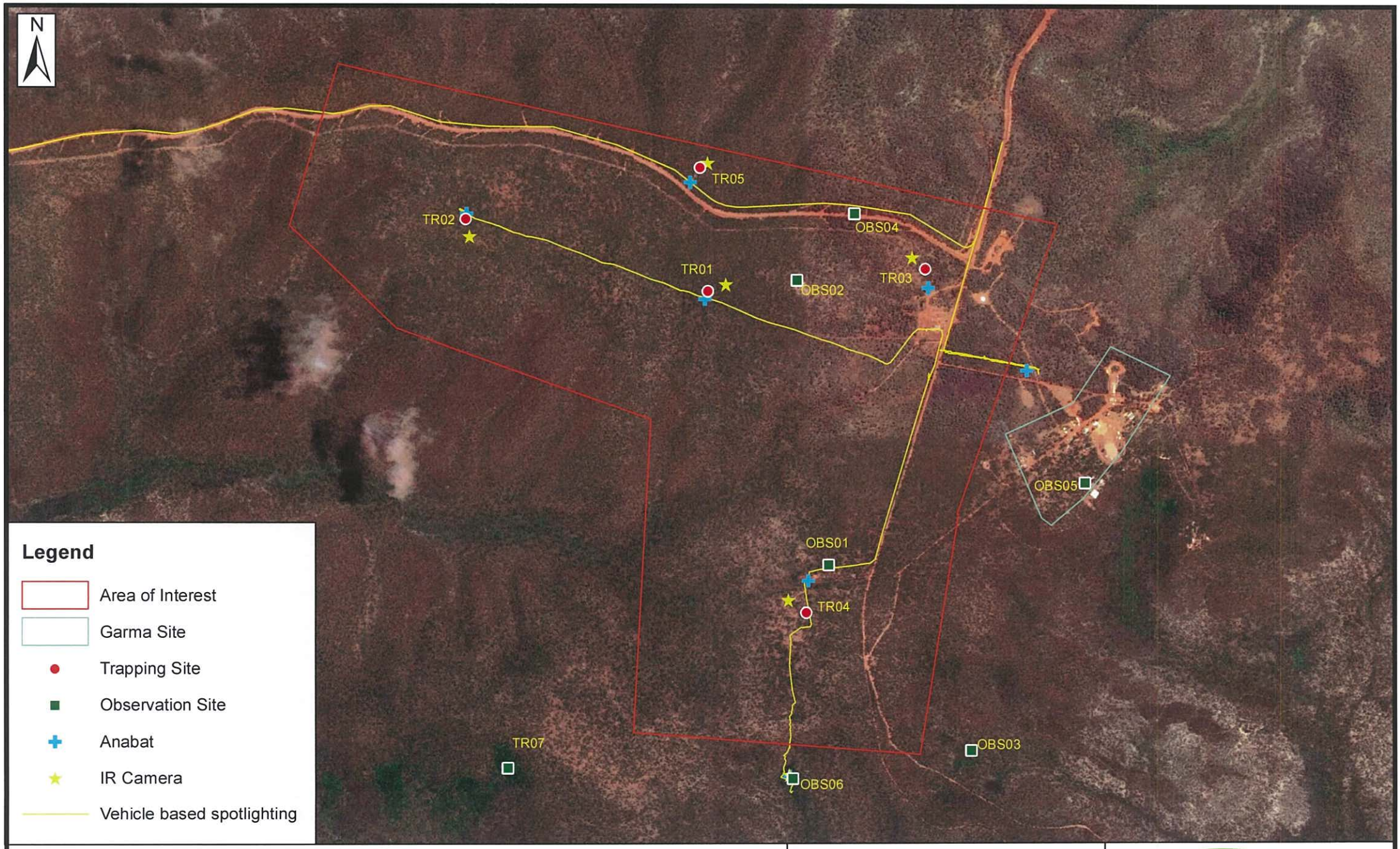

Figure 2.1

Survey Methodology Locations

Scale:

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Kilometers

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sites. Elliot traps were used for four (dry season) and six (post-wet season) consecutive nights and baited with a combination of peanut butter, rolled oats, and vanilla essence. All sites were checked twice daily, once in the morning and once in the afternoon.

Remote Sensor Camera Traps: Remote sensor cameras (Reconyx HC600 and Bushnell Trophy Cam) were used to detect the presence of medium-sized mammals. This method was used in preference to cage traps as it is non-invasive and allows for greater detection rates whilst minimising stress on the animals (de Bondi *et al.* 2010; Claridge *et al.* 2010; Paull *et al.* 2012). Further, camera traps allow for the detection of species that are difficult to detect using either cage or hair traps (Vine *et al.* 2009; Robley *et al.* 2010). Infra-Red camera traps, each baited with sardines and a ball of peanut butter, oats and vanilla essence, were deployed at each trap site; a sixth camera was positioned at the East Soak (OBS06).

Bat Sampling: Ultrasonic call detection for microchiropteran bats used Anabat devices located at each of the survey sites. Anabat devises were also deployed during both the dry and post-wet season survey at the East Soak. No significant flyways were present on site and no potentially significant micro-bat roost site, such as a cave or substantial crevices, were located. Each Anabat device was set to record from dawn until dusk.

Bird Survey: Bird surveys were conducted at each trapping site on at least two mornings during each survey. All surveys were conducted prior to 9am, when bird activity is at its peak. Bird surveys always exceeded 20 minutes in duration, although more time may have been allocated if bird activity was high. Birds within 100 m of a centre point (i.e., the pitfall/funnel trap) were located by sight or sound, and where possible their numbers estimated. Incidental observations of birds heard calling outside of 100 m were also noted, although there was no attempt to estimate abundance. Any birds not recorded during morning surveys that were detected at sites during other periods of the day were noted.

Bird surveys using similar methods were also undertaken at each observation site, although these surveys were conducted only once and, while generally conducted prior to midday, may not have occurred prior to 9am.

Active Searching: Logs, rocks, exfoliating bark and other debris were moved in search of sheltering terrestrial vertebrates such as frogs, reptiles and mammals. These activities were conducted for approximately 30 minutes at each site by two observers at various times during the day. In addition to direct observations, signs of animal activity such as footprints, droppings and claw marks on trees, were also noted and identified where possible.

Spotlighting: Spotlighting surveys, using modified high-powered head torches designed to increase eye-shine, was undertaken by two observers. Each site was searched for a period of 30-60 minutes during both the dry and wet season surveys.

Vehicle-based spotlighting was undertaken whilst travelling between foot-based spotlight locations. In addition, vehicle-based spotlighting was conducted along the Central Arnhem and Port Bradshaw Roads.

Vehicular based spotlighting allows spotlighting over a greater distance, but is bias toward larger animals such as medium- to large-sized mammals and nocturnal birds. Some smaller vertebrates such as frogs and reptiles can be located while spotlighting from a vehicle, although most are detected when crossing roads or tracks. Foot-based spotlighting allows observers to search habitats more thoroughly and increases the detection of small vertebrates (e.g., frogs, geckos etc).

Incidental observations and Habitat Assessment: Opportunistic observations of fauna were recorded throughout the survey. Records may have included direct observation or indirect signs (e.g., scats, tracks, scratch mark, nests, or feeding signs). Opportunistic observations of taxa in proximity to the Project Site were also recorded as these species are likely to occur within the project area, provided suitable habitats are present.

Throughout the survey, vegetation was visually assessed for consistency with known habitat requirements of possible listed species. This assists with later determining the likely occurrence or distribution of listed species.

2.3 Assessing Likely Occurrence Of Listed Taxa

Many vertebrate species are cryptic, migratory and/or nomadic. Short surveys can overlook such species and it is therefore necessary to predict the likely occurrence of significant species based on habitat suitability (as assessed by an experience ecologist), the proximity and relevance of local records, and interpretation of survey adequacy (i.e., conditions during which the survey was conducted). The likelihood of occurrence of all species listed under the TPWC Act or EPBC Act that have been recorded within 50 km of the Project Site was assessed, with each species evaluated based on criteria listed in Table 2.2.

Table 2.2 Likelihood of species occurrence

Likelihood of Occurrence	Criteria
Known	Recorded within and/or immediately adjacent Project Site
Likely	Suitable habitat within or adjacent Project Site; numerous relevant records (less than 20 years old and within 10 km of the Project Site) from desktop assessment
Possible	Suitable habitat within or adjacent Project Site; numerous records from desktop assessment Project Site but records > 10 km away or > 20 years old OR Marginal habitat within or adjacent Project Site; few, but recent (<20 yrs), records within 10 km of Project Site
Unlikely	No suitable habitat; few records from desktop assessment and records > 10 km from Project Site only
Transient	Species highly mobile and known to occasionally appear in areas away from known population centres (usually birds). Species unlikely to permanently establish.

2.4 Survey Conditions and Limitation

2.4.1 Conditions

Dry Season Survey

The dry season survey was undertaken in mid November (13-19th). The Australian Bureau of Meteorology records indicate that no rain fell in the two months prior, and that a total of 2.4mm had fallen since July. Mean minimum and maximum temperatures in November ranged between 22.1°C – 33°C. No rain fell during the survey period.

Post-wet Season Survey

The post-wet season survey was undertaken in late May (20-26th) with a mixture of sunny and overcast days. Conditions were warm 20.1°C – 31.8°C, with high humidity due to sporadic showers. While 2 mm fell nearby at Yirrkala, it is difficult to accurately evaluate rainfall at the Project Site due to the sporadic and isolated nature of rainfall during this period; however it is possible that rainfalls were slightly higher

at the Dhupuma Plateau. Prior to the post-wet season survey 186 mm of rain occurred in April, while another 359 mm was recorded in March.

In February 2015 Cyclone Marcia hit the Gove region causing damage to the local area. The Dhupuma Plateau and the Project Site received considerable leaf loss and tree fall. Evidence of the cyclone was very clear three months after the event.

In the weeks immediately prior to the post-wet season survey a low intensity fire swept through the northern half of the Project Site. The fire removed all ground covers, leaf litter and grass from TR 01, 02, and 03. While small fresh grass shoots were observed across the burnt areas, some larger hollow logs and stumps were observed still smouldering during the survey.

2.4.2 Constraints and Limitations

While the below constraints and limitations are recognised, they are unlikely to have significantly altered the results of this study.

- Logistical issues with equipment (e.g., Elliot Traps delayed in transit) meant that Elliot Trap effort was reduced during the dry season survey,
- One pitfall line (site 3) consisted of only three buckets as digging was impossible due to the rocky substrate (dry season only),
- Damage from cyclone Marcia may have reduced the abundance of some bird and arboreal mammal species during the post-wet season survey. This impact though, is not anticipated to have significantly affected the species richness detected using the survey methods, and
- Recent low-intensity fires had removed ground cover, leaf litter and grass from TR 01, 02, and 03 during the post-wet season surveys. The reduction in ground cover may have reduced habitat complexity and the abundance of ground dwelling species.

3.0 RESULTS

3.1 DESKTOP REVIEW

The desktop review provided a total of 7,496 vertebrate records within 50 km of the Project Site. Three-hundred-and-thirty-two taxa were recognised including 19 frogs, 56 reptiles, 212 birds and 45 mammals.

While twenty-six listed species were identified, most are associated with oceanic or coastal habitats. These species will not occur at the Dhupuma Plateau due to the lack of suitable habitats (see Appendix C Excluded Listed Species List). Five species are associated with forests and woodlands (Table 3.1), though upon further consideration are also considered unlikely, or at best possibly transient (see Table 2.2). One species, the Gove Crow Butterfly is associated with monsoonal rainforest and has the potential to occur adjacent to the Project Site.

Table 3.1 Local listed taxa associated with forest and woodland habitats

Scientific Name Common Name	Status		Likelihood assessment
	TPWC	EPBC	
Erythrotriorchis radiatus Red Goshawk	Vul	Vul	Unlikely/transient. Single record within 50 km of the Project Site. While suitable habitat is widespread, the species has not been recorded since the late 1970s (Gambold *et al* 1995) in the Gove region.
Erythrura gouldiae Gouldian Finch	Vul	EN	Transient/Unlikely. No records within 50 km. Habitat on site is marginal.
Falcunculus frontatus whitei Crested Shrike-tit	NT	Vul	Unlikely. No records exist in the Gove region.
Tyto novaehollandiae kimberli Masked Owl	Vul	Vul	Transient/Unlikely. No records within 50 km. Prey and nesting opportunities at the Project site are limited due to lack of sizeable tree hollows.
Geophaps smithii Partridge Pigeon	Vul		Unlikely. A single record approximately 10 km north from an area that has since been clear felled for mining. Record likely to be old and the species has not been recorded since the late 1970s (Gambold *et al* 1995) in the Gove region.
Euploea alcathoe enastri Gove Crow Butterfly	EN	EN	Possible. Known only from seven small patches of monsoon forest and mixed paperbark swampland with rainforest elements in the understory from the Gove region. Some monsoon forest occurs adjacent to the Project Site.

In addition to listed taxa, seven migratory species protected under the EPBC Act are also known to occur within the local area. Of these seven species, five are considered unlikely to occur due to a lack of suitable habitat on or in proximity to the Project Site. Migratory bird values are considered in Section 3.2.2.

3.2 Field Survey Results

A total of 97 species were recorded during the survey (Table 3.2). None are considered threatened under either the EPBC Act (1999) and TPWC (1994). Two avian species, the Rainbow Bee-eater (*Merops ornatus*) and White-throated Needletail (*Hirundapus caudacutus*), are listed as a Migratory species under EPBC (1999).

Overall vertebrate richness across the Project Site was low; most of the identified species were widespread and abundant. Presumably this is due a lack of habitat variability, being dominated by homogeneous *E. tetrodonta* forest.

Nine species of frog were recorded, noted in association with surface water, either at the swimming pool adjacent to TR03 or at East Soak. The lack of abundant surface water is likely to limit frog diversity at the Dhupuma Plateau.

The reptile community was dominated by a number of extremely abundant species including *Carlia sexdentata*, *Carlia amax*, *Carlia munda, Heteronotia binoei* and *Cryptoblepharus metallicus*. These species were located at all trapping sites. Less frequently observed species included Diporiphora bilineata, Acanthophis rugosa, Lialis burtonis, Tiliqua scincoides.

Only a single small terrestrial mammal species, and unidentified rodent (possibly Grassland Melomys, *Melomys cervinipes*), was detected during the surveys, captured on the IR camera near the East Soak. The diversity of other native terrestrial and arboreal mammals was also low, with only two macropods (Antilopine Wallaroo and Agile Wallaby), one Echidna, and one glider species (Sugar Glider) recorded. Bat diversity (eight species) contributed most to the mammal fauna.

The bird community across site was uniform with many species wide spread and common including Pied Butcherbird (*Cracticus nigrogularis*), White-bellied Cuckoo-shrike (*Coracina* papuensis), Peaceful Dove (*Geopelia striata*), White-throated Honeyeater (*Melithreptus albogularis*), Silver-crowned Friarbird (*Philemon argenticeps*), Rufous Whistler (*Pachycephala rufiventris*), Northern Rosella (*Platycercus venustus*), and Red-collared Lorikeet (*Trichoglossus haematodus*). Less widespread species such as Pied Imperial-Pigeon (*Ducula bicolor*), Dollarbird (*Eurystomus orientalis*), Tree Martin (*Petrochelidon nigricans*), Banded Honeyeater (*Cissomela pectoralis*), Cicadabird (*Coracina tenuirostris*), and White-necked Heron (*Ardea pacifica*) were only recorded at a single survey location.

Table 3.2 Overall capture and listing for survey period

Group	Count	LC	Int	Mig
Birds	52	52	0	2
Mammals	17	16	1	0
Reptiles	19	18	1	0
Frogs	9	8	1	0
Total	97	94	3	2

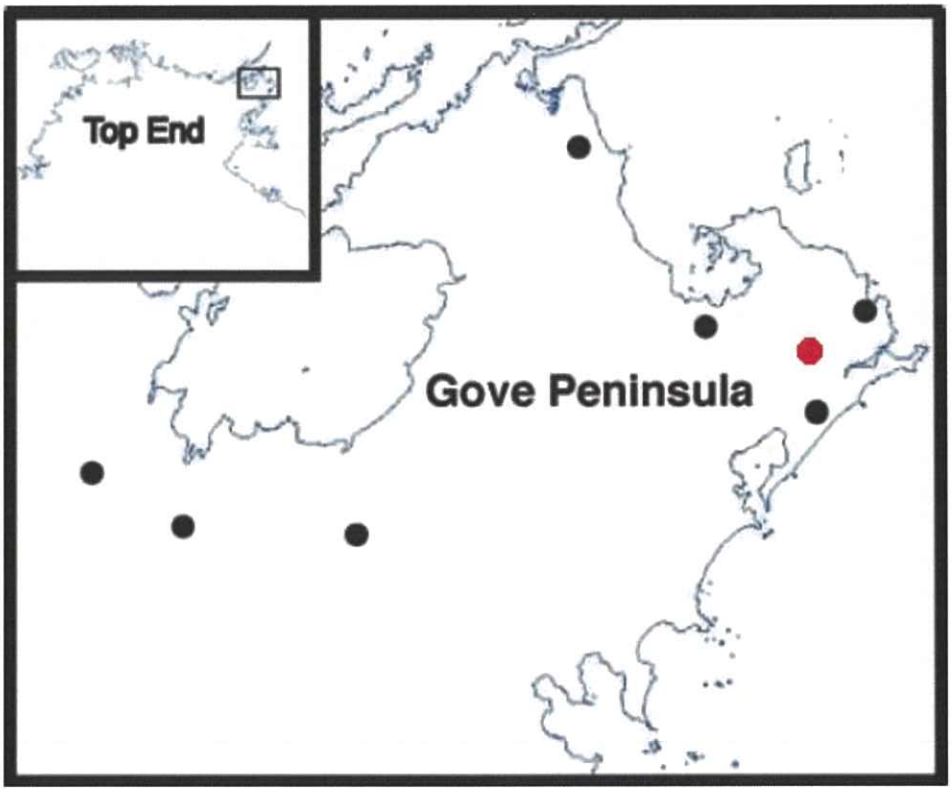
*LC – Least concern, Int – Introduced/exotic, Mig – Migratory (EPBC Act).

3.2.1 Potential or Known Conservation Significant Vertebrate Species

Database searches recognised 26 terrestrial listed species from within 50 km of the Dhupuma Plateau Appendix C Excluded Listed Species List). Surveys at Dhupuma Plateau located no threatened species protected under state or federal legislation.

Based on the EPBC database search five species identified in the desktop assessment were initially considered possible due to their described distribution, and occurrence in forest or woodland habitats. However, further examination of these species suggests that they are unlikely or at best transient (Table 3.1). The sixth species identified in the desktop assessment, the Gove Crow Butterfly has some potential to occur in the 'West Soak' a small patch of monsoonal rainforest adjacent the site.

The Gove Crow Butterfly is a subspecies of the No-brand Crow Butterfly, *Euploea alcathoe* that is restricted to the Gove Peninsula in north-eastern Arnhem Land. Currently known only from 10 sites, at seven disjunct locations (Figure 3.1), the subspecies is considered rare in terms of its relative abundance, rare in habitat preference and rare in spatial distribution (Braby 2007). All populations of the Gove Crow Butterfly are considered to be important for long-term survival of the species.



Map amended from Braby (2007)

Figure 3.1 Known populations of Gove Crow Butterfly (black dots) relative to proposed Gulkula Mine (red dot).

Known populations of the Gove Crow Butterfly occur in monsoon forest and adjacent mixed paperbark swampland. While paperbark is largely absent from the Project Site, monsoonal forest associated with groundwater seepage occurs approximately (~850m) west at the West Soak. The Gove Crow Butterfly was not observed here during the fauna surveys, and preliminary flora surveys have failed to detect either *Gymnanthera oblonga* or *Parsonsia alboflavescens,* species on which the Gove Crow Butterfly have been observed laying eggs. However the larval food plant for this butterfly has not been confirmed, making assessments based on larvae food availability difficult. Further, flora surveys within monsoonal

forest at West Soak have not been comprehensive. As such, we cannot at this early stage be confident that the species could not occur.

Surveys results and the above assessment suggest that no listed species listed under the EPBC Act or TPWC Act are likely to frequently occur, depend upon, or reside within the Project Site. The Gove Crow Butterfly however, may possibly occur in proximity to the Project Site and if indirect impacts to ground water could occur in these areas further investigation may be warranted.

3.2.2 Migratory Fauna Species

Migratory species are those that migrate to Australia and its external territories, or pass through or over Australian waters during their annual migrations (SEWPAC 2012). Migratory species under the EPBC Act include species listed under the bilateral agreements CAMBA, JAMBA, and ROKAMBA, and/or listed under the intergovernmental treaty - the Bonn Convention.

Desktop data suggests a total of seven listed Migratory species have been recorded from the local area. Three species, the Little Tern (*Sterna albifrons*), Roseate Tern (*Sterna dougallii*) and White-bellied Sea-eagle (*Haliaeetus leucogaster*) are associated with tidal and wetland habitats. These species will not occur. Barn Swallows (*Hirundo rustica*) typically inhabit open areas and are not expected to occur. The Rufous Fantail (*Rhipidura rufifrons sensu lato*) inhabits mangroves, rainforests and mesic vegetation. As such this species could occur adjacent to the Project Site associated with the two spring-fed soaks, particularly the West Soak which is surrounded by monsoonal rainforest. However no individuals were detected in this area during our survey.

Two migratory bird species were recorded during our surveys, the White-throated Needletail (*Hirundapus caudacutus*) and Rainbow Bee-eater (*Merops ornatus*). Both species are widely distributed and highly mobile. White-throated Needletails are aerial foragers and can be observed hunting over large tracts of land including modified landscapes and urban areas. Rainbow Bee-eaters also show resilience to habitat modification, often associated with open pastures, parks and gardens. Neither species are expected to occur in significant densities (and will not therefore constitute an 'important population') or be significantly affected by the proposed actions.

3.2.3 Exotic Pest Species

Although rarely encountered, six exotic terrestrial vertebrates were recorded on the Project Site including the Water Buffalo (*Bubalus bubalis*), Asian House Gecko (*Hemidactylus frenatus*), Dingo (*Canis dingo*), Feral Cat (*Felis catus*), Feral Pig (*Sus scrofa*) and Cane Toad (*Rhinella marina*). The Cane Toad, Feral Cat and Feral Pig are known to pose significant risks to native species (see Table 3.3).

Table 3.3 Pest Vertebrate Species Recorded from the Project Site

Scientific Name Common Name	Abundance	Potential Biological Impacts
Bubalus bubalis Water Buffalo	Uncommon	Large potentially dangerous animal that causes damage to waterways, soaks and other natural water sources, consumes large amount of native vegetation and damage ground cover through trampling of soils and vegetation.
Canis dingo *Dingo*	Uncommon	Can carry diseases, such as distemper and parvovirus. Competes with native fauna for resources and preys upon a wide variety of native animals. Some research (Brook

Scientific Name Common Name	Abundance	Potential Biological Impacts
		et al. 2012) suggests Dingos beneficially control other exotic predators (e.g. Feral Cats) which have even greater deleterious impacts.
Felis Catus Feral Cat	Uncommon	Preys upon a wide variety of native animals and has been implicated in the extinction of a number of native species (Burbidge and Manley 2002). Competes for resources with native species. "Predation by Feral Cat" is a key threatening process under the EPBC Act.
Sus scrofa Feral Pig	Uncommon	Causes significant damage to waterways, soaks and other natural water sources, consumes large amount of native flora and fauna whilst damaging ground covers through trampling of soils and low vegetation.
Hemidactylus frenatus Asian House Gecko	Uncommon	Preys upon a wide variety of native invertebrates and competes with native reptiles for resources.
Rhinella marina Cane Toad	Uncommon	Is highly toxic, and may fatally poison anything that tries to prey upon it. Preys upon a wide variety of small native animals. Competes for resources with native animals "The biological effects, including lethal toxic ingestion, caused by Cane Toads (*Rhinella marina*)" is a key threatening process listed under the EPBC Act.

4.0 IMPACT ASSESSMENT AND MITIGATION

4.1 POTENTIAL IMPACTS

This section considers foreseeable impacts to terrestrial fauna values within and surrounding the Project Site, during the construction, operation and decommission phases.

4.1.1 Fauna Habitat Loss (reduced occupancy), Mortality and Displacement

Habitat loss arising from vegetation clearing causes a number of impacts on terrestrial biological systems. The proposed Gulkula Mine will result in the loss of 600 ha of E. *tetrodonta* woodland, and associated vertebrate fauna habitat values. In addition to the loss of habitat, the associated vegetation clearing will likely result in some mortality and displacement of fauna. Individuals displaced by clearing are competitively disadvantaged; more readily predated upon, and usually perish rather than establish new territories (Priddel and Wheeler 2004).

Eucalyptus tetrodonta woodland is the dominant vegetation type within the Gove region and extremely widespread. Further, the fauna species we found within the Project Site are also abundant and widespread. No species specially protected under state or federal legislation are likely to be affected by habitat loss. As such, the loss of habitat is highly unlikely to lead to a widespread decline of any species known from the Dhupuma Plateau.

4.1.2 Vegetation and Habitat Degradation

In addition to the direct loss of vegetation and habitat, impacts can occur through a number of indirect pathways. Most indirect impacts are associated with the physical changes to an ecosystem along a human induced boundary (i.e., along the edge of clearing) (Lindenmayer and Burgman, 2005). A variety of changes resulting from landscape modification, and interactions between varying edge effects tend to interact, leading to degradation of habitat for fauna values and a reduction in native ecological diversity over time (Hobbs 2001). The extent of edge effects are highly variable. In some habitats it is largely restricted to the clearing edge and its immediate surrounds, while in others it may extend several hundred metres into retained habitats. Particularly in the case of weeds which play an important role in the extent of edge induced impacts.

Individual pathways that lead to edge effects, and their potential impacts within the context of the Project Site, are provided in Sections 4.1.2.1 to 4.1.4. While edge effects cannot be completely eliminated, mitigation measures that will assist in alleviating the severity of habitat degradation are provided throughout Section 4.2.

4.1.2.1 Weed Invasion

Although the Project Site is virtually weed free and no recognised environmental weeds were detected, the potential for weeds to be introduced during mining procedures remains a continual risk. Introduction of weeds has the potential to modify habitat suitability for terrestrial fauna and alter fire regimes, increasing fire frequency and intensity to the detriment of native fauna.

The potential mechanisms for weed dispersal into the Project Site, during the construction and/or operational phases of the Project include:

- Ground disturbance such as grading, removal and relocation of topsoil,
- Movement of equipment and machinery, particularly machinery sourced from adjacent regions,
- Dispersal by herbivorous species (e.g. Buffalo and Feral Pigs), and
- Public vehicles driving in close proximity to the Project Site (Central Arnhem Road and Port Bradshaw Road).

Similar mining actions are common within the Gove region and evidence of widespread weed infestation from these activities is generally low adjacent remnant habitats. While the value of vegetation surrounding the West Soak for the Gove Crow Butterfly remains unclear, this area is separated from proposed mining actions by some distance (~850 m). As such, any weed infestation is likely to be restricted to the immediate mining surrounds and affect vegetation/habitats that are widespread within the region. Possible weed impacts are likely to be minor in severity and highly localised. These risks, all be they small, can be further reduced using appropriate mitigation measures outlined in Section 4.2.

4.1.2.2 Erosion and Sedimentation

The Dhupuma Plateau is higher than surrounding areas and the flow of surface water from the Plateau has the potential to collect and move large amounts of sediment off the escarpment into nearby habitats and waterways.

While mining practices have the potential to increase sediment and erosion, it should be recognised that the Project Site is small and is not in proximity to any major creeks or river systems. Sediment controls (Section 4.2) will assist in minimising the extent and impacts of sedimentation and erosion.

4.1.2.3 Impacts to Groundwater Dependant Habitats

No groundwater dependant habitats are present within the Project Site. However activities may impact filtration and therefore recharge of the two nearby springs (the East and West Soaks). Loss of water through these springs has the potential to affect surrounding vegetation in the long-term, as well as reduce surface water availability of local species in the short-term. Nether soak is currently thought to have regional, state or national values, although the value of habitat along the West Soak for the Gove Crow Butterfly remains unclear. Further information is required to understand potential impacts in this area by either:

- Demonstrating that no groundwater impacts will occur at the West Soak, thereby ensuring existing habitat values are retained, or
- Demonstrating that the Gove Crow Butterfly is not present, and therefore impacts, if any, would not affect values of conservation significance.

4.1.3 Invasive Fauna Species (Feral Pests)

With the exception of Crazy Yellow Ants, most invasive fauna species from the region are already present within the surrounding landscape (see Section 3.2.3) and it is unlikely that the proposed activities will result in a significant increase in feral animals. However some mining-related activities can affect feral abundance by:

- The creation of surface water ponds facilitating the breeding of Cane Toads (*Rhinella marinus*) and providing a fresh water resource for exotic predators (e.g., Dingo/Feral Pig/Feral Cat), and
- Increasing foraging resources, particularly if food scraps are accessible or un-managed.

While these impacts are recognised, it seems that, on balance, the risks of a significant increase in abundance as a result of proposed actions is unlikely. Mitigation measures outlined in Section 4.1.3 will assist in ensuring pests do not proliferate.

Furthermore, while the risk of accidental introduction of Crazy Yellow Ant has been considered, it remains unlikely that machinery or equipment will have been previously active in an area of Crazy Yellow Ant infestation. As such, the probability that this species will be accidentally introduced seems unlikely.

4.1.4 Light Spill

Changes in ambient light are known to affect the physiology and behaviour of fauna with important consequences for foraging success, reproduction, predator avoidance, and navigation (Salmon 2003; Longcore and Rich 2004; Rich and Longcore 2006; Navara and Nelson 2007; Perry *et al.*, 2008). Light from anthropogenic sources can therefore affect the distribution and abundance of native fauna (Perry *et al.*, 2008). Though there are few studies on the impacts of artificial lighting on Australian fauna, research has shown behavioural changes in most faunal groups (Ogden 1996; Longcore and Rich 2004).

While light spill into adjacent habitats from artificial lighting used during construction and operation of the Mine is likely to be unavoidable, the receiving habitat and vertebrate communities are widespread and abundant in the region. Lighting impacts will therefore be minor, localised and unlikely to lead to any long-term decline in surrounding populations or species. Mitigation measures in Section 4.2 have been recommended to reduce light spill.

4.1.5 Vehicle Strike

Increased vehicular activity, particularly along existing roads leading from mining operations to Rio Tinto infrastructure will increase. An increase in vehicular traffic will also lead to an increased risk of animal/vehicle strike, particularly during the dawn and dusk periods. While mortality of surrounding fauna populations may decrease, all species likely to be affected are abundant and widespread. It seems unlikely that the increased mortality will lead to any long-term declines in surrounding populations. Vehicle Strike impacts are therefore minor.

4.1.6 Increased Fire Risk

Increased human activity is often associated with an increase in ignition risk. However the Dhupuma Plateau is managed by its Traditional Owners who frequently burn, and as such, the risk of wild fire is considered low. Provided this burning regime is maintained, impacts from fire are unlikely to significantly increase.

4.1.7 Potential Impacts to Threatened Fauna

Habitat for the Gove Crow Butterfly, if present, is located some distance from current proposed mining activities (~850m). As such, impacts are generally less likely. However indirect impacts could occur through:

- Habitat modification caused by modified groundwater quality and hydrology,
- Habitat loss through altered fire regime, and
- Accidental introduction of invasive ants (Yellow Crazy Ants).

Further discussion regarding these potential impacts is provided in Sections 4.1.2.3, 4.1.3, and 4.1.6. Risk to the Gove Crow Butterfly from this impact sources is probably low, however additional studies may be required if impacts to groundwater from mining activities is possible.

4.2 Mitigation Measures

A number of potential impact pathways resulting from mining activities have been assessed above. While impacts are generally considered to be low and localised, a number of mitigation measures can be implemented to further reduce impacts on surrounding fauna assets. Mitigation measures that should be implemented include:

- Additional investigation into the possible impacts on ground-water dependant vegetation associated with the West Soak. These studies may either:

  - Ensure that existing groundwater flow at this location is not affected, and therefore existing values will not be impacted, or
  - Investigate the likely occurrence of the Gove Crow Butterfly, and potential larvae food sources within the area. If the species is likely to be absent, ground water impacts, if any, will not affect significant fauna values.
- Restrict clearing to areas essential for the works,
- Stockpile cleared vegetation to provide shelter for a variety of small and medium terrestrial vertebrates. These stockpiles may be later used during rehabilitation,
- Undertake site rehabilitation on disturbed land as soon as possible,
- Inspect any soils, and vegetation being brought on site for the presence of Yellow Crazy Ant nests,
- Develop a weed management plan which should include:
  - Wash down protocols to be undertaken prior to, and following, vegetation clearing,
  - A weed management map (showing existing weed infestations and spread over time),
  - Triggers to initial weed control measures,
  - Weed control methods for Weeds of National Significance or declared category A and B weeds known from the Gove Peninsula (NTG 2012),
  - Monitoring timeframes and responsibilities.
- Sediment control plans including:
  - Minimise the length of time that bare soil is exposed,
  - Measure to reduce the need for large-scale clearing during the wet season,
  - Structures to divert water runoff away from natural water sources,
  - surface drainage to minimise the erosion to gullies and concentration of storm water runoff,
  - Undertake site stabilisation and rehabilitation as soon as disturbance is finished.
- The provision and consideration of principles to reduce light spill and lighting impacts on surrounding habitats, as outlined in Table 4.1, and
- Provision for the maintenance of existing fire regimes to reduce the risk of wildfire and increased ignition sources.

Table 4.1. Principles for reducing lighting impacts for inclusion in mine/infrastructure design

Type	Measure	Description
Minimise	Minimise the number of lights	Increase spacing of fixtures to reduce the overall amount of artificial lighting
	Turn off lights when not required	Control when lights are on and off, assisted by sensors, timers and motion detectors
	Flashing lights	Lights that flash intermittently can be used when constant light is not required
Confine	Light directing fittings	Use light fittings that direct and confine the spread of light

Type	Measure	Description
	Lower light fittings	Reduce the height of the lighting to confine the spread of light; use embedded lights in the ground rather than on poles
	Screens	Block light using screens of vegetation, timber, concrete blocks, earth bounds etc
Substitute	Low-pressure sodium bulbs	Substitute lamps with low-pressure sodium bulbs to produce longer wavelength light (yellow-orange)
	Lower intensity bulbs	Substitute high-intensity (wattage) bulbs with lower intensity bulbs
	Light-emitting diodes	Change the intensity/wavelength of the light using light-emitting diodes (LEDs)
	Light filters	Fit filters to light fittings to produce longer wavelength light (yellow-orange).

Modified from Gleeson and Gleeson (2012).

4.3 Impact Summary

No fauna species in decline or otherwise specially protected under legislation was located, or is considered likely to occur, within areas that may be affected by the proposed actions. All impacts associated with the proposed action are likely to be minor and localised with the exception of possible impacts to habitats which may hold some value for the Gove Crow Butterfly (i.e., monsoon rainforest at the West Soak),. This is largely due to location; *E. tetrodonta* woodland is common and widespread throughout the region and so are those fauna species within these habitats.

However, it is recognised that further work may be required to characterise impacts, if any, within habitat that appears superficially suitable for the Gove Crow Butterfly and provide a good opportunity for study by the Indigenous trainees (as guided by a qualified ecologist) from the Mining Training Centre which will be located on the Dhupuma Plateau. These habitats are offsite, located approximately 850m to the west of current mining plans, at the West Soak. This habitat is likely to be groundwater dependant and studies should demonstrate that groundwater conditions at this location won't be affected, or that the Common Crow Butterfly does not occur.

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Appendix A.
Site Descriptions

All five trapping sites occur within the same broad habitat type, consisting of *Eucalyptus tetrodonta* (Darwin Stringbark) and *Eucalyptus miniata* (Woollybutt) woodland on bauxite/laterite plateau. As all trapping sites are similar general descriptions of each sites is provided along with their proximity to unique features (i.e. proximity to water sources, fire damage). Dry season and post-wet season site photos are provided for sites where fires significantly changed habitat structure between surveys.

Transect	Lat/Long	Habitat description	Representative Photo
TR01	-12.3732/ 136.8103	TR01 was positioned at a slightly lower elevation (<10 m) than all other trapping sites situated just over the edge of the escarpment. This provided a large amount of exposed bauxite adjacent to the site that could be used for cover for ground dwelling fauna. In the period between surveys half of the site was burnt. Unlike TR02 and TR05 only half of the site was burnt and some grass and tree cover was present during the post-wet season survey. There was no debris or remains of buildings that this area had previously been inhabited.	 Dry season  Post-wet season
TR02	-12.3715/ 136.8029	The only evidence of human settlement on this site was the few large concrete slabs that appear to have been used to hold satellite dishes in place. This site was completely burnt between surveys, however, recent rains allowed for the sprouting of grasses that provided green pick for kangaroos.	 *Dry season

Transect	Lat/Long	Habitat description	Representative Photo
			 Post-wet Season
TR03	-12.3730/ 136.817	Large amounts of tin were strewn across this site providing cover for a range of vertebrate fauna. Within 100 m of the trap line was a large swimming pool that contained the only standing water on the Project Site. Grass and was relatively thick across the trapping site and Eucalypts were relatively slender providing few hollows for arboreal mammals and hollow nesting birds.	
TR04	-12.3835/ 136.8133	TR04 was in close proximity to large amount of debris, rubbish and the remains of concrete slabs left from previous inhabitants of the local area. Large flowering Eucalypts provided food for numerous honeyeaters and hollows for arboreal mammals such as Sugar Gliders. Ground cover was thick with leave litter and grass ranged from 10-45 cm in height.	
TR05	-12.3699/ 136.8101	Although relatively thick vegetation and ground cover existed during the dry season survey recent fires cleared all ground debris and most leaves from standing trees. Almost no ground cover was available for ground dwelling fauna during the post-wet season survey. This site was the hardest hit by fire of all the trapping sites. This site contained no evidence of human inhabitation.	 Dry season

Transect	Lat/Long	Habitat description	Representative Photo
			 Post-wet Season

Appendix B.
Recorded Vertebrate Fauna Species List

FROG		STATUS*		SITES							
Scientific name	**Common Name**	TPWC	EPBC	TR01	TR02	TR03	TR04	TR05	TR06	GARMA	Inc.
HYLIDAE											
Litoria bicolor	Northern Sedgefrog	LC				X					
Litoria caerulea	Green Tree Frog	LC		X							X
Litoria nasuta	Striped Rocket Frog	LC			X	X			X		X
Litoria rothii	Roth's Tree Frog	LC				X				X	
Litoria rubella	Desert Tree Frog	LC				X			X		X
Litoria tornieri	Tornier's Frog	LC								X	
Litoria watjulumensis	Wotjulum Frog	LC				X			X		X
MYOBATRACHIDAE											
Crinia remota	Northern Froglet	LC									X
BUFONIDAE											
Rhinella marina	Cane Toad	I			X	X	X			X	X

REPTILE		STATUS*		SITES							
Scientific name	**Common Name**	TPWC	EPBC	TR01	TR02	TR03	TR04	TR05	TR06	GARMA	Inc.
DIPLODACTYLIDAE											
Amalosia rhombifer	Zig-Zag Gecko	LC		X	X	X				X	X
Oedura marmorata	Marbled Velvet Gecko	LC								X	X
GEKKONIDAE											
Gehyra australis	Northern Dtella	LC								X	X
Hemidactylus frenatus	Asian House Gecko	I								X	X
Heteronotia binoei	Bynoe's Gecko	LC		X	X	X	X	X		X	X
PYGOPODIDAE											

REPTILE		STATUS*		SITES							
Scientific name	**Common Name**	TPWC	EPBC	TR01	TR02	TR03	TR04	TR05	TR06	GARMA	Inc.
Delma borea	Northern Delma	LC						X			
Lialis burtonis	Burton's Legless Lizard	LC							X		X
SCINCIDAE											
Carlia amax	Two-spined Rainbow Skink	LC		X	X	X	X	X		X	
Carlia munda	Striped Rainbow Skink	LC			X	X	X	X			X
Carlia sexdentata	Six-Toothed Rainbow-Skink	LC		X	X	X	X	X	X		X
Cryptoblepharus metallicus	Metallic Snake-eyed Skink	LC		X	X	X	X	X			X
Ctenotus spaldingi	Straight-Browed Ctenotus	LC				X					X
Lygisaurus foliorum	Iridescent Litter-Skink	LC		X				X			X
Tiliqua scincoides	Blue-tongued Lizard	LC									X
AGAMIDAE											
Chlamydosaurus kingii	Frill-necked Lizard	LC									X
Diporiphora bilineata	Two-lined Dragon	LC				X					
VARANIDAE											
Varanus scalaris	Spotted Tree Monitor	LC		X							X
BOIDAE											
Lialis olivaceus	Olive Python	LC				X					X
ELAPIDAE											
Acanthophis rugosa	Papuan Death Adder	LC		X							

BIRD		STATUS*		SITES							
Scientific name	**Common Name**	TPWC	EPBC	TR01	TR02	TR03	TR04	TR05	TR06	GARMA	Inc.
MEGAPODIDAE											
Megapodius reinwardt	Orange-footed Scrubfowl	LC									X

BIRD		STATUS*		SITES							
Scientific name	Common Name	TPWC	EPBC	TR01	TR02	TR03	TR04	TR05	TR06	GARMA	Inc.
COLUMBIDAE											
Ducula bicolor	Pied Imperial-Pigeon	LC								X	
Geopelia humeralis	Bar-shouldered Dove	LC		X		X	X	X	X	X	X
Geopelia striata	Peaceful Dove	LC		X	X	X	X	X	X	X	
PODARGIDAE											
Podargus strigoides	Tawny Frogmouth	LC								X	
APODIDAE											
Hirundapus caudacutus	White-throated Needletail	LC	Mig			X					
ARDEIDAE											
Ardea pacifica	White-necked Heron	LC				X					
ACCIPITRIDAE											
Accipiter fasciatus	Brown Goshawk	LC		X				X			
Haliastur sphenurus	Whistling Kite	LC				X					
FALCONIDAE											
Falco berigora	Brown Falcon	LC				X					
CACATUIDAE											
Cacatua galerita	Sulphur-crested Cockatoo	LC		X		X			X	X	
Cacatua sanguinea	Little Corella	LC								X	
Calyptorhynchus banksii	Red-tailed Black-Cockatoo	LC						X			X
PSITTACIDAE											
Aprosmictus erythropterus	Red-winged Parrot	LC			X	X	X			X	X
Platycercus venustus	Northern Rosella	LC		X	X	X	X	X	X		X
Psitteuteles versicolor	Varied Lorikeet	LC			X	X					

BIRD		STATUS*		SITES							
Scientific name	**Common Name**	TPWC	EPBC	TR01	TR02	TR03	TR04	TR05	TR06	GARMA	Inc.
Trichoglossus haematodus	Red-collared Lorikeet	LC		X	X	X	X	X			X
CUCULIDAE											
Centropus phasianinus	Pheasant Coucal	LC				X	X		X		X
Eudynamys orientalis	Eastern Koel	LC					X			X	
STRIGIDAE											
Ninox boobook	Southern Boobook	LC		X			X				X
HALCYONIDAE											
Dacelo leachii	Blue-winged Kookaburra	LC		X	X	X	X		X	X	X
Todiramphus macleayii	Forest Kingfisher	LC		X	X	X				X	
MEROPIDAE											
Merops ornatus	Rainbow Bee-eater	LC	Mig			X	X				X
CORACIIDAE											
Eurystomus orientalis	Dollarbird	LC		X							
PITTIDAE											
Pitta iris	Rainbow Pitta	LC									X
PTILONORHYNCHIDAE											
Ptilonorhynchus nuchalis	Great Bowerbird	LC				X	X	X		X	X
ACANTHIZIDAE											
Gerygone chloronota	Green-backed Gerygone	LC									X
Smicrornis brevirostris	Weebill	LC			X	X	X	X			X
MELIPHAGIDAE											
Cissomela pectoralis	Banded Honeyeater	LC					X				
Lichenostomus unicolor	White-gaped Honeyeater	LC									X

BIRD		STATUS*		SITES							
Scientific name	Common Name	TPWC	EPBC	TR01	TR02	TR03	TR04	TR05	TR06	GARMA	Inc.
Manorina flavigula	Yellow-throated Miner	LC		X	X	X	X		X	X	
Melithreptus albogularis	White-throated Honeyeater	LC		X	X	X	X	X		X	X
Myzomela obscura	Dusky Honeyeater	LC									X
Philemon argenticeps	Silver-crowned Friarbird	LC		X	X	X	X	X	X		
Philemon citreogularis	Little Friarbird	LC					X		X		X
CAMPEPHAGIDAE											
Coracina novaehollandiae	Black-faced Cuckoo-shrike	LC		X	X	X		X			
Coracina papuensis	White-bellied Cuckoo-shrike	LC		X	X	X	X	X			
Coracina tenuirostris	Cicadabird	LC								X	
Lalage leucomela	Varied Triller	LC									X
PACHYCEPHAGIDAE											
Pachycephala rufiventris	Rufous Whistler	LC		X	X	X	X	X		X	X
Pachycephala simplex	Grey Whistler	LC									X
ORIOLEIDAE											
Oriolus flavocinctus	Yellow Oriole	LC			X					X	
Oriolus sagittatus	Olive-backed Oriole	LC				X	X			X	X
ARTAMIDAE											
Cracticus nigrogularis	Pied Butcherbird	LC		X	X	X	X	X			X
Cracticus torquatus	Grey Butcherbird	LC		X	X	X	X				
DICURIDAE											
Dicrurus bracteatus	Spangled Drongo	LC		X							
RHIPIDURIDAE											
Rhipidura rufiventris	Northern Fantail	LC		X							X

BIRD		STATUS*		SITES							
Scientific name	**Common Name**	TPWC	EPBC	TR01	TR02	TR03	TR04	TR05	TR06	GARMA	Inc.
CORVIDAE											
Corvus orru	Torresian Crow	LC				X	X	X			
MONARCHIDAE											
Myiagra rubecula	Leaden Flycatcher	LC		X	X	X		X			
PETROICIDAE											
Microeca flavigaster	Lemon-bellied Flycatcher	LC				X					
HIRUNDINIDAE											
Petrochelidon nigricans	Tree Martin	LC						X			
NECTARINIIDAE											
Dicaeum hirundinaceum	Mistletoebird	LC		X	X	X					X

MAMMAL		STATUS*		SITES								
Scientific name	**Common Name**	TPWC	EPBC	TR01	TR02	TR03	TR04	TR05	TR06	GARMA	Inc.	Anabat
TACHYGLOSSIDAE												
Tachyglossus aculeatus	Echidna	LC									X	
PETAURIDAE												
Petaurus breviceps	Sugar Glider	LC					X				X	
MACROPODIDAE												
Macropus agilis	Agile Wallaby	LC		X					X		X	
Macropus antilopinus	Antilopine Wallaroo	LC					X				X	
Macropus sp.	Wallaroo sp.	LC		X								
VESPERTILIONIDAE												
Chalinolobus nigrogriseus/	Hoary Wattled Bat/	LC										X

MAMMAL		STATUS*		SITES								
Scientific name	**Common Name**	TPWC	EPBC	TR01	TR02	TR03	TR04	TR05	TR06	GARMA	Inc.	Anabat
Scotorepens sanborni	Northern Broad-nosed Bat											
Nyctophilus sp.	Long-eared Bat species	LC										X
Pipistrellus sp.	Pipistrelle species	LC										X
Vespadelus finlaysoni	Finlayson's Cave Bat	LC										X
MOLOSSIDAE												
Chaerephon jobensis	Northern Freetail Bat	LC										X
MINIOPTERIDAE												
Miniopterus orianae	Large Bent-wing Bat	LC										X
EMBALLONURIDAE												
Saccolaimus flaviventris	Yellow-bellied Sheath-tail Bat	LC									X	X
Taphozous georgianus	Common Sheath-tail Bat	LC										X
FELIDAE												
Felis catus	Feral Cat	I				X		X				
CANIDAE												
Canis dingo	Dingo	LC				X						
BOVIDAE												
Bubalus bubalis	Water Buffalo	I				X	X	X	X		X	

Appendix C.
Excluded Listed Species List

APPENDIX C. Significant Vertebrates Considered Unlikely to Occur

The table below lists 20 EVNT fauna species that where highlighted as known, or could potentially occur, from the region during the desktop review. However based on habitat and lack of recent relevant records, these species have been excluded from further assessment as unlikely to occur. Briefly, most of these species have been dismissed due to a lack of recent records and a lack of suitable habitat within the Project Site.

Scientific Name **Common Name**	**TPaWC**	**EPBC**	**Typical Habitat**	**Notes & Assessment**
Numenius madagascariensis Eastern Curlew	LC	CE	Estuaries, tidal mudflats, mangroves, saltmarshes.	No suitable habitat is present on the Project Site
Antechinus bellus Fawn Antechinus	DD		Tall open monsoon forest	No suitable habitat is present on the Project Site
Conilurus penicillatus Brush-tailed Rabbit-rat	V	V	Moist areas with dense grassy understorey within coastal she-oak woodlands, sclerophyll forest, and Pandanus thickets	Extinct within the local region
Dasyurus hallucatus Northern Quoll	Vul	E	Rocky eucalypt woodlands though diversity of forested habitats utilised.	Extinct within the local region
Isoodon auratus Golden Bandicoot	E		Hummock grasses on sandstone, grassy woodlands, deciduous vine thickets	Extinct within the local region
Mesembriomys gouldii Black-footed Tree-rat	NT		Tropical forest and open woodlands	Extinct within the local region
Notomys aquilo Northern Hopping-mouse	V	Vul	Restricted to dune systems and sand sheets in north east Arnhem Land, inland to Maningrida	Only occurs on sandy habitats such as sand dunes, no suitable habitat is present on site
Phascogale pirata Northern Brush-tailed Phascogale	E	V	Dry sclerophyll forest, monsoonal forest and woodlands outside of semi-arid zone	Extinct within the local region

Scientific Name **Common Name**	**TPaWC**	**EPBC**	**Typical Habitat**	**Notes & Assessment**
Saccolaimus saccolaimus nudicluniatus Bare-rumped Sheathtail Bat	NT	CE	Mostly in sclerophyll open-forest, roosts in tree hollows	Does not occur within proximity of the Project Sites, not known from the north east of the Northern Territory
Xeromys myoides Water Mouse	DD	Vul	Mangroves, saline grasslands, margins of freshwater swamps, lakes close to fore dunes	Only occurs in mangrove habitats, no suitable habitat is present on site
Balaenoptera musculus Blue Whale	DD	E	Open oceans	Marine species are not included in assessments
Megaptera novaeangliae Humpback Whale	LC	V	Open oceans, migrating along the east coast of Australia	Marine species are not included in assessments
Acanthophis hawkei Plains Death Adder	Vul	Vul	Cracking clay soils, open grasslands on black soil	Taxonomical issues complicate know distribution habitat and occurrence, however based on current evidence no suitable habitat is present, no records within 50 km.
Chelonia mydas Green Turtle	LC	Vul	Tropical ocean waters worldwide, utilising beaches for nesting	Marine species are not included in assessments
Eretmochelys imbricata Hawksbill Turtle	LC	Vul	Tropical ocean waters worldwide, utilising beaches for nesting	Marine species are not included in assessments
Caretta caretta Loggerhead Turtle	Vul	E	Tropical ocean waters worldwide, utilising beaches for nesting	Marine species are not included in assessments
Dermochelys coriacea Leatherback Turtle	CE	E	Tropical ocean waters worldwide, utilising beaches for nesting	Marine species are not included in assessments
Natator depressus Olive Ridley Turtle	Vul	E	Tropical areas of Indian, pacific and parts of Atlantic oceans, largely restricted to Northern Australia	Marine species are not included in assessments
Natator depressus Flatback Turtle	DD	Vul	Restricted to Australian coastal waters between Kimberley region and east coast of Queensland	Marine species are not included in assessments

Scientific Name **Common Name**	**TPaWC**	**EPBC**	**Typical Habitat**	**Notes & Assessment**
Varanus mertensi Merten's Water Monitor	NT		Watercourses and lagoons of northern Australia	No creeks, river or aquatic habitats relied on by this species occur within the Project Site