TERRITORY IRON Pty LTD.

Environmental Survey of Landscape, Flora and Fauna of Proposed Iron Mining within the Frances Creek Project Area

Prepared for

Territory Iron Pty. Ltd.

By

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Frontispiece: Iron Mining halted in 1974 due to cyclone Tracy and flooding and ore transport problems mitigated against reopening the mine at that time. Reappraisal and expansion of the mine is currently underway. Helene Pit 5 shows the revegetation after 30 years of natural rehabilitation.

1 EXECUTIVE SUMMARY

An environmental survey of the Frances Creek Project area was conducted between November 11th and 15th, 2005 at the start of the wet season. The aim of the study was to conduct a baseline flora and fauna survey of the project area and collect baseline information on land systems and soils present in the area before mining resumes following a 30 year break. The area is typical of the Wet – Dry Tropics. Annual rainfall for the region largely falls within a distinct wet season (December to March) with little or no rain falling for the remainder of the year. The distinct seasonality of the region causes significant temporal and spatial fluctuations in flora and fauna species composition and abundance. Therefore, to overcome the shortcomings of a single survey of short duration, the survey results and assessment of the conservation value of the area have been placed in a regional and temporal context through reference to nearby studies during other seasons.

1.1 Existing Environment

Landscape: Land Systems for the Katherine – Darwin Region have been described and mapped by Christian and Stewart (1953). The Frances Creek project area is within the *Brocks Creek Ridge* Land System (Christian and Stewart 1953). Small areas of the *Cullen* Land System are present in the southeastern and northeastern parts of the mineral lease, however no mining activity is proposed in this granitic area.

Four land unit groups from the *Brocks Creek Ridge* Land System were identified within the lease boundaries, which were generally based on landform and vegetation characteristics. These land units are listed as follows:

1) *Ridge Crest and Slopes.*
2) *Low Hills.*
3) *Riparian*
4) *Small Alluvial Flats*

Two land units from the *Cullen* Land System are present in a small portion of the project area that will not be subject to mining disturbance. These land units are Granite Hills and Low Undulating Hills associated with riparian zones. These land units are pooled together in this report and are reffered to as the *Cullen* Land System.

Vegetation: The vegetation is dominated by Eucalypt woodland over the proposed lease area. Dominant vegetation communities for the Northern Territory have been described and mapped

by Wilson *et al.* (1990). The vegetation community of Frances Creek is known as vegetation type 21, which is described as *Eucalyptus tintinans* with *Corymbia dichromophloia* and *E. miniata*, over a tall *Sorghum* grassland understorey (Wilson *et al.* 1990). *Eucalyptus tetrodonta* was also a common tree in several habitats across the mineral lease. *E. miniata* and *E. tetrodonta* commonly occur in the open tropical woodlands of the Northern Territory (Brock 1988).

Fauna survey: Fauna of Frances Creek is typical of the Pine Creek region. The fauna list from the survey is presented in Appendix 13.1. A relatively small proportion of fauna species expected to inhabit the area were recorded during the survey, which may reflect seasonal variability and the limitations of a short survey period. The impact of cane toads, which arrived about 2002, three years before the survey, may also have influenced the local fauna. Species either presently or potentially inhabiting the project area are listed in Appendices 13.5 (mammals), 13.6 (reptiles), 13.7 (frogs) and 13.8 (birds). These species lists were derived from several biological studies previously undertaken in the Pine Creek Region (Davidson 1985, Woinarski *et al.* 1989, NSR 1992, NSR 1993, Eldridge and Low 1994, Grattidge and Low 1995, Reilly, Low and Matthews 2005).

Impact Assessment: The mining operations will focus on hills with a high iron content sitting within a complex matrix of the northeastern edge of the Pine Creek Geosyncline. Clearing of vegetation for developing the iron ore mining operation at Frances Creek will result in localised habitat loss for flora and fauna, particularly for species residing on the *Ridge Crests and Slopes* land unit. Mining will also indirectly impact on the local fauna through increased noise, vibration, dust, lights, roads, human activity and yearlong availability of water. Although these disturbances are likely to lead to loss of individual plants and animals from the Frances Creek project area, the species still present are common and widespread throughout their range and their conservation status is unlikely to be affected. Permanent water availability in a tailings storage facility, already a functioning wetland following mining that stopped in 1974, will result in water-based species continuing to reside in the area.

1.2 Conservation Considerations for the Frances Creek project area

- Six fauna species of conservation significance were identified during the Frances Creek survey, these were the Bush Thicknee (*Burhinus grallarius*), Red-tailed Black Cockatoo (*Calytorhynchus banksii*), Western Chestnut Mouse (*Pseudomys nanus*), Pale Field-rat (*Rattus tunneyi*), Orange Horseshoe-bat (*Rhinonicteris aurantius*) and the Arnhem Sheathtail-bat (*Taphozous kapalgensis*). These species are listed as Near Threatened

mammals under *Territory Parks and Wildlife Conservation Act* (2000) although they may be locally common over their species range. Local habitat loss is unlikely to affect the status of these species, however, mining operations need to minimise the impact on these species by conserving habitat where possible.

- Twenty-six fauna species with Northern Territory conservation significance (*TPWC Act* 2000) have been identified in the area from fauna surveys between 1989 and 2005 (Table 7.2).

- No species of national significance were identified during the Frances Creek survey in 2005. However, six fauna species listed under the *EPBC Act* (1999) could possibly occur within the local habitat, they are: Bare-rumped Sheathtail Bat (*Saccolaimus saccolaimus nudicluniatus*), Gouldian Finch (*Erythrura gouldiae*), Northern Quoll (*Dasyurus* hallucatus), Red Goshawk (*Erythrotriorchis radiatus*), Partridge Pigeon (*Geophaps smithii smithii*) and Masked Owl (*Tyto novaehollandiae kimberli*). These species may be present either occasionally or seasonally. All species apart from the Bare-rumped Sheathtail Bat have been recorded from fauna surveys conducted in the Pine Creek region between 1985 and 2005 (Table 7.2). While these species are potential inhabitants of the area, the proposed mining areas are not critical habitat for them. Evidence is accumulating that Northern Quolls have largely disappeared from areas that Cane Toads have invaded (our surveys, Beth Crase, pers comm.. 2005). Gouldian Finches have disappeared from large parts of their former range and although the valley bottoms in the lease area contain suitable grasslands, Gouldians were not sighted. Mining areas will not impact on the valley bottom grasslands, however, traffic speed on roads through the valleys may need to be managed if Gouldians are found to be feeding in the area. Mining staff should be trained in identification of Gouldian Finches and management actions imposed if the finches are found during appropriate seasonal conditions.

- An isolated patch of Cycad (*Cycas armstrongii*) occurs on a footslope (GDA 94: E808807, N8498303) on the Ochre Hill and Millers road (Plate 12.20). *C. armstrongii* is listed as vulnerable in the N.T. (*TPWC Act* 2000) and should not be cleared or disturbed by mine operations. The Cycads are 50m away from the existing road and there is no reason for them to be disturbed during any road upgrade.

- The *Riparian* land unit deserves protection and consideration during the development of the mining operation. *Riparian* habitat is environmentally sensitive, species rich and provides important refuge for the local fauna during the dry season. This habitat will provide a valuable source of flora and fauna for rehabilitation purposes (i.e. natural spread of seed and species from the *Riparian* zones into rehabilitated areas).

- Frances Creek does not represent an area of significant endemism, but does retain areas of low grazing pressure pristine habitat where disturbance should not occur (especially in the northern section of the project area). The project area is typical of the widespread landscape and biota occurring within the Wet-Dry Tropics of the Pine Creek Region. It is recommended that mining and disturbance of pristine habitat be minimised were possible. The southern section of the proposed mining area has experienced past iron ore mining, which has altered the landscape and natural species composition (i.e. six pits were active between 1966 and 1974). Mining within these disturbed areas is not an environmental conservation issue. Low levels of grazing by feral or seldom managed stock including horses, donkeys, cattle and buffalo have had a minor impact on the area for 50 or more years, but it would be expected these animals would have grazed in preferred grasslands.
- Seven introduced flora species (weeds) were recorded during the survey; Calopo (*Calopogonium mucruroides*), Hyptis (*Hyptis suaveolens*), African Feathergrass (*Pennisetum pedicellatum*), Ringworm Scrub (*Senna alata*), Stinking Passion Vine (*Passiflora foetida*), Common Sensitive Plant (*Mimosa pudica*) and Couch Grass (*Cynadon dactylon*). All species were confined to areas where previous disturbance has occurred and were mostly species that were used for revegetation during rehabilitation programs in the mined areas and tailings dam. The functioning wetland where the tailings storage facility was previously located contained all species. Weed control is important and efforts to reduce the chance of weed spread are encouraged. Any future rehabilitation programs should use local native species or simply replace top soil.

2 INTRODUCTION

2.1 Project Description

Territory Iron Ltd intends to resume mining and to develop additional resource areas in an iron ore mining operation within the Frances Creek project area, located approximately 200 kilometres south of Darwin. Territory Iron Ltd holds exploration tenements over the area or has entered into agreements with other tenement holders. The proposed development involves expanding existing pits at Helene 5, Helene 6/7, Jasmine, Rosemary and Thelma Rosemary and mining undeveloped iron deposits at Marion, Ochre Hill and, at a later stage, Millers deposits (Figure 2.1). Exploration drilling has occurred over all proposed mining locations, which provided good quality access tracks to these sites. Other physical impacts are likely to include, processing/sorting areas, deposition of waste materials i.e. rock and tailings and upgrading tracks sufficient for use by 20 tonne trucks.

The main proposed mining area is located to the south of Frances Creek (Helene, Thelma Rosemary, Marion, Rosemary and Jasmine deposits). The proposed mining area at Ochre Hill is located within the same area, but on the northern side of Frances Creek. The Miller deposit is located further to the north, in the lower hills between the McKinley River wetlands/blacksoil plain to the west and the Mary River plains to the east. This section of the north eastern edge of the Pine Creek geosyncline has lower relief than the Frances Creek/Ochre Hill deposits and drainage consists of seasonal gullies which flood-out into swamps.

It is anticipated that a Public Environmental Report will be required for the Frances Creek project. Therefore, Territory Iron commissioned Low Ecological Services to conduct baseline surveys focusing on the landscape, flora and fauna of the proposed mining locations within the project area.

This environmental survey aimed to:

- Determine habitat, species richness and general abundance of species,
- Map vegetation communities, flora and fauna of Federal and Territory conservation significance present with particular attention to potential mining areas
- Assess their conservation value, and
- Propose development strategies to minimise environmental impact from mining.

2.2 History of site

Iron ore was mined from the old Frances Creek mining centre within the Frances Creek project area between 1966 and 1974. Over this period, the mine produced approximately eight million tones of iron ore grading 59% from thirteen open cut pits. In 1974, cyclone Tracy caused major flooding and extensive damage to mining infrastructure at Frances Creek and the loading pads in Darwin. This subsequently led to the closure of the mine site.

The Frances Creek mining village housed approximately 2,000 people that included miners, workers and their families. The village was abandoned after mine closure and only old concrete footings and other scrapped materials are present. The old church and swimming pool still exist and appear to be in reasonable condition. The large dam on the western edge of the project area is used for recreational activities, including water-skiing, swimming and camping.

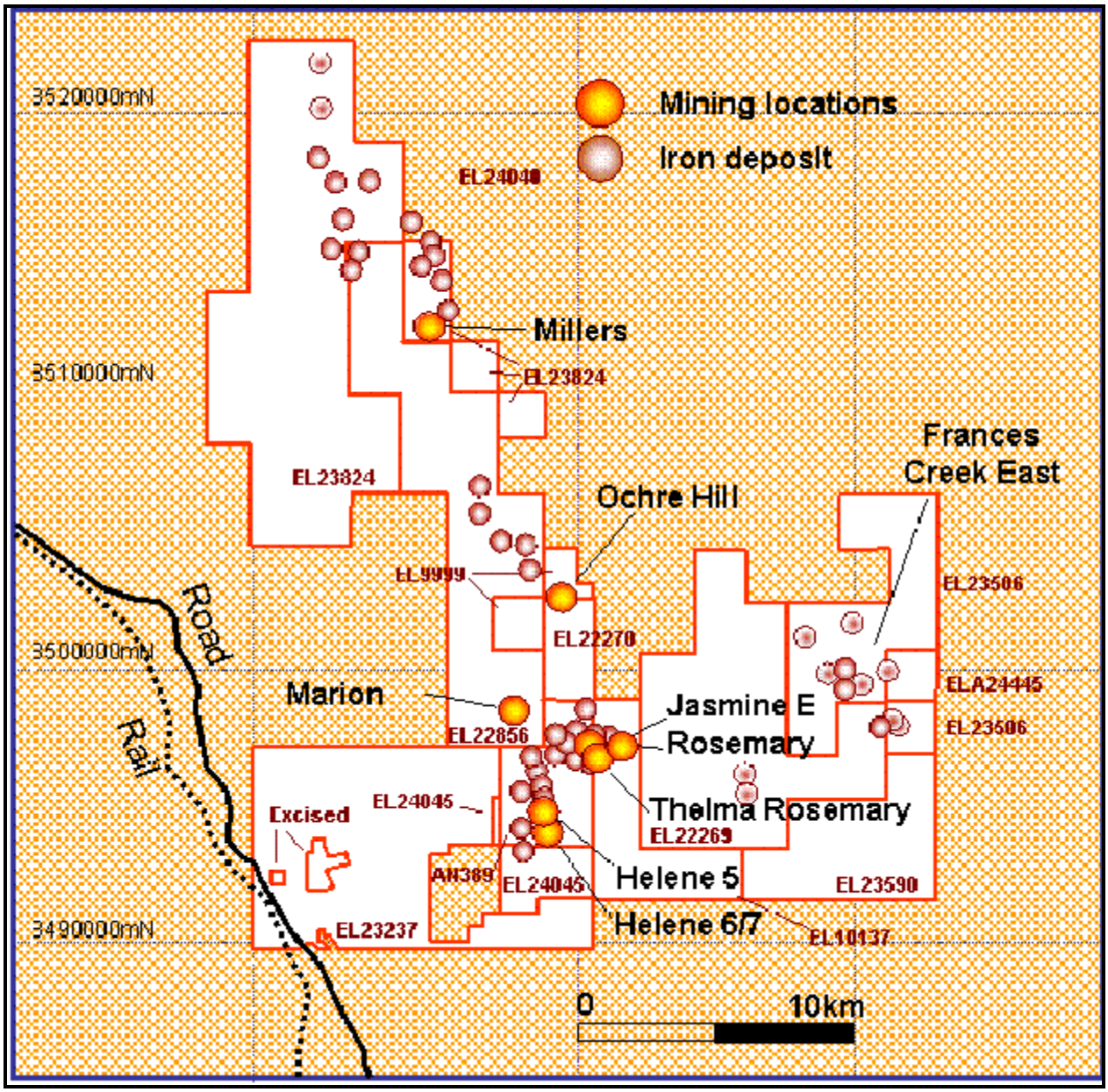

Figure 2.1: Frances Creek project area and potential locations of iron ore mining areas.

Source: MBS Environmental

3 SCOPE

Territory Iron require the following tasks to be undertaken:

- Undertake Territory and Federal database searches to identify flora and fauna species of conservation significance and threatened ecological communities within or immediately adjacent to the mineral lease application ("project") area.
- Conduct field surveys during Spring/Summer 2005 to map the vegetation communities present within the project area with particular attention to potential mining areas.
- Determine the presence of flora species or vegetation communities of Federal and Territory conservation significance within the project area.
- Determine the presence of vertebrate fauna species of Federal and Territory conservation significance within the project area with particular attention to potential mining areas.
- Identify the land systems and soil types located within the project area with particular attention to potential mining areas.

Limitations of the Survey

Frances Creek is located in the far north of the Northern Territory where the climate is typically monsoonal with distinct wet and dry seasons. It is recognised that a one-off, short-term survey within an area exhibiting strong seasonality will not fully represent species diversity and their relative abundances. Consequently, this report assesses the conservation value of Frances Creek on a habitat basis using data obtained in the survey to validate presence of species, but enabling assessment of presence of other potential species that may occur in the area. Biological records held by the Parks & Wildlife Commission N.T., regional studies such as Woinarski *et al.* (1989), Flora and Fauna Assessments for nearby locations Mt Porter, Spring Hill, Union Reef and Brocks Creek by ourselves and others have been used to place the survey results of Frances Creek into a regional and temporal perspective.

4 SITE LOCATION AND REGIONAL DESCRIPTION

4.1 Location

The Frances Creek project area is located approximately 200 kilometres south of Darwin and 25 kilometres north of Pine Creek (Latitude 13^{o} 37' 00''S, Longitude 131^{o} 51' 06''E) (Figure 4.1). Frances Creek, Ochre Hill and Millers iron deposits are within Exploration License Areas 24045, 10137, 9999 & 23824 located on Ban Ban Springs and Mary River West (PPL815, NT Portion 1630) pastoral stations. A Mineral Lease Application for Frances Creek has been submitted for an area of 1,212 hectares.

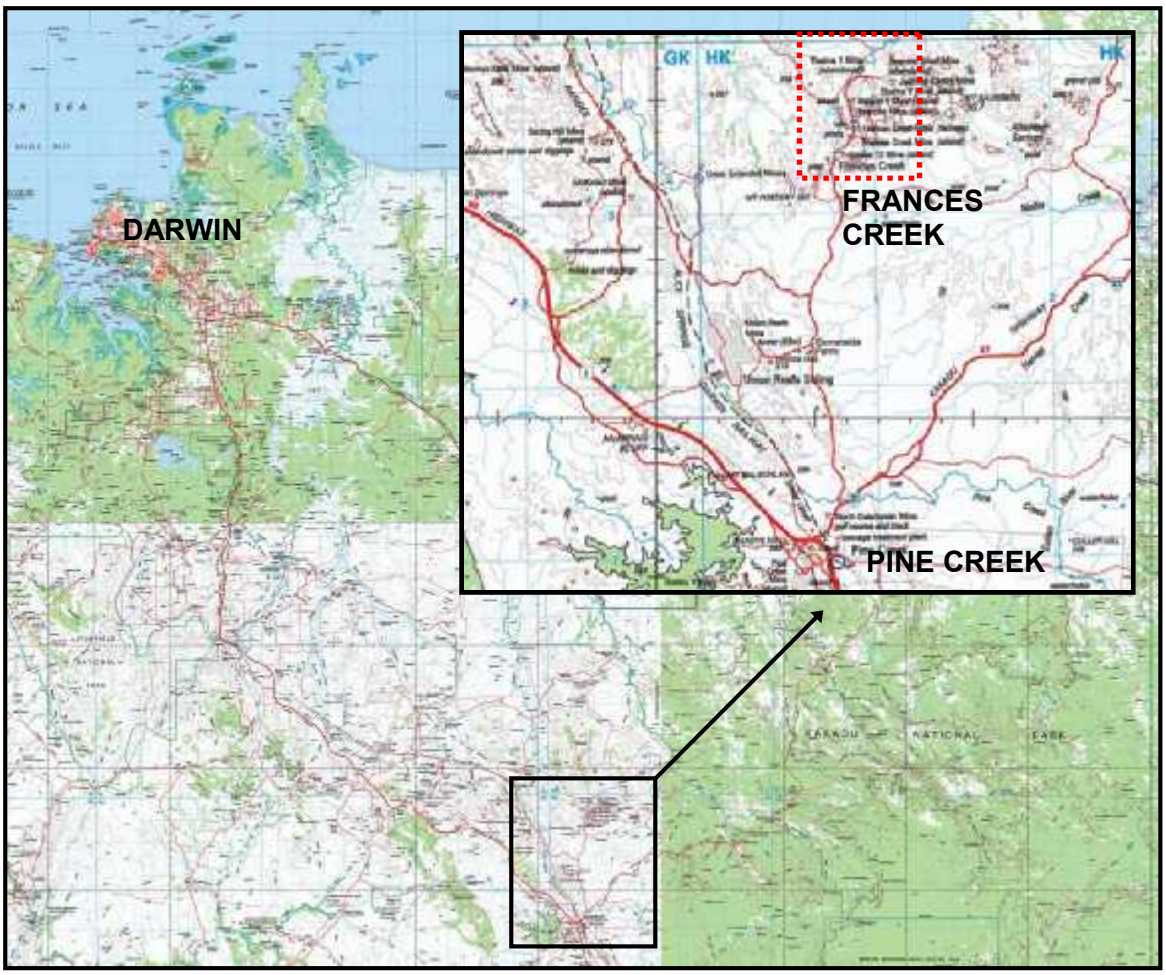

Figure 4.1: Location Map showing Frances Creek project area.

Scale: Grids are 20 x 20 km. Grid ticks are every 1 km.

Note: Map was taken from NATMAP Raster Mosaic 2003.

4.2 Climate

The climate of Frances Creek is typically monsoonal, characterised by a long dry season (May to October), and a short wet season (December to March) when 80 – 90% of the annual rainfall occurs (Woinarski *et al.* 1989). April and November are usually transitional months.

Pine Creek is the nearest location that has long-term weather records. The Pine Creek Post Office has records dating back to 1874.

Rainfall is predictable in the region and averages between 1100 – 1200mm per year. The Pine Creek Post Office has recorded an average annual rainfall of ~1150mm since 1874. The period between October and March produces a significant part of the rainfall for the year due to the presence of sub-tropical NW monsoons and associated tropical low-pressure systems. June and August are the driest times of the year with little or no rain. The distinct seasonality greatly affects the regions fauna, causing significant temporal and spatial fluctuation in species richness and abundance.

Air temperatures are relatively high and constant between years. During the coolest time of the year (June and July), the mean monthly temperature for Pine Creek ranges from a minimum of 10 – 13^{o}C to a maximum 20-32^{o}C. In the hottest part of the year (October to November), the mean monthly temperature ranges from a minimum of 24 – 27^{o}C to a maximum of 37 – 41^{o}C.

Humidity measured at Pine Creek averaged 49% in September 2004 and 79% in February 2005 (Bureau of Meteorology, 2005). Evaporation at Pine Creek is estimated at 3,360 millimetres per year. Therefore, evaporation exceeds rainfall by a factor of 2.9 (based on an average year for Pine Creek).

Rainfall and temperature data collected from Pine Creek 12 months prior to the Frances Creek environmental survey is provided in Figure 4.2 (Bureau of Meteorology 2005).

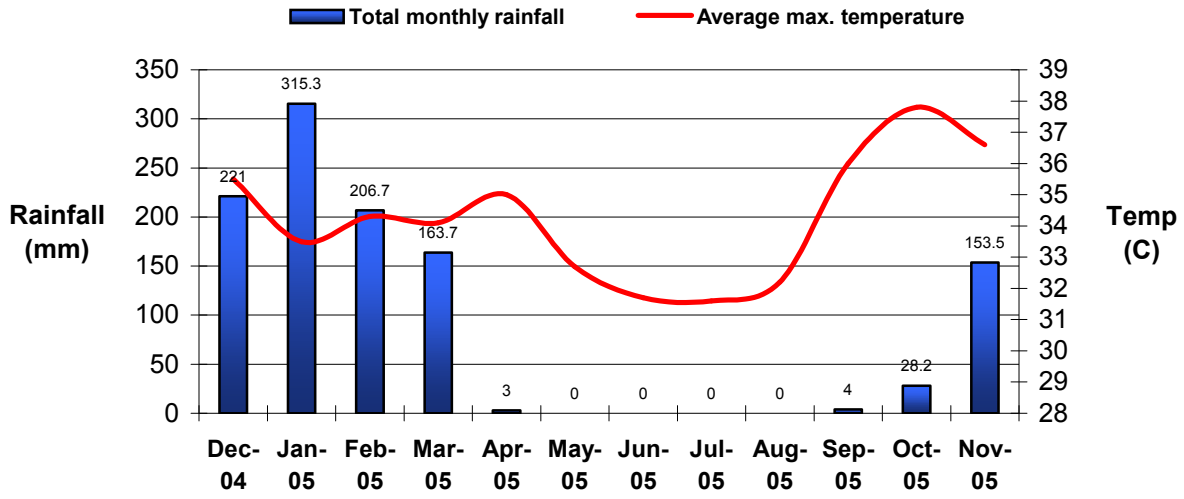

Figure 4.2: Total rainfall (mm) and average maximum temperatures for the previous 12 months. **Blue bars** represent rainfall data, and the **red line** represents temperature. Information was extracted from Pine Creek climatic data on the Bureau of Meteorology website.

4.3 Biological Records

No previous systematic wildlife survey has been conducted for the Frances Creek project area. However, several short-term environmental surveys have been conducted for a number of mines within the region of Frances Creek, including: Mt Porter (Reilly *et al.* 2005), Spring Hill (Grattidge and Low 1996), Brocks Creek (Eldridge and Low 1995), Union Reefs (NSR 1993), Pine Creek (Mitchell 1995), Cosmo Howley Mine (Davidson 1985) and Mt Todd Mine (NSR 1992). Woinarski *et al.* (1989) conducted a year long study of fauna distribution and density in nearby Kakadu National Park to examine changes in distribution of fauna in relation to wet and dry seasons.

4.4 Land System Description

The geomorphology and land systems of the Katherine – Darwin region were described and mapped by Christian and Stewart (1946). Frances Creek contains two land systems, 1) *Brocks Creek Ridge* Land System, which comprises approximately 90% of the project area, and 2) *Cullen* Land System, located on the southern southeastern and northeastern edges of the project area (Figure 4.3). These two land systems fall into the broader geomorphological unit referred to as Elevated Backbone Country or eroding upland country. The proposed mining locations are within the *Brocks Creek Ridge* Land System.

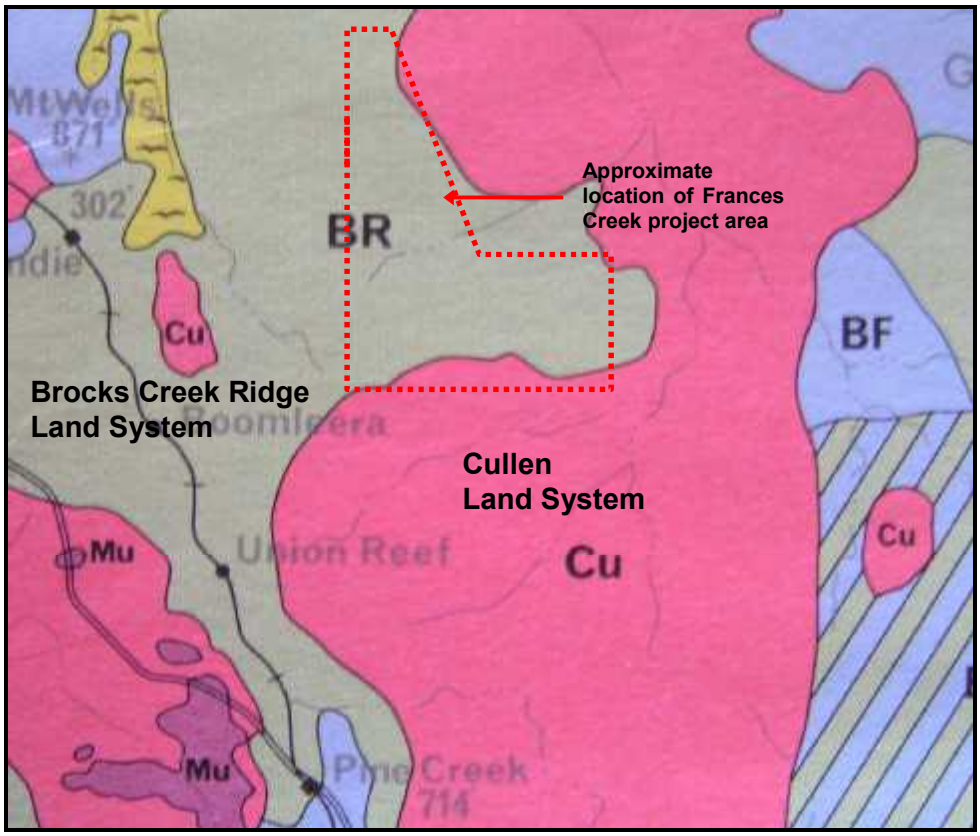

Figure 4.3: Land System Map of the Frances Creek project area.

Legend: Green (BR) is Brocks Creek Ridge LS, Red (Cu) is Cullen LS

Note: Map is an extract from the Land System Map for Katherine – Darwin Region (Christian *et al.* 1946).

4.5 Geology and Geomorphology

The *Brocks Creek Ridge* Land System is described as consisting of sharp, rocky, north/south ridges, and hills with steep slopes (up to 40 – 60%) to gentle crests that are dissected by watercourses. Erosion is active and there is little or no accumulation of soils on the steep slopes. The system is formed on strongly folded metamorphics of the Brocks Creek Group (i.e. slates, quartzites, sandstone, greywacke and siltstone). The steep rocky ridges are associated with lower convex hills, small alluvial flats and channels incised through sandy or loamy material (Christian and Stewart, 1946). Rocky ridges in the Frances Creek project area contain ironstone (up to 62% iron content) and siltstone outcrops and slopes. Sparse areas of quartzite and sandstone also occur within the area.

The *Cullen* Land System contains topography that varies from rough, rocky granite outcrops to gently undulating country with small areas of flat land. The base rock of this land system is Cullen Granite, which is known to commonly intrude rocks in the Brocks Creek Group from the *Brocks Creek Ridge* Land System. The granites within the *Cullen* land system differ in structure,

mineral composition and resistance to erosion. In consequence, the topographic form of the *Cullen* land system can be quite variable (Christian and Stewart 1946).

4.6 Soils

Soils of the *Brocks Creek Ridge* Land System generally comprise of very gravelly sandy loam and skeletal soils formed on metamorphics of the Brocks Creek Group (Christian and Stewart, 1946). Alluvial flat areas contain heavier darker soils that contain higher levels of clay and silt, which are described as “Acid” Alluvial soils.

Soils within the steep topography of the *Cullen* Land System of large, rounded granite boulders are described as very gritty, sandy skeletal soils. The undulating country is generally comprised of granitic sandy yellow podsolic soils.

4.7 Fauna

Several fauna species of conservation significance (*EPBC Act* 1999; *TPWC Act* 2000) could potentially occur within the Frances Creek project area, specifically seven threatened species and nine migratory species. Three species of significance are the Bare-rumped Sheathtail Bat *Saccolaimus saccolaimus nudicluniatus* (Critically Endangered), the Gouldian Finch *Erythrura gouldiae* (Endangered) and the Northern Quoll *Dasyurus hallucatus* (Endangered).

4.8 Vegetation

Vegetation communities of the Northern Territory have been mapped and described by Wilson *et al.* (1990) (Figure 4.4). The vegetation community of Frances Creek is known as vegetation type 21, which is described as *Eucalyptus tintinans* with *Corymbia dichromophloia* and *E. miniata*, over a tall *Sorghum* grassland understorey (Wilson *et al.* 1990). *Eucalyptus tetrodonta* was found to be commonly associated with the vegetation community across the project area, especially in the lowland country in association with *E. miniata*. The surrounding vegetation community is vegetation type 15 - *Eucalyptus tectifica* and *Corymbia latifolia* with Sorghum Grasses (Wilson *et al.* 1990).

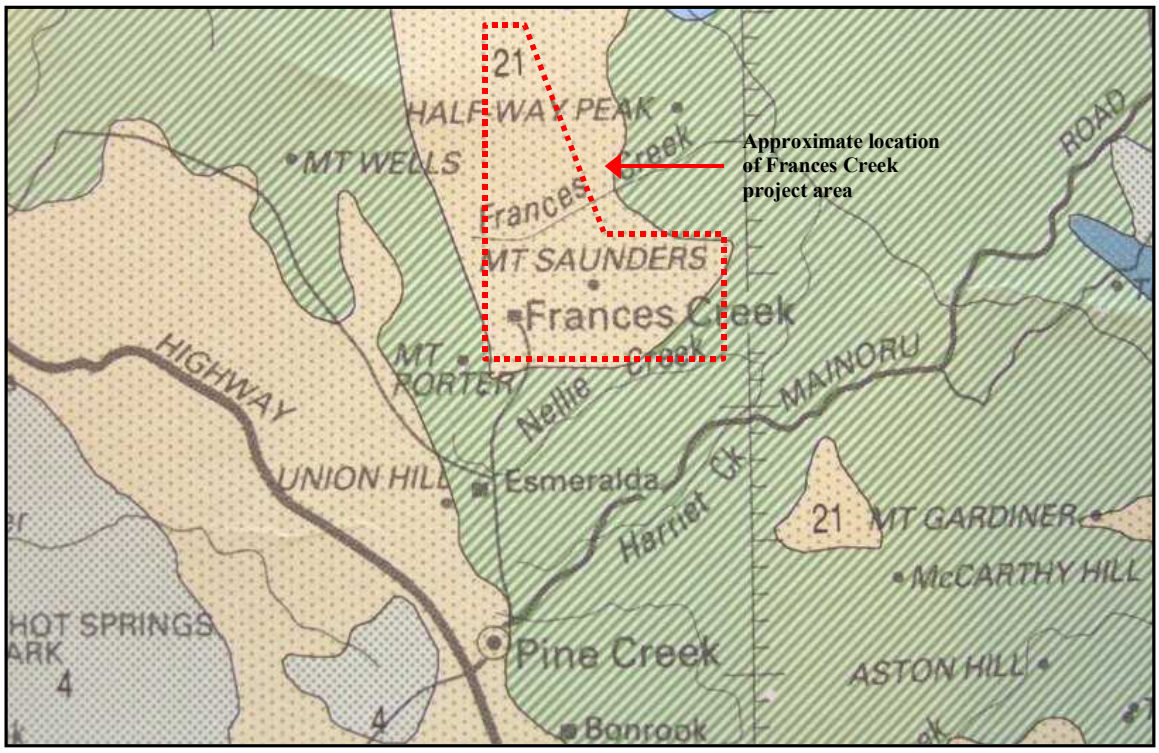

Figure 4.4: Vegetation Map for the Frances Creek project area

Cream with green dots: *E. tintinans* associated with *Corymbia dichromophloia* and *E. miniata*, over a tall *Sorghum* grassland understorey

Green Stripes: *Eucalyptus tectifica* and *Corymbia latifolia* woodland with *Sorghum* grassland understorey

Note: Map is an extract from Wilson *et al.* (1990) Vegetation Map of the Northern Territory.

5 SURVEY METHODS

A four day survey of the flora, fauna and landscape for the Frances Creek project area was conducted between 11th and 15th November 2005, by Dr Bill Low and Tom Reilly of **Low Ecological Services** and bat specialist Dennis Matthews.

Firstly, the major land units within the boundary of the lease were identified. This was based on geology, topography, soils and vegetation composition. Four land units in the survey area are part of the Brocks Creek Ridge Land System. The land units were mapped and described (Maps 1A and 1B).

Land Units of the Brocks Creek Ridge Land System

1) *Ridge Crest and Slopes*
2) *Low Hills*
3) *Riparian*
4) *Small Alluvial Flats*

Note: Land units from the Cullen Land System (granite Hills, riparian, low undulating plains) are also present but will not be disturbed by the mining operations.

Survey Sites: Flora and fauna survey sites were chosen at three of the main ironstone deposits proposed for mining by Territory Iron. These included Helene, Ochre Hill and Millers ironstone deposits. Trap lines were installed across differing habitats to represent the species at each location. All sites were photographed at ground level, and surveyed for flora and fauna. Survey sites are described in Table 5.1 and locations are shown in Maps 1A and 1B.

Flora Assessment: At each site, a 100m^2 quadrat was marked out to represent the typical habitat of the site. Two people then surveyed the quadrat for 30 minutes (1 hour total). The survey aimed to determine species composition and dominance, community structure, the presence and phenological state of trees, and the presence of significant vegetation. Plant species were identified in the field where possible and voucher specimens collected where identifications were uncertain or reference material was required. Specimens collected were identified by botanist Des Nelson (Alice Springs) and the NT Herbarium (Darwin).

Fauna Assessment: The general presence of small mammals and reptiles were surveyed at each location using Elliott and pitfall trap transects (10 to 15 metre spacing). Twenty-five Elliott traps were used at each of the three locations. Elliott trap transects were split into two sub-transects that allowed assessment of different habitats within each site. One pitfall trap was installed within each sub-transect (six in total). Each site was trapped for three nights. Trapped

fauna were identified, details recorded (gender, body length, snout-vent length),photographed if warranted, then released. Opportunistic sightings, captures and sign of fauna were recorded at each site (approximately 1 hour per day). Birds and their general abundance were recorded within trap sites or opportunistically by observation or call. All opportunistic sightings or signs of animals within the survey area were recorded. Spotlighting was conducted each evening for one or two hours, mainly by walking the roads into the range of habitats available. An Anabat bat detector was positioned at each site for one night and a 2nd recorder was used during spotlighting (described below).

Table 5.1: Brief description of survey sites with the type of assessment method used at each site.

Note: GPS locations are provided in WGS 84

Survey Site ID	Site Location		Land Unit	Assessment Method
Site 1a	Tailings Rehabilitation		Riparian	14 Elliott traps, 1 Pitfall trap, bat detector, bird survey, fauna sign search, flora assessment
	E808439	N8494425		
Site 1b	Helene		Rocky Slopes	11 Elliott traps, 1 Pitfall trap, bat detector, bird survey, fauna sign search, flora assessment
	E808489	N8493902		
Site 1c	Jasmine		Rocky Ridges	Flora assessment, bird survey, fauna sign search. No animal trapping occurred
	E811238	N8497500		
Site 2a	Ochre Hill		Small Alluvial Flats	10 Elliott traps, 1 Pitfall trap, bird survey, fauna sign search, flora assessment
	E809008	N8502992		
Site 2b	Ochre Hill		Rocky Ridges	14 Elliott traps, 1 Pitfall trap, bat detector, bird survey, fauna sign search, flora assessment
	E809555	N8501921		
Site 3a	Millers		Low Hills (flats)	11 Elliott traps, 1 Pitfall trap, bird survey, fauna sign search, flora assessment
	E804653	N8512032		
Site 3b	Millers		Low Hills (rocky)	14 Elliott traps, 1 Pitfall trap, bat detector, bird survey, fauna sign search, flora assessment
	E804698	N8512073		

Bat Identification: The bat survey was conducted by specialist Dennis Matthews. Bat calls were used to identify bat species in the area. Calls were recorded by two ANABAT Systems (version 6) (Chris Corben, Titley Electronics). ,Bats detectors were set-up at survey locations listed in Table 5.2 and Maps 1A and 1B .

Bat calls were stored on a memory card and then transferred to a computer for analysis. Poor calls and insect calls were deleted. Calls were identified from “Key to the calls of the Top End of

the Northern Territory" by Damian Milne, Parks and Wildlife Commission of the Northern Territory. The ANABAT System (version 6) used this way cannot provide abundance data of species recorded, because a single bat can pass the detector many times. Therefore, only a checklist of species can be provided. However, the results can give an indication of the relative activity of different species at a particular location. Some species were not separated from other species due to constraints of this technique.

Table 5.2: Bat detector locations during the Frances Creek survey.

		Detector #	Eastings	Northings
Day 1	**Swimming Pool**	1	807458	8493030
	Church	2	807336	8493002
Day 2	**Ridge**	1	809274	8502277
	Church	2	807336	8493002
Day 3	**Millers**	1	804725	8512290
	Walk to Pit and Church	2	808515	8494430

Soil and Water Sampling: Sampling was collected for Dr Ian Martin (MBS Environemntal) who will assess the results in a separate report for Territory Iron. Soil and water samples were collected from various locations within the project area (described in Tables 5.3 and 5.4). Sampling targeted existing open cut pits, waste rock dumps, undisturbed areas above pits and waste rock dumps, rehabilitated tailings storage facility and pristine water bodies around the lake. The sampling exercise aimed to assess the level of iron mineralisation and other ions that might concentrate as a result of mining operations at selected disturbed and undisturbed sites. Six soil and seven water samples were collected using standard techniques and 500ml unpreserved bottles/jars (AS/NZ 5667.1: 1998 Water Quality – sampling). Maps 1A and 1B shows the location for each sample. Samples were immediately sealed, refrigerated and posted to the analytical laboratory.

Northern Territory Environmental Laboratories (NTEL) analysed the samples (NTEL is a NATA, National Association of Testing Authorities, accredited laboratory).

Table 5.3: Water sample locations and descriptions

Water Samples				
Sample ID	Date	GPS location		Location description
		eastings	northings	
F1	14-Nov	806298	8510266	Natural Pond along Millers access road
F2	14-Nov	810641	8497660	Jasmin Pit 1
F3	14-Nov	809957	8497192	Thelma Pit 2
F4	14-Nov	808477	8494430	Tailings swamp (Helene area)
F5	14-Nov	808435	8494350	Upstream from tailings area (Helene)
F6	14-Nov	808875	8495268	Helene 4 Dam area
F7	14-Nov	808814	8495410	Helene 4 Pit water

Table 5.4: Soil sample locations and descriptions

Soil Samples				
Sample ID	Date	GPS location		Location description
		eastings	northings	
FS1	14-Nov	811239	8497506	Jasmine Ridge top - above old pit
FS2	14-Nov	809027	8502940	Helene Slopes
FS3	14-Nov	808477	8494420	Tailings Dam area near culvert
FS4	14-Nov	808435	8494350	Upstream from tailings area
FS5	14-Nov	806298	8510266	Natural Pond along Millers access road
FS6	15-Nov	808953	8495388	Above Helene 4 waste dump

GPS and GIS Mapping: Two *Garmin E-Mapper*™ GPS units were used during the survey. Readings obtained were within an accuracy of 4.5 to 10 metres during the survey. Elevations were also obtained and these varied by a few metres between repeat visits although they usually matched within one to five metres of survey data on the geological map. Waypoints or eastings/northings were noted at each survey site or interest point. Other AMG coordinates were obtained from the automatic breadcrumb trails produced by the GPS unit.

Maps were produced using ArcMap and ArcView (version 8.3). Three aerial photographs were used for the project area. Aerial photographs were provided by Territory Iron, MBS environmental and the two lower quality photographs were copied from the NT government website. Contour, watercourse and road information was sourced from NatMap Raster viewer (Geoscience Australia).

Survey Conditions: Climatic conditions during the survey were hot and humid. There was 7.2mm rainfall recorded in Pine Creek during the survey (25km south of Frances Creek). Records for Pine Creek show the maximum temperature was 37.3^{o}C, which occurred on November 15th 2005. There was an average Relative Humidity of 70.8% (at 9am) and 41.6% (at 3pm) during the survey period. The winds were generally easterlies to north-easterlies and ranged from calm to nine kilometres per hour (Bureau of Meteorology 2005).

The survey was conducted at the start of the wet season, with rain events and thunderstorms becoming more frequent. Pine Creek received 28.2 mm of rain during October, marking the start of the wet season for Northern Australia. Rainfall between April and September was 7 mm. Watercourses within the project area were mostly dry with the occasional water pool. Several open cut pits in the area retained water to varying levels. The rehabilitated tailings storage facility had a shallow swamp. The recreation dam on the west side of the project area was full of water.

Roads in the project area were generally in good condition, but several sections became boggy and will need constant upgrading during the wet season with increased traffic.

Criteria used in identifying notable species: This report draws attention to species of conservation significance inhabiting or potentially inhabiting the Frances Creek project area. The Commonwealth *EPBC Act* (amended 2004) and species listed in the *TPWC Act* (2000) have been used to identify species of conservation significance. The status and conservation value for any notable species identified from Frances Creek have been confirmed through consultation with relevant experts.

6 RESULTS

6.1 Natural Landscape

The landforms within Frances Creek project area consist of steep ironstone ridges with several rocky cliff faces, steep to low foothills, low convex hills, small alluvial flats and associated watercourses. Soils consisted of mostly shallow, skeletal sandy loams with depositional areas of clay or loamy clays. The vegetation consists of open *Eucalyptus* woodland with patches of Low *Eucalyptus* Forest associated with creeks, drainage depressions and some west facing slopes. Several areas have been recently burned and new growth and seedling emergence are occurring.

6.2 Frances Creek Land Unit Descriptions

Four land units were identified during the survey. Table 6.1 provides the approximate proportion of the land units within the project area, the representative site number and plate references. Maps 1A and 1B define the boundaries for each land unit. All land units are widespread throughout the project area and surrounding areas. Appendix 13.4 provides a list of plant species recorded at each site during the survey.

Table 6.1: Lands Units of the Frances Creek project area, representative Survey Site and Plate Reference Number.

Land Unit	Representative Survey Site	Plate Number(s)
1. Ridge Crests and Slopes	1b, 1c, 2b	3, 4, 7, 8, 9, 10
2. Low Hills	3b	12, 13, 14
3. Riparian	1a	1, 2
4. Small Alluvial Flats	2a, 3a	6, 11
Cullen Land System	Not surveyed *	n/a

* Cullen Land System (land units: granite hills and low undulating plains) are not located within the proposed disturbance zone, therefore time allocated for the survey did not allow survey of this land unit. Information associated with this land unit is provided using data from previous work in the area.

6.2.1 Ridge Crests and Slopes

Ridge crests and slopes are common within the lease area. It consists of rocky hill crests, steep rocky slopes (e.g. incline up to 60^{o}) associated with cliff faces and gullies. They are related to the Brocks Creek Ridge land system. Soils are shallow and skeletal with sandy loams in gully floors and other depressions. Surface rocks on the ridge crests in Frances Creek cover

approximately 90% of the bare ground, and were predominantly ironstone outcrops with small amounts of metasiltstones, greywacke and quartzite pebbles on the ridges which will be mined.

The vegetation of Ridge Crests and Slopes can be broadly described as open forests and woodlands. Dominant trees are *Eucalyptus tetrodonta, E. miniata* and *Corymbia dichromophloia* (approximately 10 metres high) over mid to tall grasses (up to one metre high) and scattered forbs. There is a sparse shrub/small-tree layer (approximately 2 to 4 metres high) that can consist of G*revillea decurrens, Gardenia megasperma, Petalostigma quadriloculare*, *Acacia aulacocarpa, Terminalia ferdinandiana, T. grandiflora* and *Tephrosia polyzyga*. There are slight differences in species richness and abundances between the crests and slopes.

Ridge Crests and Slopes were surveyed at sites 1b, 1c, and 2b. All sites have been extensively disturbed by mining exploration (i.e. drill holes, drill pads and particularly access roads). Ridge Crests and Slopes will be extensively altered by mining activities due to the presence of economical ironstone deposits within the ridges.

6.2.2 Low Hills

Low Hills are common interspersed across the Frances Creek Project area. Low Hills are distinguished from Ridge Crests and Slopes on the basis of topography and erosional characteristics, other features such as soils and vegetation are similar to those described in the Ridge Crests and Slopes land unit. The hills of this land unit are described as low gently rounded hills associated with alluvial washouts and channels that occasionally become inundated during the wet season. The hills have a local relief of less than 30 metres and an incline of less than 10^{o}. Soils comprise compacted sandy loams with clayey loams commonly appearing in depressions.

Open Eucalypt Woodlands with a sparse understorey of grasses and forbs commonly occur within Low Hills of Frances Creek. *Corymbia dichromophloia, Erythrophleum chlorostachys* and *Eucalyptus miniata* were the common trees in the area (approximately 10 metres high). Shrubs were not common. Grasses and herbs to 1½ metres were widespread and dispersed, which included *Themeda triandra*, *Chrysopogon fallax*, *Sorghum plumosum*, *Glycine* sp. and *Ludwigia octovalvis*.

The Millers deposit (Site 3b) is mapped as being located within the Brocks Creek Ridge land system by the coarse mapping of Christian and Stewart 1953, however it is topographically typical of the Brocks Creek Foothills land system.

6.2.3 Riparian

Riparian areas occur along perennial and seasonal drainage channels in ridge lands and undulating country. Soils are clayey loams with loamy clays in larger depressions, and coarse to fine sands in dry creek beds. Frances Creek drains through the central part of the project area and is the main drainage channel in the local area. There are numerous smaller creeks and streams from the higher sections of the project area that supply water to Frances Creek during the wet season. Mark Creek to the northeast and Watts Creek to the northwest also feed northern parts of the project area with smaller tributaries branching out from the main rivers. During the wet season relatively large volumes of water flow through the creeks and drainage gullies, but the watercourses tend to dry out during the dry season. Several seasonal and some semi-permanent natural waterholes persist within the lease area.

The vegetation in riparian and riverine areas is distinct from surrounding vegetation communities. They typically have a narrow belt of characteristic vegetation that creates thicker canopies and a higher degree of structural complexity and species diversity. Common species include *Pandanas spirilis, Lophostemon grandiflorus, Ficus virens, Melaleuca* spp., *Acacia auriculiformis* and *Eucalyptus camaldulensis*. Many other species are associated with the riparian habitat, but tend to occur beside long lasting waterholes, e.g. *Xanthostemon eucalyptoides, Syzygium armstrongii* and *Bambusa arnhemica*.

6.2.4 Small Alluvial Flats

Small Alluvial Flats are associated with the Brocks Creek Ridge land system and are described by Christian and Stewart (1953) as relatively small areas that occur where watercoarses exit at the base of larger hills and slopes (Maps 1A and 1B). Soils were generally light textured “acid” alluvial soil, however, several areas contained dark organic clay materials. The alluvial flats along Frances Creek had patchy open woodland vegetation with sorghum grasses. The dominant trees in the woodlands varied between sites including *Erythrophleum chlorostachys*, *Eucalyptus miniata, E. tetrodonta* and *E. alba*.

6.2.5 Cullen Land System

The **Low Undulating Plains** land unit predominantly lies in the southern and an eastern edges of the Frances Creek project area, and is associated with the Cullen land system. They consist of Open Eucalyptus Woodlands with a sparse understorey of medium grasses. The undulating country is dominated by *Eucalyptus* and *Corymbia* species, mainly *Eucalyptus tintinans* and *Corymbia dichromophloia* (approximately 8 to 10 metres high). The understorey varies in species dominance from *Sorghum plumosum* to *Themeda australis/triandra* (up to 1½ metres).

The **Granite Hills** are located in a small zone on the south and eastern edge of the project area (Maps 1A and 1B). The Granite Hills are characteristic of the Cullen Land System. The hills are scattered with boulders and fragments of granite. The low open woodland is dominated by *Corymbia dichromophloia* and *Eucalyptus tinitinans*, with a relatively high density of *Sorghum intrans* (1 to 1½ metres high grass). The tall shrubs and/or smaller trees *Brachychiton diversifolius*, *Cochlospermum fraseri*, *Gardenia megasperma* and *Owenia vernicosa* are common plants on the rocky hill tops and slopes. *Ficus platypoda* occurs in sheltered areas.

6.3 Survey Site Vegetation Descriptions

6.3.1 Site 1: South of Frances Creek

Vegetation was surveyed at three habitats within the proposed mining area south of Frances Creek; these included the wetland created by the rehabilitated tailing storage facility (**Site 1a**), Hill Slopes near Helene 8 (**Site 1b**) and Ridge Crests of Jasmine East (**Site 1c**).

The swampy environment of the rehabilitated tailings storage facility was dense with grasses, sedges, vines and shrub thickets. The lower wetter areas were thick with *Calopogonium mucunoides*, Cyperus digitatus, Passiflora foetida*, Senna alata** and *Paspalium scrobiculatum*. Couch Grass (*Cynodon dactylon**) covered all elevated patches of land (Plates 12.1, 12.2). Dense thickets of the introduced Ringworm Scrub (*Senna alata*) were present across the centre of the swamp. Water Lilies (*Nymphoides indica*) occurred in areas of freestanding water. Seven introduced species were identified in and around the swamp area (listed and described in Section 6.3.5).

The tailings storage facility wall on the southern edge of the wetland contained relatively dense vegetation cover with a variety of species including *Acacia auriculiformis, Grevillea mimosoides, Ficus opposita, Livistona humilis, Terminalia ferdinandiana, Schefflera actinophylla and Alstonia actinophylla* and numerous forbs, sedges (*Cyperus digitatus*) and grasses. The upstream area to the south of the tailings dam wall also contained water but fewer introduced species than the wetland area. This area becomes inundated during large rains which has flattened Annual Sorghum grasses existing in low areas and a distinct water level line on the creek bank. The introduced shrub *Hyptis suaveolens* forms patchy thickets in some areas and generally along many stream banks. The native Water Lily (*Nymphoides indica*) was present and flowering.

The survey site near Helene 8 (Site 1b) was a northeast-facing siltstone slope dominated by *Corymbia dichromophloia* (canopy cover of 65 – 70%). Shrubs and grasses were relatively sparse with approximately 30% ground cover. Christian and Stewart (1953) describe the slopes in the area as mixed woodlands, which is true for the Frances Creek project area due to the

variation of dominant trees (i.e. *Corymbia dichromophloia, Eucalyptus miniata, E. tetrodonta, E. tintinans*). Other common species found on the ridge slopes are *Xanthostemon paradoxus, Brachychiton paradoxum, Livistona humilis, Erythrophleum chlorostachys, Glycine tomentella, Cymbopogon bombycinus, Terminalia ferdinandiana* and *Sorghum intrans.*

Site 1c focused on the ridge crest of the Jasmine iron ore deposit (0811236E 8497506N). The vegetation community is dominated by *Corymbia dichromophloia* and *Eucalyptus tetrodonta* (canopy cover of 75 – 90%). The ridge top is large and flat with a mix of trees and shrubs. Several broadly shaped gullies dominated by *Eucalyptus tetrodonta* incised ridge slopes to the north and south. A patch of large Northern Cypress Pines (*Callitris intratropica*) was present at the top end of the Jasmine exploration track. Other species recorded on the ridge top were *Callytrix extipulata, Acacia melleodora, Owenia vernicosa, Gardenia megasperma*, *Grevillea decurrens, Livistona humilis*, *Glycine sp., Aristida holothera, Sorghum plumosum* and *Themeda triandra*.

Appendix 13.4 shows all flora species recorded during the survey for Site 1a (rehabilitated tailings area), Site 1b (ridge slopes) and Site 1c (ridge crest)

6.3.2 Site 2: Ochre Hill

Small Alluvial Flats (**Site 2a**) and Ridge Crests and Slopes (**Site 2b**) were surveyed at Ochre Hill. Both land units are common in the area and no flora species of conservation significance were found during the survey.

Site 2a occurs in a low-lying alluvial valley at the northwestern foot of Ochre Hill. The vegetation varies from a closed to open woodland dominated by *Erythrophleum chlorostachys* and *Eucalyptus tetradonta* (up to 25 metres) associated with patchy grasses (mostly *Sorghum* sp.) and several dense stands of *Hyptis suaveolens* (Plate 12.6). Other trees present were *Eucalyptus miniata* and *Eucalyptus alba*. Low trees and shrubs were a small component of this habitat and ranged between 1 to 4 metres, these species included *Cochlospermum fraseri, Eucalyptus setosa*, *Brachychiton paradoxum* and several clusters of *Eucalyptus* suckers. Grasses were mostly *Sorghum* sp. and *Sehima nervosum*, with many other grasses beginning to emerge after recent fires. The introduced vine *Passiona foetida* is present across the site.

Site 2b shows a difference in species structure, richness and abundance depending on slope orientation (east and west slopes) and ridge crest for the Ochre Hill ridge top (Plates 12.8, 12.9, 12.10). The ridge crest consisted of shallow stony soils amongst ironstone outcrop. The

relatively diverse species composition formed a canopy cover ranging from 20 to 70%. *Corymbia dichromophloia* (between 6 – 8 metres high) is dominant on the ridge crest with other common species such as *Livistona humilis, Owenia vernicosa, Corymbia papuana* and *Sorghum plumosum*. Figs (*Ficus acubata*) were common on the rocks. Grasses and herbs were a minor component of this habitat (10 - 15%).

A closed woodland exists on the west-facing slope where dense trees (between 5 to 10 metres) formed a thin 100% canopy cover. The dominant tree for the west facing slopes is *Eucalyptus miniata* with scattered *Owenia vernicosa*, *Eucalyptus tintinans* and *Livistona humilis*. There is a open woodland on the east-facing slope that currently creates 50% canopy cover between five and eight metres high. *Corymbia dichromophloia* is the dominant tree with *Eucalyptus tintinans* and *Erythrophleum chlorostachys*. A low density of small shrubs and forbs are present on the eastern and western slopes (10 – 15%) of Ochre Hill. Grasses were more common on the slopes rather than the ridge crests.

Appendix 13.4 shows all flora species recorded during the survey for Site 2a (Small Alluvial Flats) and Site 2b (Rocky Ridge Crests and Slopes).

6.3.3 Site 3: Millers

Survey sites at Millers targeted Small Alluvial Flats (**Site 3a**) and Low Hills (**Site 3b**). The two sites differed in physical appearance and species composition. The small rocky hills at Site 3b contained a more abundant and diverse range of species compared to alluvial flats of Site 3a. Alluvial flats are extensive along the drainage valleys and low hills, frequently with rock outcrop, are scattered commonly in this region. Although no flora species of conservation significance were found during the survey, the rock outcrop low hills are more biologically diverse than the flats.

The small alluvial flats of **Site 3a** consist of a slightly sloping open woodland/parkland dominated by Northern Swamp Box (*Lophostemon grandiflorus*) and Ironwood (*Erythrophleum chlorostachys*) over mid to tall *Themeda* and *Sorghum* grasses (Plate 12.11). Soils vary from granitic sands with pebbles to loamy clays. Seasonal inundation is a feature of these lowland areas. The vegetation structure of the open woodland has trees ranging between 10 to 12 metres with a canopy cover of 60%, a minimal shrub layer restricted below 0.5 metres and a widespread grass layer up to one metre covering of 90 – 95% of the area. The shrub layer is dominantly *Erythrophleum* suckers with stunted *Brachychiton paradoxum* shrubs occurring infrequently.

A Closed Forest occurs on the ironstone rocky outcrops of **Site 3b**. The canopy cover becomes thicker towards the crest of the ridge and the *Sorghum* and *Themeda* grasses become sparse (Plates 12.13, 12.14). The forest is dominated by *Erythrophleum chlorostachys* and *Xanthostemon paradoxus* (8 to 10 metres) with a variety of other common trees, shrubs and vines. The site consists of shallow iron rich soils, with ironstone outcrops covered with lichen and moss dominating the ridges. The vegetation structure of the forest has trees ranging between eight to ten metres with a 100% canopy cover, a diverse and relatively tall shrub/small tree layer averaging three metres with 50 - 60% groundcover, and a small and low grass/herb layer.

The shallow slopes between sites 3a and 3b were typical of woodland vegetation. Tall *Eucalyptus miniata* and *Lophostemon grandiflorus* (8 to 12 metres) dominated the upper storey vegetation with a variety of mid to tall shrubs including *Grevillea mimosoides, Acacia holosericea* and *Livistona humilis* (2 to 4 metres) and *Themeda* grasses underlying the open tree canopy (Plate 12.12). The vegetation structure and composition is denser and more diverse than the alluvial flats at Site 3a, but not as dense or diverse as the rocky outcrop vegetation of Site 3b.

Appendix 13.4 shows all flora species recorded during the survey for Site 3a (Small Alluvial Flats) and Site 3b (Low Hills).

6.3.4 Important Flora

Most plant species are generally widely spread across the landscape in appropriate habitat. within the proposed project area and the surrounding region. The only species noted of conservation significance in this region which would require avoidance was an isolated patch of Cycad (*Cycas armstrongii*) was found on a hillside (GDA 94: E808807, N8498303) on the Ochre Hill and Millers road (Plate 12.30). *C. armstrongii* is listed as vulnerable in the N.T. (*TPWC Act* 2000) and should not be cleared or disturbed by mine operations. This cycad is a deciduous species that can reach 4m in height and is used as bush tucker (nuts, flour) and medicine (antiseptic) by local aborginal people. They occur in open forests and woodlands, and can form dense stands on sandy well-drained soils.

6.3.5 Weeds

Seven introduced species were recorded during the survey; Calopo (*Calopogonium mucruroides*), Hyptis (*Hyptis suaveolens*), African Feathergrass (*Pennisetum pedicellatum*), Ringworm Scrub (*Senna alata*), Stinking Passion Vine (*Passiflora foetida*), Common Sensitive Plant (*Mimosa pudica*) and Couch Grass (*Cynadon dactylon*). All species were confined to

areas where previous disturbance has occurred. The swampy environment where the old tailings storage facility was located contained all these species.

Calopogonium mucuroides is an annual vine with stems covered with yellow hairs. It produces pea-shaped, bluish-purple flowers that have yellow-green centres. It is native to tropical America and has been listed as a weed in the Philippines, Malaysia and Indonesia. In Australia, it exists in the Darwin and Gulf regions of the Northern Territory and in Cape York. It has been reported as a weed in Kakadu National Park. It is common in the Darwin region and surrounding bushland, where it forms dense mats that smother native vegetation. Information was sourced from DEH website.

Hyptis suaveolens is an annual or perennial upright branched plant with a characteristic aromatic mintysmell, generally growing 1 to 1.5 metres high, but at times reach 2 metres. *Hyptis* is a native of South America. It is now widespread in the Darwin, Katherine, Gulf and Victoria River Districts, particularly in pastoral lands. This weed is continuing to invade through natural spread and is a contaminant in hay, on livestock, clothing, native animals and vehicles. It favours disturbed areas such as roadside and overgrazed areas around cattle yards and stream banks. It is resistant to fire.

Senna alata (formerly *Cassia alata*) is native to South America and has been recorded as a weed in Ghana, Nigeria, Cambodia, Puerto Rico, Indonesia and the Solomon Islands. It has naturalised in Queensland and the Northern Territory, where it exists as isolated infestations over large areas. It is declared noxious in the Northern Territory where it has formed dense thickets in disturbed/ overgrazed areas and riparian habitats in coastal and sub-coastal regions. It is particularly aggressive in areas where there is a high water table.

Pennisetum pedicellatum is an annual grass that infests grain sorghum crops. *Passiflora foetida* is *a* woody climber vine to 9 m high, and the flower emits an unpleasent smell (i.e. stinking passion flower). *Cynadon dactylon, Couch Grass,* is a robust perennial grass introduced to Australia and grows on a wide range of soils, but best in moist, relatively fertile and well-drained soils.

Mimosa pudica is a low, sprawling, perennial plant which usually grows about 15-45 cm high. It is a native of tropical America, introduced into Australia as a curiosity plant in gardens. It is a weed of disturbed and cultivated areas, such as roadsides, heavily grazed pastures, crops and lawns. It grows on a wide variety of soils, and can stand considerable shading. Seeds are mainly spread by clinging to clothing and animals and can remain viable for many years.

6.4 Fauna of the Frances Creek project area

Fauna species identified during the Frances Creek survey are listed in Appendix 13.2 and 11.3. There were 117 animal species identified, including 67 birds, 26 mammals, 17 reptiles, six amphibians and one fish. Two bats listed under the *EPBC Act* (1999) or *TPWC Act* (2000) as being of conservation significance were recorded during the survey, these were Orange Horseshoe-bat (*Rhinonicterus aurantius*) and White-striped Sheathtail bat (*Taphozous kapalgensis*).

Only a small proportion of the fauna expected to inhabit the Frances Creek project area were actually observed during the survey. This is a reflection of the short survey period, long grasses impeding opportunistic sighting of ground dwelling animals, seasonal variation in species composition and abundance, and possibly disappearance of carnivorous species due to arrival of the poisonous Cane Toad in 2003. Therefore, species lists are provided that pool fauna records from surveys of 10 nearby locations (Appendices 13.5, 13.6, 13.7 and 13.8).

Trap Success: Trapping success ranged between low to moderate during the survey period, with an overall trap success of 12%. The sites near Helene 8 (1a and 1b) recorded the highest success rates of 21.4% and 14.3% on the slopes and tailings area, respectively. Ochre Hill ridge (site 2b) followed with 13.3%, Ochre Hill bottom (site 2a) with 10%, Millers alluvial flats (site 3a) with 9.1% and Millers low hills with 4.8% (Figure 6.1).

A pitfall trap was installed along each Elliott trap transect. The pitfall located in the rehabilitated tailings area caught six specimens (five species). Other sites caught between zero and three animals over the three night trapping program. Capture records for both Elliott and Pitfall trapping session are provided in Appendix 13.5.

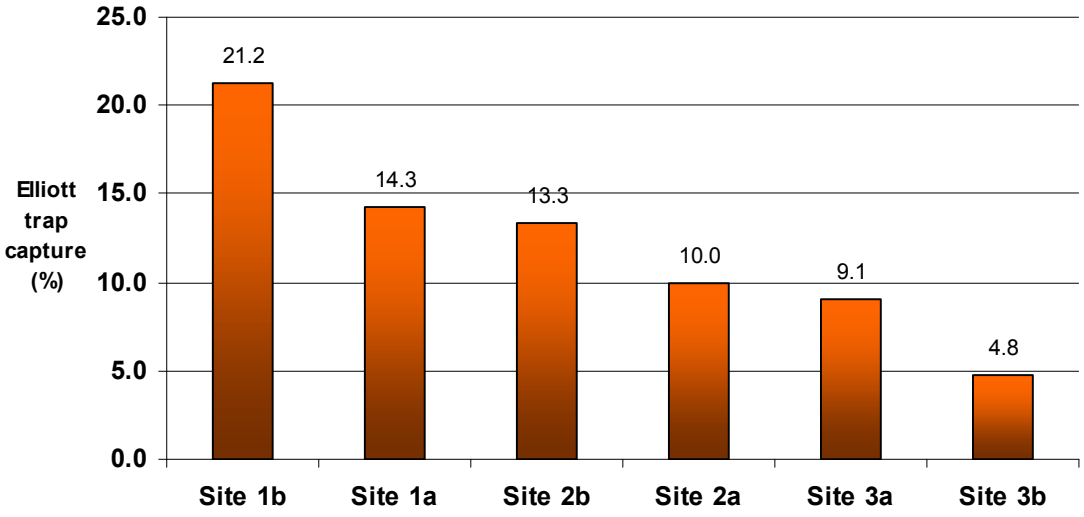

Figure 6.1: Elliott trap success rate (%) for the three night trapping period at Frances Creek in November 2005.

Mammals: Mammal species recorded during the November 2005 survey are listed in Appendix 13.3. Survey results identified a total of 22 native mammal species and four feral species for the project area.

Two male Common Planigales (*Planigale maculata maculata*) were caught during the survey, one in the tailings rehabilitation area (site 1a) and the other in the alluvial flats below Ochre Hill (site 2a). Common Planigales are common carnivorous marsupials (Family Dasyuridae) that occupy a range of habitats from rainforest, sclerophyll forests, and grasslands to marshlands and rocky areas. Populations are restricted to coastal Arnhem Land (i.e. Frances Creek) and coastal Queensland and northern New South wales (Strahan 1983). They are known to exist in outer suburbs of cities such as Brisbane (Strahan 1983), but occur in lower population densities in these disturbed areas. Breeding occur throughout the year for Arnhem Land populations.

Three native rodent species were caught and identified during the survey, Pale Field Rat (*Rattus tunneyi tunneyi*), Common Rock-rat (*Zyzomys argurus*) and Western Chestnut Mouse (*Psuedomys nanus*). The Pale Field Rat (*R. tunneyi tunneyi*) was the most commonly encountered rodent during the fauna survey. Sixteen individuals were captured and they occurred at each survey location: Frances Creek area (Sites 1a, 1b), Ochre Hill (Sites 2a, 2b) and Millers (Site 3a) with habitats ranging from watercourses, rocky ridges, hill slopes and alluvial flats. *R. t. tunneyi* typically live in tall grassland (i.e. *Sorghum* sp.) that is usually close to creeklines. Breeding appears to take place post autumn in the Northern Territory (Strahan 1983; Woinarski et al. 1992).

Common Rock Rats (*Z. argurus*) were trapped on the rocky ridge at Ochre Hill (site 2b) and an ironstone rocky outcrop at Millers (site 3b). This species is endemic to Northern Australia and are found in a wide range of habitats that are always associated with rocky outcrops (Strahan 1983; Ride 1970). Breeding reaches a peak during the end of the Wet Season (March to May) (Strahan 1983; Woinarski et al. 1992).

Western Chestnut Mice (*P. nanus*) were found on alluvial flats at Millers (site 3a) and the rehabilitated tailings area. *P. nanus* is known to occur in a range of habitats that are associated with low eucalypt woodlands with a dense cover of tussock grasses. Breeding occurs at a very rapid rate and appears to be responsive to favorable conditions (i.e. rapid vegetation growth after fires, flooding and rains) (Strahan 1983; Woinarski et al. 1992).

Three macropod species were observed during the survey, these were the Agile Wallaby (*Macropus agilis*), Euro (*Macropus robustus woodwardi*) and Short-eared Rock Wallaby (*Petrogale brachyotis signata*). Agile Wallabies were commonly seen around creeks in open woodlands along the north-south access road to Millers. They are the most common macropodid in tropical coastal Australia (Strahan 1983). Euros are also an abundant macropod, but are more common south of northern Australia's tropical climate. Scats likely to be from Short-eared Rock Wallabies (Arnhem Land Race) were observed on ironstone rocky outcrops on Millers deposit (site 3b). They are abundant in rocky areas amongst savanna grasslands in the top end of the Northern Territory (Strahan 1983; Ride 1970). However, the distribution of *P. brachyotis* appears to be contracting northward. Therefore, the Frances Creek iron ore project will contribute to habitat loss in the short-term for *P. brachyotis* when rocky ridges are disturbed or removed for mine development. Numerous rocky ridges in the local area and also granite hills on the southern extent of the project area will act as refuge areas for rock wallabies in the area.

A Northern Brown Bandicoot (*Isoodon macrourus macrourus*) was encountered to the southwest of Ochre Hill during a spotlighting session on the 13th of November 2005. Bandicoot diggings were commonly observed at Millers on the ridge crests and slopes. *I. m. macrourus* is considered common throughout the region, especially in areas with tall grasses or dense shrubbery, and has been recorded from nearby locations such as Brocks Creek, Unions Reef and Kakadu National Park (Elderidge and Low 1994; NSR 1993; Woinarski *et al.* 1989).

Horses (*Equus caballus*), Donkeys (*Equus asinus*) and feral pigs (*Sus scrofa*) were commonly identified by tracks within the project area, mostly along watercourses and flatter areas. A feral cat was observed after nightfall near the rehabilitated tailings area.

The ANABAT System (bat detector) was setup for three nights and recorded 419 calls that could be identification. Assessment of the calls determined 12 different species with a further two other groups of calls that include at least two other species, but they could not be identified with confidence (Table 6.2; Appendix 13.2). The Frances Creek project area has a potential for 17 species of micro bats that could inhabit the area over a full cycle of seasons. Considering the short-term of the survey (i.e. four nights, four locations) this is a good result and shows that November is a good time to survey for bats at this latitude. Little Red-flying Foxes (Fruit bats or blossom bats) were commonly observed flying over camp or feeding in trees during the night.

Two species of bats that are of conservation significance were observed during the survey, namely the:

1. Orange Leaf-nosed Bat (*Rhinonycteris aurantius*): This species has very few known maternity sites. During the dry season the species is cave/mine dwelling. During the wet season they will disperse from caves/mines to forage and live in monsoon forests and open woodlands. There are no known cave/mines in the immediate area so the recorded individuals are feeding in the area and most likely returning to a cave/mine or possibly sheltering under bark on trees during the day.
2. White-Striped or Arnhem Sheathtail Bat (*Taphozous kapalgensis*): This is an unexpected recording of the uncommonly recorded plains dwelling bat. Recorded on one sequence on one night in one habitat. A number of fragmented calls could also have been this species, but were not complete enough to positively identify. This species is a tree dweller and the records are significant.

Table 6.2: Results recorded by the ANABAT system during the Frances Creek survey.

All identifications were completed by Dennis Matthews.

Scientific Name	Common Name	Day 1		Day 2		Day 3	
		Pool	Church	Ridge	Church	Millers	Church, wetland
Chaerephon jobensis	Northern Mastiff-bat	X	X	X	X	X	X
Chalinobulus gouldii	Goulds Wattled Bat	X	X	X	X		
Mormopterus beccarii	Beccari's Mastiff-bat	X	X				X
Nyctophilus sp. **		X	X		X	X	X
Nyctophilus walkeri	Pigmy Long-eared Bat		X			X	
Rhinonicterus aurantius	Orange Horseshoe Bat		X				
Saccolaimus flaviventris	Yellow-bellied Sheathtail Bat	X	X		X	X	X
Scotorepens greyii / sanborni		X					X
Taphozous georgianus	Common Sheathtail Bat	X	X		X	X	X
Taphozous kapalgensis	White-striped Sheathtail Bat						X
Vespadelus caurinus	Little Red Flying Fox	X	X	X	X	X	X
Pteropus scapulatus			X		X		X
Sp. 1		X	X		X	X	X
Sp. 2		X	X	X			X
Total number of calls recorded		**155**	**421**	**32**	**310**	**72**	**683**
Total number of Identified calls		**61**	**134**	**10**	**25**	**43**	**146**
Total number of species		**10**	**12**	**4**	**8**	**7**	**11**

** = Nyctohilus geoffroyi or N. arnhemensis or N. bifax

Sp. 1 : Scotorepens greyii / sanborni or Chalinolobus nigrogriseus

Sp. 2 : Pipistrellus westralis or Miniopterus schreibersii orianae

Reptiles: Reptiles recorded during the survey are presented in Appendix 13.2. No reptile species of conservation significance were identified. Warm and humid conditions at Frances Creek reflected a relatively abundant and diverse selection of reptile species (17 species). Dragons (family: Agamidae) and skinks (family: Scincidae) were abundant during the survey. No monitors (goannas) were recorded. White-lipped Two-lined dragons (*Diporiphora albilabris*) (Plate 12.22) were very active during the survey with individuals commonly seen perched on ironstone rocks within the ridge crests and slopes. Gilberts Waterdragons (*Amphibolurus gilberti*) were active in the low areas such as undulating plains, alluvial flats and riparian areas.

Two-spined Rainbow Skinks (*Carlia amax*), Striped Rainbow Skinks (*C. munda*) and Smooth-scaled skinks (*Glaphyromorphus isolepis*) were commonly observed throughout the survey area. *C. munda* (Plate 12.19) and *G. isolepis* (Plate 12.24) preferred rocky habitats such as Site 3b (Millers rocky hills) whereas *C. amax* appeared amongst leaf litter in open woodland country and riparian zones. Other skinks observed included *Ctenotus inornatus* (Plate 12.23)*, C. robustus, Menetia greyii* and *Morethia ruficauda*.

Four juvenile Frill-necked Lizards (*Chlamydosaurus kingii*) (Plate 12.21) were observed along Ochre Hill and Millers access roads. These arboreal dragons are commonly encountered during the wet season across the Australian tropical woodlands (Wilson and Swan 2003).

Three snakes were identified during the survey, Macleays Water snake (*Enhydris polylepis*)*,* Whipsnake (likely *Damensia olivacea*) and a Childrens Python (*Antaresia childreni*). *E. polylepis* are colubrid snakes (subfamily: Homalopsinae) that are weakly venomous, rear fanged, water loving and brown with a darker ventral stripe (Plate 12.17). They are regarded as non-dangerous. These snakes contract to permanent pools during the dry season, but are disperse during sheet-flooding during the wet season. Several individuals were observed around water holes and creeklines during the survey. It is encouraging that this species is still present with high numbers in the area since the invasion of Cane Toads in 2003. The Whipsnake (*Demansia* sp.) was a slender, orangey yellow snake with a dark head that was observed in the church at the old Frances Creek village. It is most likely the Marble-headed Whipsnake (*Damensia olivacea*), but may also be an undescribed species that has been rarely recorded in the Pine Creek and Kakadu region (Gambold, *pers. comm*.. Dec 2005). In general, Whipsnakes are diurnal, very fast and alert and are regarded as potentially dangerous. The Childrens Pythons (*A. childreni*) is a small weakly patterned python that is found across northern Western Australia and Northern Territory (Plate 12.18). It is a commonly encountered non-venomous snake that is found in highest numbers around rocky outcrops and woodlands during nightfall.

Two juvenile freshwater crocodiles (*Crocodylus johnstoni*) were observed in Helene 4 void which contains fresh water (Plate 12.25). Freshwater crocodiles are common in the area and are not normally dangerous. Five crocodiles were removed from Helene 5/6 during de-watering of the void before exploration drilling began (Parks *pers. comm.* 2005). Freshwater crocodiles are a listed marine species protected under the *EPBC Act* (1999) and should be appropriately dealt with when encountered during mine development.

Amphibians: Six amphibian species were identified during the survey, including five native frogs and the introduced Cane Toad (*Bufo marinus*) (Appendix 13.2). Native frogs included

Cyclorana australis, C. longipes (Plate 12.16)*, Litoria personata, L. rothii* and *L. rubella*, which are all common species for the area and are represented in high number throughout the Kakadu National park (Mathews *pers. comm*. 2005). Frogs were present around most water bodies encountered during spotlighting sessions, such as the old tile lined concrete swimming pool at the abandoned village and the tailings wetland. Loud sessions of breeding calls from *C. australis* occurred during the survey (male mating call is a loud "woark, woark"). Other frogs were also calling but were drowned out by *C. australis*.

The introduced Cane Toad (*Bufo marinus*) (Plate 12.15) was abundant during the survey. It was encountered during spotlighting sessions and did not appear to be confined to areas where freestanding water existed. All large adults appeared lean but healthy. The cane toad first appeared in the area during 2003 (J. Goulevitch, *pers. comm.* 2005).

Birds: Sixty-seven birds were observed during the survey (Appendix 13.3). This includes sedentary, vagrant and migratory species. Many bird species are migratory and vagrants and their populations are known to fluctuate with seasonal and temporal variation of resources. Appendix 13.8 also includes species potentially occurring within the Frances Creek project area based on previous studies in the local area (Davidson 1985, Woinarski *et al.* 1989, NSR 1992, NSR 1993, Eldridge and Low 1994, Grattidge and Low 1996, Reilly, Low and Matthews 2005). There were three birds listed under "Other Matters Protected by the *EPBC Act* (1999)" observed during the survey, these are the White Egret (*Ardea alba*), Rainbow Bee-eater (*Merops ornatus*) and the Magpie Goose (*Anseranas semipalmata*). The Parks and Wildlife Commission classified two species observed during the survey as 'Near Threatened'; these were the Bush-stone Curlew (*Burhinus magnirostris*) and Red-tailed Black Cockatoo (*Calyptorhynchus banksii*).

There are several substantial permanent water bodies located within the project area, which attracts higher diversities and abundances of birds. The wetland created by the rehabilitated tailings storage facility (Site 1b) held the highest bird numbers and species compared to other survey sites. For example, the bird count at the wetland was 33 species, followed by Ochre Hill alluvial flats (22 species), Millers hill (12 species), Helene slopes (11), Ochre Hill ridge top (3) and Millers alluvial flats (2). Water birds, vagrants, and sedentary and migratory birds were present. Frequently encountered species were the Sacred Ibis (*Threskiornis aethiopica),* Magpie Geese (*Anseranas semipalmata*), Red-winged Parrots (*Aprosmictus erythropterus*), White-faced Herons (*Ardea novaehollandiae*) Great Egrets (*Ardea alba*), Pied Stilts (*Himantopus himantopus*), Rainbow Bee-eaters (*Merops ornatus*), Crimson Finches (*Neochmia phaeton*), Magpie Larks (*Grallina cyanoleuca*), Royal Spoonbills (*Platalea regia*), Budgerigars (*Melopsittacus undulates*), Silver-crowned Friarbirds (*Philemon argenticep)* and Little Cuckoo-

Shrikes (*Coracina papuensis*). Although specifically looked for, no Gouldian Finches were seen. This species is listed on the EPBC web site and is becoming critically endangered.

Aquatic Fauna: The aquatic environment within the project area includes dams, tailings wetland, voids, creeks, drainages areas and freshwater ponds. The dams, voids and wetland have permanent water supplies. Two juvenile Freshwater Crocodiles (*Crocodylus johnstonii*) were seen floating in Helene void 4, and tracks of a larger individual were also identified on the foreshore of the Helene 4 dam. Spangled Grunters (*Leiopotherapon unicolor*) and Bony Bream (*Nematalosa erebi*) are common fish known to inhabit permanent water bodies of Frances Creek (Parks *pers. comm*. 2005).

Creeks at the time of survey had low to no freestanding water. Watercourses in the area flow steadily in the wet season, ceasing in the mid dry season with water remaining in a few pools that act as refuge for freshwater fish, reptiles, amphibians and macroinvertebrates. It is expected that aquatic fauna inhabiting McKinlay River and Frances Creek also occur in tributaries in surrounding areas during the wet season.

An aquatic snake, Macleay's Water Snake (*Enhydris polylepis*), was observed on several occasions at the tailings wetland and in an empty abandoned pool. Five frog species were also found during spotlighting sessions at these areas.

7 CONSERVATION VALUE OF THE FRANCES CREEK PROJECT AREA (REGIONAL CONTEXT)

7.1 Habitat

The tropical woodland community of the Frances Creek project area is known as vegetation type 21, which is *Eucalyptus tintinans* with *Corymbia dichromophloia* and *E. miniata*, over a tall *Sorghum* grassland understorey (Wilson *et al.* 1990). *Eucalyptus tetrodonta* is also common and dominates a variety of slopes and undulating country. Vegetation type 21 covers hundreds of square kilometres in the Northern Territory (Wilson *et al.* 1990), and Frances Creek constitutes approximately 1,212 hectares of this community. On a regional scale the vegetation and landscape of Frances Creek is not considered to be threatened or significant, but it is poorly represented in National Parks and is subject to widespread mining development and exploration.

On a regional scale, physical disturbance associated with iron ore mining at Frances Creek is insignificant in terms of regional conservation values. The proposed mine will cause only localised loss of common habitat and alteration of the landscape.

The *Riparian* land unit within the project area deserves a higher conservation value and it is recommended that it be not disturbed during mining operations where it can be avoided. The local drainage network of the *Riparian* land unit contains ephemeral watercourses that can hold valuable surface waters throughout the wet and dry seasons. As a consequence, the species diversity of this land unit is relatively high and it provides important refuge for fauna through the dry season.

The rehabilitated tailings storage facility has created a well-utilised wetland environment for a diverse selection of birds, mammals, reptiles and vegetation. It is recommended that efforts be made to retain this area in good quality, as the wetland will act as a refuge area for mobile species when mining operations begin.

7.2 Flora

An isolated patch of Cycad (*Cycas armstrongii*) was found on a hillslope (GDA 94: E808807, N8498303) on the Ochre Hill and Millers road (Plate 12.30). *C. armstrongii* is listed as vulnerable in the N.T. (*TPWC Act* 2000) and should not be cleared or disturbed by mine operations. This cycad is a deciduous species that can reach 4m in height and is used as bush

tucker (nuts, flour) and medicine (antiseptic) by local aborginal people. The species occurs in open forests and woodlands, and can form dense stands on sandy well-drained soils.

7.3 Fauna

Vegetation clearing for Frances Creek mine development will result in habitat loss for local fauna living in the impact zones, particularly those preferring the *Ridge Crest and Slopes* land unit. Mining will also indirectly impact on the local fauna through increased noise, vibration, dust, lights, roads, increased human activity, vehicle traffic and possible alteration of the natural drainage patterns. Although these disturbances are likely to locally impact populations, fauna known in the area are common and widespread throughout their range and their conservation status is unlikely to be affected. Discussion of species of conservation significance that are known or may exist in the lease and the potential for impact by the mining operation is presented in the following paragraphs. Tables 7.1 (*EPBC Act* 1999) and 7.2 (*TPWC Act* 2000) list species of conservation significance that may inhabit the Frances Creek project area.

Mammals of conservation concern that were identified during the Frances Creek survey include the Western Chestnut Mouse (*Pseudomys nanus*), Pale Field-rat (*Rattus tunneyi*), Orange Horseshoe-bat (*Rhinonicterus aurantius*) and Arnhem Sheathtail bat (*Taphozous kapalgensis*) (Table 7.2). The Northern Brown Bandicoot (*Isoodon macrourus*) and the Short-eared Rock Wallaby (*Petrogale brachyotis*) are thought to have declining populations in the territory's top end, but do not retain any territory or national conservation status.

Pale Field-rats and Western Chestnut Mice are listed as Near Threatened in the Northern Territory (*TPWC Act* 2000). The Field-rats were active during the survey and are known to be relatively abundant in the region. They were caught in previously mined areas and pristine areas during the survey, suggesting that populations were not affected by previous iron-ore mining at Frances Creek. The Western Chestnut Mouse were also found in previously disturbed and undisturbed areas, however, populations appeared to be more active in less disturbed areas such as the woodland flats near Millers deposit.

The Golden Horseshoe Bat, *R. aurantius,* is classified as a Near Threatened species (N.T. Parks and Wildlife Commission 2005). The species is endemic to Australia and it's distribution extends from the Pilbara to western Queensland, with most of the populations occurring in the Northern Territory (Churchill 1991). Churchill (1991) suggests the scarcity of *R. aurantius* is due to highly specialised roost requirements and low numbers of caves and mines with suitable microclimates. Although the mining operation will create considerable disturbance in the local

area, such as increased noise, vibrations and dust, to which *R. aurantius* are sensitive, the lack of local roosting habitat implies there will be no significant impact on the population as the animals are likely flying in from nearby areas as indicated by the few recordings.

T. kapalgensis is a data deficient species and has only been recorded from the Kapalga and Kakadu areas of the Northern Territory where it occupies the floodplains. It is a fast and direct flying species that forages in open areas well above treetop height in open woodlands and adjacent grassy plains, but also descends to lower levels where flight paths are not obstructed (McKean and Friend 1979). Potential threats to this species are not known.

Three **Bird species** observed on the lease are protected under the *EPBC Act* (1999): the White Egret (*Ardea alba*), Rainbow Bee-eater (*Merops ornatus*) and the Magpie Goose (*Anseranas semipalmata*). Mining development by Territory Iron Ltd is not considered likely to significantly reduce or disturb populations due to the birds preferring habitats that are not under threat from mine operations (Table 7.1).

Conservation species lists (birds) compiled by the Northern Territory Parks and Wildlife Service contains two species observed during the survey; the Bush Thicknee (*Burhinus grallarius*) and Red-tailed Black Cockatoo (*Calyptorhynchus banksii*). These birds are listed as Near Threatened in the Northern Territory (*TPWC Act* 2000) (Table 7.2). These birds were common throughout the project area and the Pine Creek region. Both birds are common throughout the top end of the Northern Territory and relatively uncommon throughout central and southern habitats. Therefore, their Near Threatened status may be more targeted at the arid to semi-arid zones rather than the top end habitats in Frances Creek. These birds are lowland feeding birds and the iron ore operation is unlikely to disturb or destroy habitat for these species apart from road construction.

There are several other important bird species that may potentially occur within the project area.

The Gouldian Finch (*Erythrura gouldiae*) is an endangered species under the *EPBC Act* (1999) and the *TPWC Act* (2000) and could possibly occur within the project area (Tables 7.1 and 7.2). Open Woodlands of *Eucalyptus tintinans* and *Sorghum* grasses provide a preferred habitat for Gouldian finches. Habitat selection changes from breeding areas in hill woodland in the dry season to adjacent lowlands throughout much of the wet season (Dostine et al., 2001). Finches feed on annual grass seeds during the dry season until germination occurs in the wet season at which time they switch to ripening seeds of, particularly, perennial grasses. The species has experienced considerable decline in numbers over the past 50 years (Woinarski *et al.* 1989).

Suggested threats and reasons of decline of populations are trapping, changes in fire regime, grazing cattle and respiratory mites. There are few known breeding areas and few populations occurring in National Parks. Gouldian Finches have been recorded in Kakadu National Park (Woinarski *et al*. 1989), Pine Creek (NSR 1993) and Mt Todd (NSR 1992) (Appendix 13.8), thus may be found on the mining lease as well. Identification of the species should be taught to all employees during induction and if Gouldian Finches are detected during mining, a monitoring program should be established to determine movements of this species in order to assess whether populations could be impacted by mine development. It seems likely that if the species is found in the area, it will be along the valley bottoms. Thus vehicle traffic on roads may be the main threat, and vehicle speed limiations imposed where the species may occur along the roads.

The Partridge Pigeon (subspecies *Geophaps smithii smithii*) is classified as vulnerable (*EPBC Act* 1999) and has experienced considerable reduction in numbers and range in Northern Australia over the last 70 years (RAOU 1993). They can be locally common, but are generally scarce (RAOU 1993). The decline of Partridge Pigeons has been attributed to the degradation of small waterholes by exotic animals and altered fire regimes (RAOU 1993). They are represented in regional National Parks and are more commonly observed in Open Woodlands of the *Low Undulating Hills* land unit. Localised habitat loss within Frances Creek is unlikely to disturb habitat where the Partridge Pigeon may occur. Partridge Pigeons have been recorded at Union Reef (NSR 1993), Kakadu National Park (Woinarski *et al.* 1989) and Pine Creek (NSR 1993) (Appendix 13.8).

Red Goshawk (*Erythrotriorchis radiatus*) is a vulnerable species according to the *EPBC Act* (1999) and the *Action Plan for Australian Birds* (2000). This bird occupies a range of habitats in northern and eastern Australia, including coastal and subcoastal tall open forests and woodlands. However, within these habitats Red Goshawks are sparsely distributed. Red Goshawks breeding requirements are very specific, for example they will only nest in trees taller than 20 metres and these must be within one kilometre of water (Birds Australia 2005). Most of the range contraction in this species has occurred in New South Wales and southern Queensland where suitable habitat has been cleared. It is estimated that fewer than 1,000 Red Goshawks remain (Birds Australia 2005). No observations of the species have been made in the Frances Creek project area and there is not likely to be any impact on the species by the mining operation due to habitat preference. Red Goshawks have been recorded in Kakadu National Park (Woinarski *et al*. 1989) (Appendix 13.8).

Masked Owls (*Tyto novaehollandiae*) are classed as a vulnerable species under the *EPBC Act* (1999). They inhabit forests, woodlands, timbered waterways and open country on the fringe of these areas (Slater 1970). They require tall trees with suitable hollows for nesting and roosting and adjacent areas for foraging. The population range is a broad coastal band around most of mainland Australia and throughout Tasmania (i.e. no more than 300 kilometres from the coast). Population numbers of Masked Owls are low on the mainland. While the loss of several large trees in the pit area will occur, there is no evidence that the species has occurred in the area or in surrounding surveys (Appendix 13.8).

The **reptiles** identified during the Frances Creek environmental survey are common and widespread and mining operations are unlikely to change the status of these species. Freshwater Crocodiles (*Crocodylus johnstonii*) are protected under the *EPBC Act* (1999). If they are encountered during void dewatering they should be relocated using appropriate measures advised by NT Parks and Wildlife Section.

All frogs (**amphibian**) listed as occurring or potentially occurring within the Frances Creek project area are common species. Localised habitat loss is unlikely to significantly affect the status of any frog species found during the survey. The Cane Toad is abundant in the area and is a nationally listed pest that needs to be eradicated or controlled.

None of the **fish** identified during the survey are considered to have conservation status under the *EPBC Act* (1999) and *TPWC Act* (2000). Nonetheless, waterways that provide habitat for these species are important and should not be disturbed by mining if possible. Fish provide a good source of prey for birds, reptiles and aquatic species.

Table 7.1: Species of Conservation Significance that occur or could possibly occur within the Frances Creek project area.

Environmental Protection and Biodiversity Conservation Act (1999) (*EPBC Act* (1999)) protected species that could potentially be found within the Frances Creek project area. *EPBC Act* (1999) search consisted of a point search type (13^{o} 37" 00'S, 131^{o} 51" 06'E) with a buffer of 10km on November 21st, 2005.
It is also mentioned if species are listed under the *Territory Parks and Wildlife Conservation Act* (2000) (*TPWC Act (*2000)).

Species Name and Status	Common Name	Source	Presence during the Survey	Preferred habitat
CRITICALLY ENDANGERED				
Mammals				
Saccolaimus saccolaimus nudicluniatus	Bare-rumped Sheathtail Bat	*EPBC Act* (1999)	Not recorded	Woodland communities
ENDANGERED				
Birds				
Erythrura gouldiae	Gouldian Finch	*EPBC Act* (1999), *TPWC Act* (2000)	Not recorded	Open woodlands and grasslands
Dasyurus hallucatus	Northern Quoll	*EPBC Act* (1999), and also listed as vulnerable *TPWC Act* (2000).	Not recorded	Generalist that dens in tree hollows, rock crevices and caves
VULNERABLE				
Birds				
Erythrotriorchis radiatus	Red Goshawk	*EPBC Act* (1999)	Not recorded	Open Woodlands
Geophaps smithii smithii	Partridge Pigeon (eastern)	*EPBC Act* (1999)	Not recorded	Open Woodlands, creeklines

Species Name and Status	Common Name	Source	Presence during the Survey	Preferred habitat
Tyto novaehollandiae kimberli	Masked Owl (northern)	*EPBC Act* (1999)	Not recorded	Forests and Woodlands
Sharks				
Pristis microdon	Freshwater Sawfish	*EPBC Act* (1999)	Not recorded	
MIGRATORY				
Migratory Terrestrial Species - Birds				
Coracina tenuirostris melvillensis	Melville Cicadabird	*EPBC Act* (1999)	Not recorded	Around Water bodies
Erythrura gouldiae	Gouldian Finch	*EPBC Act* (1999)	Not recorded	Open woodlands and grasslands
Haliaetus leucogaster	White-bellied Sea-Eagle	*EPBC Act* (1999)	Not recorded	Around Water bodies
Poecilodryas superciliosa cerviniventris	White-browed Robin	*EPBC Act* (1999)	Not recorded	Woodlands, creeklines
Rhipidura rufifrons	Rufous Fantail	*EPBC Act* (1999)	Not recorded	Around Water bodies
Migratory Wetland Species - Birds				
Charadrius veredus	Oriental Plover	*EPBC Act* (1999)	Not recorded	Timbered Habitats
Glareola maldivarum	Oriental Pratincole	*EPBC Act* (1999)	Not recorded	Creeklines
Numenius minutus	Little Curlew	*EPBC Act* (1999)	Not recorded	Generalist
Migratory Marine Species				
Crocodylus porosus	Salt-water Crocodile	*EPBC Act* (1999)	Not recorded	Ocean, watercourses
OTHER MATTERS PROTECTED BY THE EPBC ACT				
Birds				
Anseranas semipalmata	Magpie Goose	*EPBC Act* (1999)	Recorded	Subcoastal wetlands

Species Name and Status	Common Name	Source	Presence during the Survey	Preferred habitat
Apus pacificus	Fork-tailed Swift	*EPBC Act* (1999)	Not recorded	
Ardea alba	Great Egret, White Egret	*EPBC Act* (1999)	Recorded	Wetlands
Ardea ibis	Cattle Egret	*EPBC Act* (1999)	Not recorded	Subcoastal, near water
Charadrius veredus	Oriental Plover	*EPBC Act* (1999)	Not recorded	Dryfloodplains, paddocks
Glareola maldivarum	Oriental Pratincole	*EPBC Act* (1999)	Not recorded	Dry open plains
Haliaeetus leucogaster	White-bellied Sea-Eagle	*EPBC Act* (1999)	Not recorded	Coast, rivers, dams
Merops ornatus	Rainbow Bee-eater	*EPBC Act* (1999)	Recorded	Woodlands and timbered plains
Numinius minutus	Little Curlew	*EPBC Act* (1999)	Not recorded	Tussock grassland
Rhipidura rufifrons	Rufous Fantail	*EPBC Act* (1999)	Not recorded	Rainforest and forests
Reptiles				
Crocodylus johnstonii	Freshwater Crocodile	*EPBC Act* (1999)	Recorded	Fresh watercourses
Crocodylus porosus	Salt-water Crocodile	*EPBC Act* (1999)	Not Recorded	Ocean, watercourses

Flora and Fauna surveys in the local region between 1989 and 2006 have identified 26 species of conservation significance for the Northern Territory (*TPWC Act* 2000) (Table 7.2). Only six species were found during the Frances Creek survey. However, previous surveys in the region do suggest the possibility species of conservation significance could occur within the project area.

Table 7.2: Fauna species of Northern Territory conservation significance that have been recorded in surveys in the Pine Creek region between 1985 and 2006.

* EPBC Act (1999) listed species

Surveys include: Davidson 1985, Woinarski *et al.* 1989, NSR 1992, NSR 1993, Eldridge and Low 1994, Grattidge and Low 1995, Reilly *et al.* 2005

Scientific Name	Common Name	Frances Creek Survey	Prefered Habitat
ENDANGERED			
Birds			
Erythrura gouldiae	Gouldian Finch *	No	Open woodlands and grasslands
VULNERABLE			
Mammals			
Dasyurus hallucatus	Northern Quoll *	No	Generalist that dens in tree hollows, rock crevices and caves
Phascogale tapoatafa pirata	Brush-tailed Phascogale	No	Tall Eucalypt woodlands, particularly stream lines
Birds			
Dromaius novaehollandiae	Emu	No	Wide ranging lowlands
Erythrotriorchis radiatus	Red Goshawk *	No	Tall Riparian vegetation
Rostratula benghalensis	Painted Snipe	No	wetlands
Reptiles			
Morelia oenpelliensis	Oenpelli Python	No	outcrops
NEAR THREATENED			
Birds			
Burhinus grallarius	Bush Thicknee	Yes	Lowland woodlands
Calyptorhynchus banksii samueli	Red-tailed Black-Cockatoo (centralian Australian	Yes	Open woodlands

Scientific Name	Common Name	Frances Creek Survey	Prefered Habitat
	subspecies)		
Geophaps smithii	Partridge Pigeon *	No	Lowland near watercourses
Heteromunia pectoralis	Pictorella Mannikin	No	Euc. Woodland near water
Lonchura flaviprymna	Yellow-rumped Mannikin	No	Euc. Woodland near water
Lophoictinia isura	Square-tailed Kite	No	Open woodland
Neochmia ruficauda clarescens	Star Finch	No	Euc. Woodland near water
Poecilodryas superciliosa	White-browed Robin	No	Shrubby woodland areas
Psephotus dissimilis	Hooded Parrot	No	Woodland plains with Termite mounds
Tyto novaehollandiae kimberli	Masked Owl *	No	Woodlands and adjacent open country
Mammals			
Hipposideros stenotis	Lesser Wart-nosed Horseshoe-bat	No	Tall open woodland, cave roosts
Onychogalea unguifera	Northern Nailtail Wallaby	No	Rock outcrops
Pseudomys nanus nanus	Western Chestnut Mouse	Yes	Alluvial slopes, hills
Rattus tunneyi	Pale Field-rat	Yes	Valleys, alluvial slopes open woodland
Rhinonicteris aurantius	Orange Horseshoe-bat	Yes	Deep humid caves, tall woodland
Taphozous kapalgensis	Arnhem Sheathtail Bat	Yes	Open plains
Reptiles			
Acanthophis praelongus	Northern Death Adder	No	Dry sclerophyl woodland
Chelosania brunnea	Chameleon Dragon	No	Savannah woodland
Varanus panoptes	Yellow-spotted Monitor	No	woodlands

7.4 Landscape of the Frances Creek Project Area

Frances Creek lies within the *Brocks Creek Ridge* and the *Cullen* land systems (Christian *et al.* 1953). The area is on pastoral land which has experienced minimal stocking due to low carrying capacity of vegetation and few permanent waters. However, mining has occurred in several areas in the Pine Creek region (i.e. Spring Hill, Brocks Creek, Mt Porter, Pine Creek, Mt Todd, Union Reef), including an abandoned iron ore mine at Frances Creek that operated between

1966 and 1974. Consequently, the southern section of the Frances Creek project area was highly disturbed and has since rehabilitated in many areas to healthy tropical woodlands.

A biogeographical feature of northern Australia is the fauna of the tropical woodlands and open forests being relatively homogenous across an extensive longitudinal arc from the Gulf of Carpentaria region to the southwest of the Kimberly (Woinarski *et al.* 1989).

The biological and landscape survey of Frances Creek suggests it is representative of the widespread landscape, as it contains species commonly found in the northern Wet-Dry tropics. All species recorded during the flora and fauna survey are represented in nearby Kakadu National Park or other reserves in the region. Thus from an environmental perspective, Frances Creek does not represent an area of outstanding conservation significance. However, it is recommended that any development within the area should attempt to minimise disturbance of the local environment.

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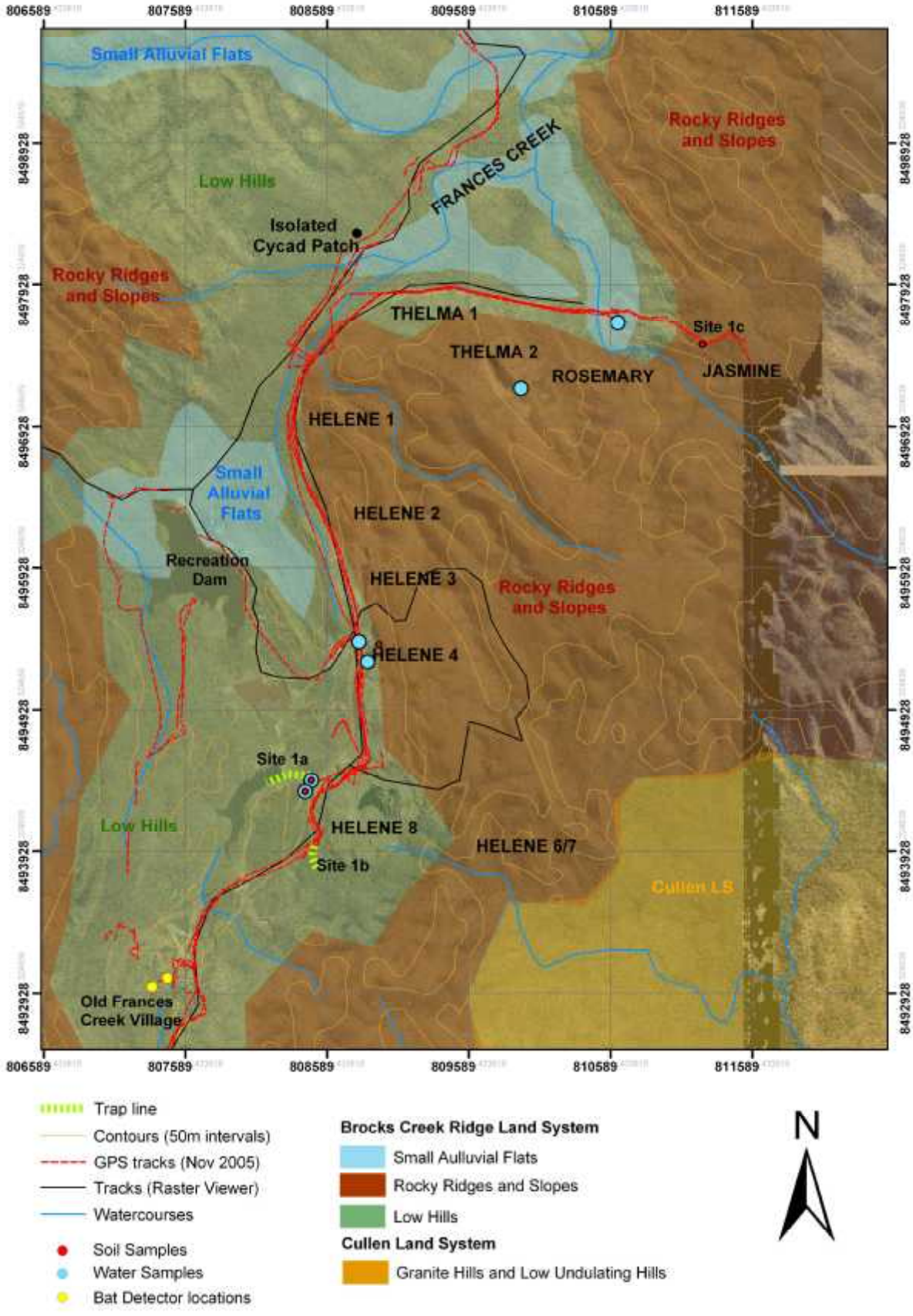
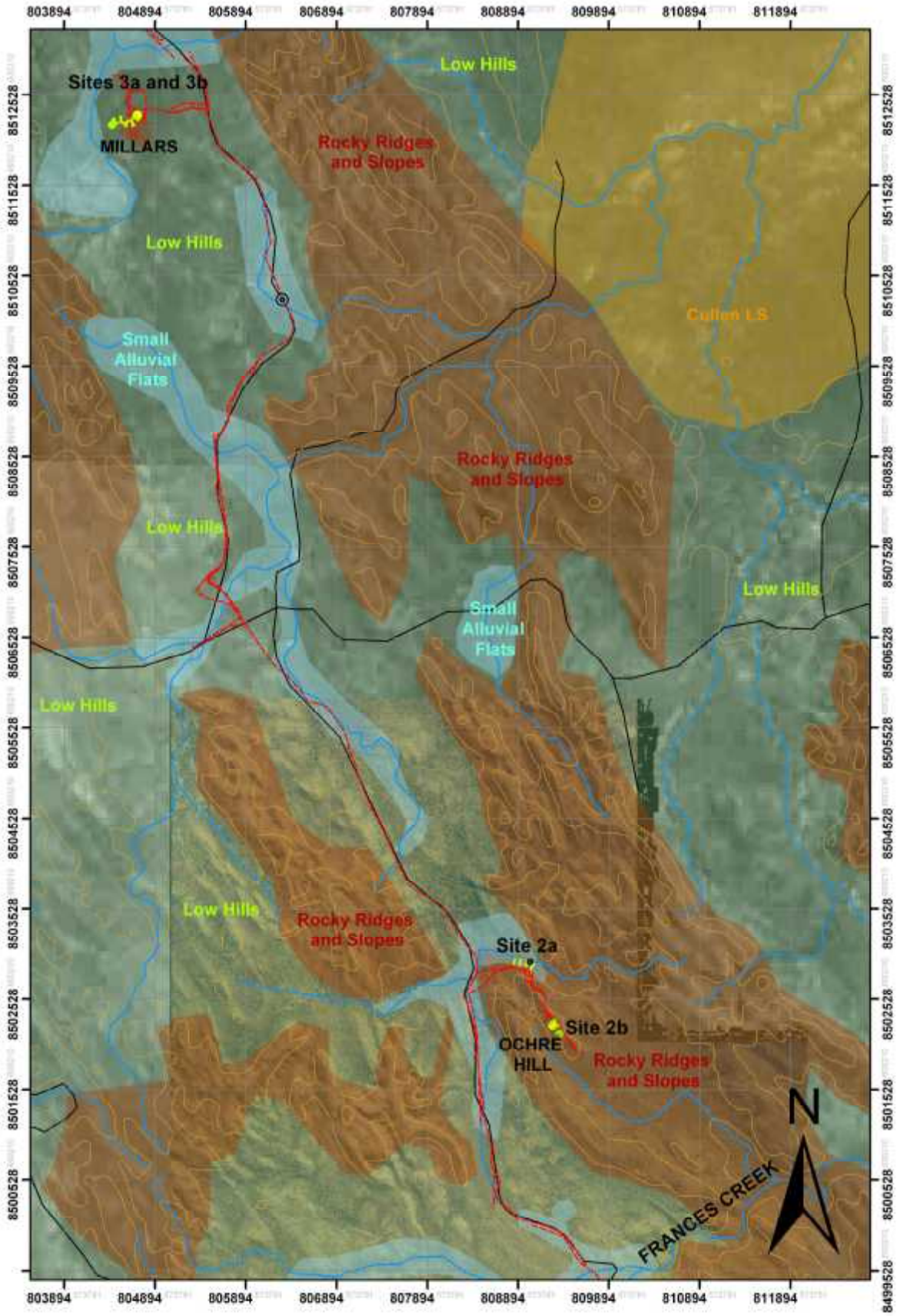
10 MAP 1A – SOUTHERN SECTION OF PROJECT AREA



11 MAP 1B – NORTHERN SECTION OF PROJECT AREA



12 PLATES

12.1 Survey Sites

12.1.1 Survey Site 1a: Rehabilitated Tailings Storage Facility from iron ore mining between 1966 and 1974. Thirty-three bird species were recorded at this site. This area is a good quality wetland and management efforts to retain this quality should be adopted.

12.1.2 Survey Site 1a: Rehabilitated Tailings Storage Facility. Iintroduced flora species within the permanent swamp include *Calopogonium mucunoides, Cyperus digitatus, Passiflora foetida, Senna alata* and *Paspalidium scrobiculatum*.

12.1.3 Survey Site 1b: Helene slopes. Northeast-facing siltstone slope dominated by Variable Barked Bloodwood (*Corymbia dichromophloia*).

12.1.4 Survey Site 1c: Jasmine Ridge. The ridge crest is dominated by *Corymbia dichromophloia* and *Eucalyptus tetrodonta*, with patchy areas of Northern Cypress Pines (*Callitris intratropica*).

12.1.5 Survey Site 1c: Jasmine void with vegetation recovery since mine closure in 1974.

12.1.6 Survey Site 2a: Ochre Hill alluvial flats. Vegetation varies from a closed to open woodland dominated by *Erythrophleum chlorostachys* and *Eucalyptus tetrodonta* associated with patchy grasses (mostly *Sorghum* sp.) and several dense stands of *Hyptis suaveolens.*

12.1.7 Survey Site 2b: Ochre Hill ridge crest, south view. The shallow stony soils are dominated by *Corymbia dichromophloia* (between 6 – 8 metres high) with other common species such as *Livistona humilis, Owenia vernicosa, Corymbia papuana* and *Sorghum plumosum.*

12.1.8 Survey Site 2b: Ochre Hill ridge crest, north view. The shallow stony soils are dominated by *Corymbia dichromophloia* (between 6 – 8 metres high) with other common species such as *Livistona humilis, Owenia vernicosa, Corymbia papuana* and *Sorghum plumosum.*

12.1.9 Survey Site 2b: Ochre Hill west facing slope. Closed woodland dominated by *Eucalyptus miniata* with scattered *Owenia vernicosa*, *Eucalyptus tintinans* and *Livistona humilis.*

12.1.10 Survey Site 2b: Ochre Hill east facing slope. An open woodland dominated by *Corymbia dichromophloia* with *Eucalyptus tintinans* and *Erythrophleum chlorostachys*.

12.1.11 Survey Site 3a: Millers alluvial flats, north view. Slightly sloping open woodland/parkland dominated by Darwin Box and Ironwood (*Erythrophleum chlorostachys*) over mid to tall *Themeda* and *Sorghum* mid-grasses.

12.1.12 Survey Site 3a: Millers gentle slopes, south view. Tall *Eucalyptus miniata,* Darwin Woollybutt, (8 to 12 metres) dominated the upper storey vegetation with a variety of mid to tall shrubs including *Grevillea mimosoides, Acacia holosericea* and *Livistona humilis* (2 to 4 metres) and Kangaroo Grass, *Themeda triandra*.

12.1.13 Survey Site 3b: Millers ironstone outcrop hills. Closed forest dominated by *Erythrophleum chlorostachys* and *Xanthostemon paradoxus* (8 to 10 metres) with a variety of other common trees, shrubs and vines.

12.1.14 Survey Site 3b: Millers ironstone outcrop. Closed forest dominated by *Erythrophleum chlorostachys* and *Xanthostemon paradoxus* (8 to 10 metres) with a variety of other common trees, shrubs, vines and mid grasses.

12.2 Fauna

12.2.1 Two Cane Toads (*Bufo marinus*) at the rehabilitated tailings dam (Site 1a). Cane toads were abundant during the survey and have been known to inhabit the area since early 2003.

12.2.2 *Cyclorana longipes* were commonly seen around shallow water bodies.

12.2.3 Macleay's Water Snakes (*Enhydris polylepis*) were observed at permanent water points and creeks. They are colubrid snakes (subfamily: Homalopsinae) that are weakly venomous, rear fanged, water loving and brown with a darker ventral stripe.

12.2.4 Childrens Python (*Antaresia childreni*) was caught on Frances Creek rd near Helene 4 dam.

12.2.5 Striped Rainbow Skinks (*Carlia munda*) were common around rocky outcrops at Millers (Site 3b)

12.2.6 Two-lined Dragon (Diphoriphora bilineata)

12.2.7 Frill-necked Lizards (*Chlamydosaurus kingii*) were seen on four occasions during the survey, indicating relatively high activity levels.

12.2.8 White-lipped Two-lined Dragon (*Diporiphora albilabris*) were very common on the rocky ridges at Ochre Hill.

12.2.9 *Ctenotus inornatus* was caught at Ochre Hill rocky ridge top.

12.2.10 Smooth-scaled Skinks (*Glaphyromophus isolepis*) were active during the survey on the rocky ridge top at Ochre Hill and within the rocky outcrops at Millers.

12.2.11 Two Freshwater Crocodiles (*Crocodylus johnstoni*) were seen floating in the waters of the Helene 4 void. Tracks on the foreshore from larger individuals were also identified.

12.2.12 Blue-winged Kookaburra (*Dacelo leachii*) were common during the survey.

12.2.13 Greater Bowerbird Bower at Miller rocky outcrop (Site 3b)

12.2.14 Common Planigales (*Planigale maculata*) are present in the area.

12.2.15 Common Rock Rats (*Zyzomes argurus*) were caught in the rocky ridges and outcrops of Ochre Hill and Millers.

12.3 Flora

12.3.1 An isolated patch of Cycads (*Cycas armstrongii*) along the Ochre Hill access road (~1.5km from Frances Creek rd) should be avoided during road making.

12.3.2 *Gardenia megasperma* (Family: Rubiaceae) was common in the rocky slopes and crests around Frances Creek.

12.4 Frances Creek village area

12.4.1 The old church is the only building remaining from the Frances Creek village that was abandoned in 1974. This was our water proof camp site during the survey.

12.4.2 The old Frances Creek village recreation area included a swimming pool, wading pool, shelter, barbecue area, oval and the magnificent Mango tree at right.

12.4.3 The old swimming pool at the abandoned Frances Creek village remains in relatively good condition. Water from recent rains is trapped in the pool and five frog species, a cane toad and an water snake, *Enhydris polylepis,* were identified at the site.

12.4.4 Barbecue area at the Frances Creek village under a large Mango tree.

13 APPENDICES

13.1 Trap capture results from the fauna survey within the Frances Creek project area, November 2005

Survey Period: November 11th to 15th, 2005.

Legend: **Red** digits represent Pitfall trap captures

Black digits represent Elliott trap captures

***** Introduced species,

Scientific Name		Common Name	Trap Sites					
			1a	1b	2a	2b	3a	3b
			Helene	Helene	Ochre Hill	Ochre Hill	Millers	Millers
			Tailings swamp	Slopes	Alluvial flats	Rocky Ridge	Alluvial flats	Rocky Ridge
AMPHIBIANS								
Bufonidae								
	*Bufo marinus**	Cane Toad	1					
Hylidae								
	Cyclorana longipes		1	2				
	Cyclorana sp. (juvenile)		2					
REPTILES								
Scincidae								
	Carlia amax	Two-spined Rainbow Skink	1					
	Carlia sp.	Rainbow Skink					1	
	Carlia munda	Striped Rainbow Skink	1		1			

	Ctenotus inornatus					1		
	Glaphyromorphus isolepis	Smooth-tailed Skink				1		
	Menetia greyii			1			1	
MAMMALS								
Dasyuridae								
	Planigale maculata	Common Planigale	1		1			
Muridae								
	Rattus tunneyi	Pale Field Rat	4	6	2	1		
	Zyzomys argurus	Common Rock-rat		1		3		2
	Psuedomys nanus	Western Chestnut Mouse	1				3	

13.2 All mammals, reptiles and amphibians identified from the Frances Creek survey, November 2005

Survey Period: November 11th to 15th, 2005.

General abundance during Survey: Scarce (S) , Uncommon (U), Common (C), Abundant (A), Present (P)

Land Unit: Animals identified were split into the land unit/habitat where they were identified

Observation Type: Fauna were identified on the field trip using Elliott traps, Pitfall traps, animal sign (i.e. tracks, scats) and incidental sightings.

Note: ANABAT Bat identifications only indicate presence of species and not abundance.

* Introduced species

Species Name		Common Name	Land Unit							Voids, Pool, Church	Observation Type
			Ridges and Slopes	Low Hills	Riparian	Undulating Plains	Alluvial Flats	Granite Hills	Rehabed Tailings Dam		
FISH											
Terapontidae											
	Leipotherapon unicolor	Spangled Grunter								A	Personal communication
AMPHIBIANS										C	
Bufonidae											
	*Bufo marinus**	Cane Toad		A	A	A	A		A		Elliott trap, incidenfal sightings
Hylidae											
	Cyclorana australis	Giant Frog							C	A	Incidental sightings
	Cyclorana longipes	Long-footed Frog							A	A	Elliott trap, incidental sightings
	Litoria personata	Masked Frog							C	C	Incidental sightings

Species Name		Common Name	Land Unit							Voids, Pool, Church	Observation Type
			Ridges and Slopes	Low Hills	Riparian	Undulating Plains	Alluvial Flats	Granite Hills	Rehabed Tailings Dam		
	Litoria rothii	Roths Tree Frog							C	C	Incidental sightings
	Litoria rubella	Red Tree Frog							C	C	Incidental sightings
REPTILES											
Agamidae (dragons)											
	Chlamydosaurus kingii	Frill-necked Dragon		U			C				Incidental sightings
	Ctenophorus caudicinctus	Ring-tailed Dragon	U								
	Diporiphera albilabris sobria		A								Incidental sightings
	Diporiphera bilineata	Two-lined Dragon		C							Incidental sightings
	Amphibolurus gilberti	Gilbert's Waterdragon			C		C				Incidental sightings
Colubridae (snakes)											
	Enhydris polylephis	Macleay's Water Snake		C	C						Incidental sightings
Crocodylidae											
	Crocodylus johnstoni	Freshwater Crocodile								C	Incidental sightings
Elapidae (snakes)											
	Demansia olivacea	Marble-headed Whipsnake		S							Incidental sightings
Gekkonidae (gecko's)											
	Heteronotia binoei	Bynoe's Gecko		C						C	Spotlighting

Species Name		Common Name	Land Unit							Voids, Pool, Church	Observation Type
			Ridges and Slopes	Low Hills	Riparian	Undulating Plains	Alluvial Flats	Granite Hills	Rehabed Tailings Dam		
Pythonidae											
	Antaresia childreni	Childrens Python		S							Spotlighing
Scincidae (skinks)											
	Carlia amax	Two-spined Rainbow Skink	U	C			C				Incidental sightings
	Carlia munda		A	C			U				Incidental sightings
	Ctenotus inornatus		S								Elliott traps
	Ctenotus robustus	Robust Ctenotus		S							Incidental sightings
	Glaphyromorphus isolepis		C							U	Elliott trap, Incidental sightings
	Menetia greyii						C		C		Pitfall trap
	Morethia ruficauda		U	U						U	Incidental sightings
MAMMALS											
Chiroptera											
	Chaerephon jobensis	Northern Mastiff-bat	P	P					P	P	Anabat recording
	Chalinobulus gouldii	Goulds Wattled Bat	P							P	Anabat recording
	Mormopterus beccarii	Beccari's Mastiff-bat							P	P	Anabat recording
	Nyctophilus sp. **			P					P	P	Anabat recording
	Nyctophilus walkeri	Pigmy Long-eared Bat								P	Anabat recording
	Rhinonicterus aurantius	Orange Horseshoe Bat								P	Anabat recording

Species Name		Common Name	Land Unit							Voids, Pool, Church	Observation Type
			Ridges and Slopes	Low Hills	Riparian	Undulating Plains	Alluvial Flats	Granite Hills	Rehabed Tailings Dam		
	Saccolaimus flaviventris	Yellow Bellied Sheathtail Bat		P					P	P	Anabat recording
	Scotorepens greyii / sanborni								P	P	Anabat recording
	Taphozous georgianus	Common Sheathtail Bat		P					P	P	Anabat recording
	Taphozous kapalgensis	White-striped Sheathtail Bat							P		Anabat recording
	Vespadelus caurinus	Little Red Flying Fox	P	C					P	P	Anabat recording
	Pteropus scapulatus			P					P	P	Anabat recording, spotlighting
	Species 1			P					P	P	Anabat recording
	Species 2		P						P	P	Anabat recording
Dasyuridae											
	Planigale maculata	Common Planigale					U		U		Elliott trap
Equidae											
	Equus caballus	Feral Horse		C		C					Incidental sighting
Felidae											
	Felis catus	Feral Cat		U						U	Spotlighting, scats
Macropodaidea											
	Macropus agilis	Agile Wallaby		C		C					Incidental sighting

Species Name		Common Name	Land Unit							Voids, Pool, Church	Observation Type
			Ridges and Slopes	Low Hills	Riparian	Undulating Plains	Alluvial Flats	Granite Hills	Rehabed Tailings Dam		
	Macropus robustus	Euro						U			Incidental sighting
	Petrogale brachyotis	Rock Wallaby, Short-eared	S								Scats
Muridae											
	Psuedomys nanus	Western Chestnut Mouse					C		U		Elliott traps
	Rattus tunneyi	Pale Field Rat	U	A			C		C		Elliott traps, spotlighting
	Zyzomys argurus	Common Rock-rat	A	U							Elliott traps
Peramelomorphia											
	Isoodon macrourus	Bandicoot, Northern Brown		U		C					Incidental sighting, diggings
Perissodactyla											
	Equus asinus	Feral Donkey				C					Incidental sighting
Suidae											
	Sus scrofa	Feral Pig			C				C		Tracks

** = *Nyctohilus geoffroyi* or *N. arnhemensis* or *N. bifax*

Species 1 *Scotorepens greyii / sanborni* or *Chalinolobus nigrogriseus*

Species 2 *Pipistrellus westralis* or *Miniopterus schreibersii orianae*

13.3 Bird species recorded within the Frances Creek project area during November survey 2005.

Survey Period: November 11th to 15th, 2005.

species is listed in the *EPBC Act* (1999) or *TPWC Act* (2000)

* Introduced species

Common Name	Scientific Name	Trap Sites						Camp	Other
		1a	1b	2a	2b	3a	3b		
		Helene	Helene	Ochre Hill	Ochre Hill	Millers	Millers		
		Tailings swamp	Slopes	Alluvial flats	Rocky Ridge	Alluvial flats	Rocky Ridge		
Babbler, Grey-crowned	*Pomatostomus temporalis*	1		1					1
Bee-eater, Rainbow	*Merops ornatus*	1	1						
Bowerbird, Greater	*Chlamydera nuchalis*	1		1			1		4
Budgerigar	*Melopsittacus undulatus*			10				1	
Butcherbird, Grey	*Cracticus torquatus*			1					1
Butcherbird, Pied	*Cracticus nigrogularis*								1
Cockatoo, Red-tailed Black	*Calyptorhynchus banksii*	1		2			2		
Cockatoo, Sulfur-crested	*Cacatua galerita*								5
Cormorant, Little-black	*Phalacrocorax sulcirostris*	2							
Coucal, Pheasant	*Centropus phasianuinus*			1					1
Cuckoo Shrike, Little	*Coracina papuensis*	1	1	1	1			1	
Darter	*Anhinga melanogaster*	1							
Dollarbird	*Eurystomus orientalis*								2
Dove, Bar-shouldered	*Geopelia humeralis*			1			2		

Common Name	Scientific Name	Trap Sites						Camp	Other
		1a	1b	2a	2b	3a	3b		
		Helene	Helene	Ochre Hill	Ochre Hill	Millers	Millers		
		Tailings swamp	Slopes	Alluvial flats	Rocky Ridge	Alluvial flats	Rocky Ridge		
Dove, Collared	*Streptopelia decaocto*								
Dove, Peacefull	*Geopelia striata*		1	2				1	
Drongo, Spangled	*Dicrurus hottentottus*								2
Duck, Burdekin (Radjah Shelduck)	*Tadorna radjah*	4							
Eagle, Wedge-tailed	*Aquila audax*						1		
Egret, Great	*Ardea alba*	1							
Fairy Wren, Varigated	*Malurus lamberti*		1					1	1
Falcon, Brown	*Falco berigora*						1		
Fantail, Grey	*Rhipidura fuliginosa*		1			1			
Finch, Crimson	*Neochmia phaeton*	1							
Finch, Double-barred	*Poephila bichenovii*								1
Finch, Longtailed	*Poephila acuticauda*		1						
Finch, Star	*Neochmia ruficauda*								1
Friarbird, Helmeted	*Philemon buceroides*			1					
Friarbird, Silver-crowned	*Philemon argenticeps*	1		1			2		1
Frogmouth, Tawny	*Podargus strigoides*							1	
Galah	*Cacatua roseicapilla*			1			1		1
Goose, Magpie	*Anseranas semipalmata*	1							
Grebe, Hoary-headed	*Poliocephalus poliocephalus*	2							

Common Name	Scientific Name	Trap Sites						Camp	Other
		1a	1b	2a	2b	3a	3b		
		Helene	Helene	Ochre Hill	Ochre Hill	Millers	Millers		
		Tailings swamp	Slopes	Alluvial flats	Rocky Ridge	Alluvial flats	Rocky Ridge		
Heron, Pied	*Ardea picata*	1							
Heron, Rufous Night	*Nycticorax caledonicus*							1	
Heron, White-faced	*Ardea novaehollandiae*	1							
Honeyeater, Brown	*Lichmera indistincta*		1				1		
Honeyeater, Red-headed	*Myzomela erythrocephala*								1
Ibis, Glossy	*Plegadis falcinellus*	1							
Ibis, Sacred	*Threskiornis aethiopica*	1							
Ibis, Straw-necked	*Threskiornis spinicollis*	1							
Kingfisher, Sacred	*Todiramphus sanctus*	1		1					
Kookaburra, Blue-winged	*Dacelo leachii*		1	1	1		1		1
Lapwing, Masked	*Vanellus miles*	1							
Lorikeet, Rainbow	*Trichoglossus haematodus*	1		1					1
Lorikeet, Varied	*Psitteuteles versicolor*	1	1						10
LotusBird (or Comb-crested Jacana)	*Irediparra gallinacea*	4							
Magpie Lark, Australian	*Grallina cyanoleuca*	1		1					1
Miner, Yellow-throated	*Manorina flavigula*			1					
Oriole, Yellow	*Oriolus flavocinctus*		1						
Owl, Southern boo-book	*Ninox novaeseelandiae*							1	
Parrot, Red-winged	*Aprosmictus erythropterus*	1	1						2

Common Name	Scientific Name	Trap Sites						Camp	Other
		1a	1b	2a	2b	3a	3b		
		Helene	Helene	Ochre Hill	Ochre Hill	Millers	Millers		
		Tailings swamp	Slopes	Alluvial flats	Rocky Ridge	Alluvial flats	Rocky Ridge		
Pigeon, Torresian Imperial	*Ducula spilorrhoa*			2					1
Rosella, Northern	*Platycercus venustus*	1							
Sparrow-hawk, Collared	*Accipiter cirrhocephalus*					1	1	2	1
Spoonbill, Royal	*Platalea regia*	1							
Stilt, Pied	*Himantopus himantopus*	2							
Thicknee, Bush	*Burhinus magnirostris*	1							
Shrike-thrush, Grey	*Colluricincla harmonica*						1		
Treecreeper, black-tailed	*Climacteris melanura*			1					
Wagtail, Willy	*Rhipidura leucophrys*	1					1	1	1
Wedgebill, Chiming	*Psophodes occidentalis*			1					
Whistler, Rufous	*Pachycephala rufiventris*	1		1	2			1	1
Woodswallow, Black-faced	*Artamus cinereus*			2					
Woodswallow, Little	*Artamus minor*	1							
Woodswallow, Masked	*Artamus personatus*								1
Woodswallow, White-breasted	*Artamus leucorhynchus*	1							

13.4 Vegetation Records from the Frances Creek flora survey, and other nearby flora surveys

Legend: The digit '1' indicates a species is present at the site. Light green shaded cells indicate dominant/co-dominant species at each site.

Survey Sites: Site 1a – Rehabilitated tailings storage facility, Site 1b – Helene slopes, Site 1c – Jasmine Ridge, Site 2a – Ochre Hill small alluvial flats, Site 2b – Ochre Hill ridge top, Site 3a – Millers small alluvial flats, Site 3b – Millers rocky outcrop.

References: Wheeler *et al.* 1992; Brock 1988; Strong 1987; Petheram and Kok 1983.

[10]Flora species recorded during the Mt Porter Survey (Low Ecological Services, 2005)

[11]Flora species recorded during the Mt Porter Survey (ERA environmental, 1993)

Species Name	Common Name	Site 1a Helene Tailings swamp	Site 1b Helene Slopes	Site 1c Jasmine Rocky Ridge	Site 2a Ochre Hill Alluvial flats	Site 2b Ochre Hill Rocky Ridge	Site 3a Millers Alluvial flats	Site 3b Millers Rocky Ridge	Incidental recordings
GRASSES & SEDGES									
Adiantaceae									
Cheilanthes sp. [10]									
Cyperaceae									
Cyperus digitatus		1							
Fimbristylis cinnamonetonum			1						
Fimbristylis dichotoma	Eight Day Grass	1							
Scleria sphacelata [10,11]									
Gramineae									
Aristida holothera [10]	Erect Keronsene Grass			1		1			1
Arundinella nepalensis [10]	Reed Grass					1			
Chrysopogon fallax [10]	Goldern Beardgrass					1			1

Species Name	Common Name	Site 1a	Site 1b	Site 1c	Site 2a	Site 2b	Site 3a	Site 3b	Incidental recordings
		Helene	Helene	Jasmine	Ochre Hill	Ochre Hill	Millers	Millers	
		Tailings swamp	Slopes	Rocky Ridge	Alluvial flats	Rocky Ridge	Alluvial flats	Rocky Ridge	
Cymbopogon bombycinus [10,11]	Silky Oilgrass		1						1
*Cynodon dactylon**	Couch Grass	1							1
Eragrostis sp. [10]									
Eragrostis speciosa [10]	Handsome Lovegrass								
Eriachne armitii [10,11]	Longawn Wanderrie								
Eulalia mackinlayi [10]									
Heteropogon contortus [10]	Bunch Speargrass								1
Heteropogon triticeus [10]	Giant Speargrass								
Mnesithea rottboelloides [10]									
Panicum sp. [10]									
Paspalum scrobiculatum	Scrobic	1							
*Pennisetum pedicellatum** [10]	Mission Grass	1							1
Schizachyrium fragile [10]	Small Redleaf								
Sorghum intrans [10]	Annual Sorghum	1				1	1	1	1
Sorghum plumosum [10,11]	Plume Grass Sorghum	1		1	1		1	1	1
Themeda triandra [10]	Kangaroo Grass			1			1	1	1
Whiteochloa capillipes [10]									
HERBS, FORBS, VINES, FERNS & EPIPHYTES									
Acanthaceae									
Rostellularia adscendens [10]									
Amaranthaceae									
Gomphrena sp. [10]									

Species Name	Common Name	Site 1a	Site 1b	Site 1c	Site 2a	Site 2b	Site 3a	Site 3b	Incidental recordings
		Helene	Helene	Jasmine	Ochre Hill	Ochre Hill	Millers	Millers	
		Tailings swamp	Slopes	Rocky Ridge	Alluvial flats	Rocky Ridge	Alluvial flats	Rocky Ridge	
Apocynaceae									
Parsonia velutina								1	
Aizoaceae									
Trachymene didiscoides [11]									
Aizoaceae									
*Mimosa pudica**	Common Sensitive Plant						1		1
Asteraceae									
Vernonia cinerea [11]	Vernonia								
Convolvulaceae									
Evolvulus alsinoides [11]	Tropical Speedwell								
Evolvulus numularis		1							
Jacquemontia sp. [11]									
Merremia aegyptia [11]									
Merremia quinata [10]									
Dilleniaceae									
Pachynema complanatum			1						
Pachynema dilataum [11]									
Pachynema pshenadrum [10]									
Droseraceae									
Drosera petiolaris [11]	Woolly Sundew								
Euphorbiaceae									
*Euphorbia heterophylla** [10]	Painted Spurge								
Euphorbia hirta	Asthma Plant	1							

Species Name	Common Name	Site 1a	Site 1b	Site 1c	Site 2a	Site 2b	Site 3a	Site 3b	Incidental recordings
		Helene	Helene	Jasmine	Ochre Hill	Ochre Hill	Millers	Millers	
		Tailings swamp	Slopes	Rocky Ridge	Alluvial flats	Rocky Ridge	Alluvial flats	Rocky Ridge	
Euphorbia vachellii							1		1
Euphorbia wheeleri [10]	Wheeler's Spurge								
Fabaceae									
Calopogonium mucunoides *	Calopo	1							
Cajanus acutifolius						1			
*Crotalaria goreensis** [10]	Gambia Pea								
Crotalaria medicaginea [10]	Trefoil Rattlepod								
Crotalaria montana [10]									
Galactia muellera [11]	Mueller's Pea								
Gycine tomentella [10,11]	Rusty Glycine		1	1		1			1
Indigofera saxicola			1						
Tephrosia polyzyga [10,11]			1						
Tephrosia sp.						1			
Goodeniaceae									
Goodenia sp. [10]									
Haemodoraceae									
Haemodorum sp. [11]									
Lythraceae									
Rotala sp. [10]									
Menyanthaceae									
Nymphoides indica	Water Lily	1							
Orchidaceae									
Cymbidium canaliculatum [10]	Black Orchid								1

Species Name	Common Name	Site 1a	Site 1b	Site 1c	Site 2a	Site 2b	Site 3a	Site 3b	Incidental recordings
		Helene	Helene	Jasmine	Ochre Hill	Ochre Hill	Millers	Millers	
		Tailings swamp	Slopes	Rocky Ridge	Alluvial flats	Rocky Ridge	Alluvial flats	Rocky Ridge	
Passifloraceae									
*Passiflora foetida** [10,11]	Stinking Passion Vine	1			1				1
Plumbaginaceae									
Plumbago									
Polygalaceae		1							
Polygala sp. [10]	A dock								
Scrophulariaceae									
Buchnera linearis [10]									
Sinopteridaceae									
Cheilanthes tenuifolia [10]	Rock Fern								
Smilacaeae									
Smilax australis [10]	Austral Smilax								
Spermacoce									
Spermacoce leptoloba [10]									
Spermacoce occultisefa [10]									
Sterculiaceae									
Helicteres sp.			1	1					
Stylidiaceae									
Stylidium sp. [10]									
Tinospora									
Tinospora smilacina [10]	Snake Vine								
Thymelaeaceae									
Thecanthes punicea [10]									

Species Name	Common Name	Site 1a	Site 1b	Site 1c	Site 2a	Site 2b	Site 3a	Site 3b	Incidental recordings
		Helene	Helene	Jasmine	Ochre Hill	Ochre Hill	Millers	Millers	
		Tailings swamp	Slopes	Rocky Ridge	Alluvial flats	Rocky Ridge	Alluvial flats	Rocky Ridge	
Vitaceae									
Cayratia trifolia [11]	Hairy Watervine							1	
Ampelocissus acetosa [11]	Wild Grape								
TREES & SHRUBS									
Anacardiaceae									
Buchanania obovata [10,11]	Wild Mango								
Apocynaceae									
Alstonia actinophylla [11]	Milkwood	1							
Alyxia tropica						1			
Wrightia saligna [10,11]	Milk Bush								
Araliaceae									
Schefflera actinophylla	Umbrella Tree						1		1
Arecaceae									
Livistona humilis [10,11]	Sand Palm	1	1	1		1	1	1	1
Bignoniaceae									
Dolichandrone filiformis [10,11]									
Bixaceae									
Cochlospermum fraseri [10,11]	Yellow Kapok				1	1			1
Combretaceae									
Terminalia ferdinandiana [11]	Billygoat Plum	1	1	1					1
Terminalia grandiflora [11]	Nut Tree								
Terminalia pterocarya [11]									

Species Name	Common Name	Site 1a	Site 1b	Site 1c	Site 2a	Site 2b	Site 3a	Site 3b	Incidental recordings
		Helene	Helene	Jasmine	Ochre Hill	Ochre Hill	Millers	Millers	
		Tailings swamp	Slopes	Rocky Ridge	Alluvial flats	Rocky Ridge	Alluvial flats	Rocky Ridge	
Caesalpiniaceae									
Erythrophleum chlorostachys [10,11]	Ironwood			1	1		1	1	1
Senna alata *	Ringworm Scrub	1							
Cupressaceae									
Callitris intratropica	Northern Cypress Pine			1					1
Cycadaceae									
Cycas armstrongii	Cycad								1
Euphorbiaceae									
Antidesma glaesembilla								1	
Antidesma parvifolium						1			
Bridelia tomentosa [10]									
Croton arnhemicus						1			
Flueggea virosa [10,11]									
Petalostigma pubescens [10,11]	Downy Cracker Bush								
Petalostigma quadriloculare [10,11]	Qunine Bush		1			1		1	1
Fabaceae									
Erythrina variegata [10]	Coral Tree								
Erythrina vespertilio [11]	Batswing Coral Tree								
Flemingia lineata [10,11]									
Lamiaceae									
Hyptis suaveolens * [10,11]	Hyptis	1			1		1		1
Lauraceae									
Litsea glutinosa [10]									

Species Name	Common Name	Site 1a	Site 1b	Site 1c	Site 2a	Site 2b	Site 3a	Site 3b	Incidental recordings
		Helene	Helene	Jasmine	Ochre Hill	Ochre Hill	Millers	Millers	
		Tailings swamp	Slopes	Rocky Ridge	Alluvial flats	Rocky Ridge	Alluvial flats	Rocky Ridge	
Lecythidaceae									
Planchonia careya [11]	Cocky Apple				1			1	
Malvaceae									
Abelmoschus moschatrus [11]	Native Rosella								
Meliaceae									
Owenia vernicosa [10,11]	Emu Apple			1		1	1	1	1
Mimosaceae									
Acacia aulacocarpa [10,11]	Hickory Wattle								
Acacia auriculiformis [10]	Earpod Watle	1							
Acacia bidwillii [10,11]	Corkwood Wattle								1
Acacia cowleana [10]	Hall's Creek Wattle								
Acacia difficilis [10,11]									
Acacia dimidiata [10]	Swamp Wattle								
Acacia hemignosta	Club-leaf Wattle								
Acacia holosericea	Candelabra Wattle					1	1		1
Acacia lamprocarpa						1			
Acacia leptocarpa [11]									
Acacia oncinocarpa [10]									
Acacia pachyphloia [10]									
Acacia pachyphylla [10]									
Acacia platycarpa [10]	Ghost Wattle								
Acacia torulosa [10]	Torulosa Wattle								
Acacia umbellata				1					

Species Name	Common Name	Site 1a	Site 1b	Site 1c	Site 2a	Site 2b	Site 3a	Site 3b	Incidental recordings
		Helene	Helene	Jasmine	Ochre Hill	Ochre Hill	Millers	Millers	
		Tailings swamp	Slopes	Rocky Ridge	Alluvial flats	Rocky Ridge	Alluvial flats	Rocky Ridge	
Moraceae									
Ficus acubata								1	
Ficus opposita [10,11]	Sandpaper Fig	1							1
Ficus brachypoda (=platypoda) [10,11]	Native Fig								
Ficus scobina [11]									
Ficus virens [10]	Banyan								1
Myrtaceae									
Calytrix achaeta [11]									
Calytrix existipulata [10,11]	Kimberly Heather	1		1					1
Corymbia dichromophloia [10,11]	Variable Barked Bloodwood	1	1	1		1			1
Corymbia disjuncta					1				
Corymbia latifolia [10,11]	Round-leafed Bloodwood								
Corymbia polysciada [10]									
Corymbia polycarpa [10]	Long-fruited Bloodwood				1				
Corymbia porrecta [11]	Grey Bloodwood								
Eucalyptus alba	White Gum								1
Eucalyptus bigalerita [10,11]	Northern Salmon Gum								
Eucalyptus clavigera [11]	Apple Gum								
Eucalyptus confertiflora [11]	Broad-leaved Carbeen								
Eucalyptus miniata [10,11]	Darwin Woollybutt				1	1	1		1
Eucalyptus phoenicea [10]	Scarlet Gum								
Eucalyptus setosa [10,11]	Rough-leafed Bloodwood				1				1
Eucalyptus tectifica [10,11]	Darwin Box								

Species Name	Common Name	Site 1a	Site 1b	Site 1c	Site 2a	Site 2b	Site 3a	Site 3b	Incidental recordings
		Helene	Helene	Jasmine	Ochre Hill	Ochre Hill	Millers	Millers	
		Tailings swamp	Slopes	Rocky Ridge	Alluvial flats	Rocky Ridge	Alluvial flats	Rocky Ridge	
Eucalyptus tetrodonta [10,11]	Darwin Stringybark		1	1					1
Eucalyptus tintinnans [10,11]	Salmon Gum					1			1
Lophostemon grandiflorus [10,11]	Northern Swamp Box						1		1
Melaleuca dealbata (?) [10,11]	Blue-leafed Paperbark								1
Melaleuca viridiflora	Green Paperbark								1
Xanthostemon paradoxus [10,11]	Bridal Tree		1						1
Olacaceae									
Olax perdulina								1	
Onagraceae									
Ludwigia octovalvis [10]	Willow Primrose	1							
Pandanaceae									
Panadanus spiralis [10,11]	Screw Palm								1
Pittosporaceae									
Pittosporum melanospermum [10,11]	Goldern Pittosporum								
Proteaceae									
Grevillea decurrens [10,11]		1		1				1	1
Grevillea dimidiata [10]									
Grevillea mimosoides [11]						1	1	1	1
Hakea arborescences [11]									
Rhamnaceae									
Alphitonia excelsa [10,11]	Red Ash				1				
Rhizophoraceae									
Carallia brachiata [11]	Carallia Wood								

Species Name	Common Name	Site 1a	Site 1b	Site 1c	Site 2a	Site 2b	Site 3a	Site 3b	Incidental recordings
		Helene	Helene	Jasmine	Ochre Hill	Ochre Hill	Millers	Millers	
		Tailings swamp	Slopes	Rocky Ridge	Alluvial flats	Rocky Ridge	Alluvial flats	Rocky Ridge	
Rubiaceae									
Gardenia megasperma [10,11]				1		1			1
Ixora sp. [10]									
Sapindaceae									
Allophylus cobbe								1	
Sapotaceae									
Pouteria sericea								1	
Santalaceae									
Exocarpos latifolius	Native Cherry					1			
Solonaceae									
Solanum echinatum	Wild Tomato	1							
Sterculiaceae									
Brachychiton diversifolius [10,11]	Northern Kurrajong		1						1
Brachychiton megaphyllus [10,11]					1		1	1	1
Sterculia quadrifida	Peanut Tree								
Tiliaceae									
Grewia retusifolia [10,11]	Emu Berries								
Verbenaceae									
Vitex glabrata						1			
TOTAL SPECIES AT EACH SITE		**25**	**14**	**16**	**12**	**23**	**15**	**18**	**44**

13.5 Mammals presently or potentially inhabiting the Frances Creek project area.

This table includes species recorded during the environmental survey of the proposed Frances Creek project area (marked in **bold** text) and species recorded from other nearby environmental surveys.

Survey Legend:

[1]Brocks Creek (Source: Brocks Creek EIS, Eldridge and Low 1994)

[2]Unions Reef (Source: Unions Reef DEIS, NSR 1993)

[3]Cosmo Howley (Source: Cosmo Howley Project Flora and Fauna Survey; Davison 1985)

[4]Kakadu National Park Stage III Wildlife Survey (Source: Woinarski *et al.* 1989)

[5]Pine Creek (Source: Union Reefs DEIS, NSR 1993)

[6]Mt Todd (Source: Union Reefs DEIS, NSR 1993)

[7]Woodcutters (Source: Unions Reefs DEIS, NSR 1993)

[8]PAWCNT (Source: Biological Records bound by $131^{o}30^{E}$ – $132^{o}00^{W}$ and $13^{o}30^{N}$ – $13^{o}55^{S}$)

[9]Spring Hill (Source: Spring Hill EIS, Grattidge and Low 1995)

[10]Mt Porter (Source: Reilly *et al*. 2005)

GROUP	SCIENTIFIC NAME	COMMON NAME	STATUS	RANGE	PREFERRED HABITAT
Prototheria					
Tachyglossidae	*Tachyglossus aculeatus* [2, 4, 9]	Short-beaked Echidna	Common	Australia wide	Lowlands and drainage depressions
Marsupialia					
Dasyuridae	*Antechinus bellus* [4]	Fawn Antichinus	Common, limited disturbution	Far Northern Territory	Woodlands and open Forests
	Dasyurus hallucatus [2,3,4,8,9]	Northern Quoll	Vulnerable*	Northern Aust.	generalist
	Parantechinus bilarni [4]	Sandstone Antechinus	Restricted	Western	

GROUP	SCIENTIFIC NAME	COMMON NAME	STATUS	RANGE	PREFERRED HABITAT
			distribution	Arnhemland	
	Phascogale tapoatafa [4]	Brush-tailed Phascogale	Vulnerable* distribution limited	Coastal Aust	Arboreal, prefers rocky ridges and hills
	Planigale maculata [4,5,8]	Common Phascogale	Common	Far North and east coastal Australia	Various habitat types
	Sminthopsis sp. [4,6]	Kakadu Dunnart	Unknown range	Western Arnhemland	Woodland on stony hills
	Sminthopsis virginae [2,4,10]	Red-cheeked Dunnart	Common in limited range	Far Northern Australia	Woodland habitats
Peramelomorphia	*Isoodon macrourus* [1,2,4,8,9]	Northern Brown Bandicoot	Common to abundant	Northern and east coastal Australia	Generalist, anywhere where ground cover is lows
Phalangeroidea	*Petaurus breviceps* [4,6,10]	Sugar Glider	Common	North and south east Australia	Woodland habitats
	Pseudocheirus dahli [4]	Rock Ringtail Possum	Common but limited distribution	North NT and WA	*Eucalyptus miniat*a woodland around rocky outcrops
	Trichosurus arnhemensis [4,5]	Northern Brushtail Possum	Common over a limited range	Far northern Australia	In frequently burnt Eucalypt woodland (*E. miniata*).
Macropodaidae	*Macropus agilis* [1,2,4,5,6,8,9]	Agile Wallaby	Abundant	Tropical Coastal Australia	Lowlands and drainage depressions
	Macropus antilopinus [3,4,5,6]	Antilopine Wallaroo	Common	Far Northern	Eucalypt woodlands with a

GROUP	SCIENTIFIC NAME	COMMON NAME	STATUS	RANGE	PREFERRED HABITAT
				Australia	perennial grass understorey
	Macropus robustus [2,4,5,6,9]	Euro	Abundant	Australia wide	Rocky hills and escarpments
	Onychogalea unguifera [4]	Northern Nailtail Wallaby	Near Threatened*	Northern Australia	Open long-grass woodland and riverine areas
	Peradorcas concinna [4]	Nabarlek, Little Rock-wallaby	Rare, limited	Far north NT and WA	Rocky slopes
	Petrogale brachyotis [4,5]	Shorteared Rock Wallaby	Abundant, but locally rare	Far North-west Austalia	Low rocky hills and savannah grassland
Eutheria					
Chiroptera (bats)	*Chaerophon jobensis* [4]	Northern Mastiff Bat	Common	Northern Tropical Aust.	Open forest, roosts in hollow trees
	Chalinolobus gouldii [1,4]	Gould's Wattled Bat	Widespread and common	Aust. wide	Open forests and riverine areas
	Chalinolobus nigrogriseus [4]	Hoary Bat	Relatively common	Northern Aust.	Wide range of habitats
	Eptescicus causrinus [1,4]	Northern Brown Bat	Common	Far north Aust.	Various habitats
	Eptescicus finlaysoni [4]	Little Cave Eptescicus	Abundant	WA, NT and coastal Qld	Wide range of habitats
	Hipposideros ater [4,8]	Dusky Horseshoe bat	Locally common		Caves and disused mine shafts
	Hipposideros diadema [4]	Diadem Horseshoe bat	Limited, sparse to common	Far north NT and Qld	Warm humid climate, roosts in forests
	Hipposideros stenotus [4]	Lesser Wart-nosed Horseshoe-bat	Near Threatened*	Far northern Australia	Caves, disused mine shafts and rock crevices
	Macroderma gigas [1, 4,8]	Ghost Bat	Rare	Patchy distribution in tropical and arid	Caves and disused mine shafts

GROUP	SCIENTIFIC NAME	COMMON NAME	STATUS	RANGE	PREFERRED HABITAT
				Australia	
	Macroglossus minimus [4]	Northern Blossom Bat	Common, limited	Far Northern Australia	Woodland, especially *Melaleuca* woodland
	Miniopterus schreibersii [4]	Common Bent-wing Bat	Abundant	Coastal Australia	Caves and disused mine adits
	Mormopterus beccarii [4,8]	Beccari's Freetail-bat	Common, widespread	North-east Australia	Closed forest to woodland
	Mormopterus loriae				
	Myotus macropus				
	Nyctophilus arnhemensis [4]	Arnhem Land Long-eared Bat	Common	Northern Australia	Open forests and river fringes
	Nyctophilus bifax [4]	North Queensland Long-eared Bat	Common	Northern Australia	Rainforest, dry sclerophyll woodland and riverine vege.
	Nyctophilis geoffroyi [1,4]	Lesser Long-eared Bat	Widespread and common	Northern Tropical Australia	Woodland and riverine areas
	Nyctophilis walkeri				
	Pipistrellus adamsi				
	Pteropus alecto [7,8]	Black Flying Fox	Common	Coastal Australia	Mangrove forests or similarly dense vegetation
	Pteropus scapulatus [4]	Little Red Flying Fox	Widespread and common	Coastal Australia	Eucalypt woodland and forest
	Rhinonicterus aurantius [4,9]	Orange Horseshoe-bat	Near Threatened*	Far Northern Australia	Requires warm humid caves near open Eucalypt woodland
	Saccolaimus flaviventris				
	Scotorepens balstoni [8]	Western Broad-nosed bat	Common	Most of Australia	Riverine areas with tree hollows and open water
	**Scotorepens greyii* [4,8]	Little Broad-nosed Bat	Common	Most of Australia	Open woodland and forested areas

GROUP	SCIENTIFIC NAME	COMMON NAME	STATUS	RANGE	PREFERRED HABITAT
	**Scotorepens sanborni*				
	Taphozous georgianus [1,3,4]	Common Sheathtail-bat	Common	Tropical and subtropical Australia	Required deep caves and small fissures in rocks
	Taphozous flaviventris [4]	Yellow-bellied Sheathtail bat	Widespread and common	North to south-eastern Aust.	Tree hollows, Mallee or Open woodland
	Taphozous kapalgensis	Arnhem Sheathtail bat	Near Threatened*		
	Taphozous saccolaimus [4]	Naked-rumped Sheathtail bat	Rare, scattered	Far North Qld	Dry woodland to dense rainforest
	Vespadelus pumilus [8]	Eastern Forest bat			
Rodentia	*Leggadina foresti* [4,5,6]	Forrest's Mouse	Sparse	Arid to Semi Aird Central Australia and Kimberly	Tussock grasslands and low shrublands
	Mesembrionys gouldii [4,5,6]	Black-footed tree Rat	Common in Arnhemland, rare elsewhere	Far North Qld	Monsoonal woodland and open forest with grass understory
	Mus musculus [5]	House Mouse	Abundant	Australia wide	Generalist
	Pseudomys nanus [3,4,5,6]	Western Chestnut Mouse	Near Threatened*	Northern Australia	Variety of habitat, with dense tussock grasses
	Pseudomys deliculatus	Delicate Mouse	Sparsely scattered, seasonal fluctuations	Northern Australia	Patchy distribution in sclerophyll forest and woodland
	Pseudomys sp. [4]	Calaby's Mouse	Rare	Western Arnhemland	Open forest with stony substrate.
	Rattus colletti [4,8]	Dusky Rat	Common	Northern NT	Grassy alluvial floodplains
	Rattus tunneyi [1,4,6]	Pale Field-rat	Near Threatened*	North-west and	Tall grassland, typically