Rio Tinto Iron Ore

Report for 320 Mt Marshalling Yards, Maintenance Workshop and Quarry

Flora and Fauna Assessment

October 2008

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Executive Summary

Rio Tinto Iron Ore (RTIO) proposes to construct a rail marshalling yard, maintenance workshop and quarries, between Cape Lambert and Roebourne, in North-Western Australia. GHD Pty Ltd (GHD) has been commissioned by RTIO to complete a baseline flora and fauna assessment to support the submission of the project to the Environmental Protection Authority under Part 5 of the *Environmental Protection Act 1986*.

The study area comprises a total of 1793 hectares. RTIO propose to construct a rail marshalling yard, rail ore wagon maintenance facility, a series of roads to service the workshop facility and marshalling yard, expand an existing quarry for rail ballast and a waste water treatment facility that will produce potable water and treat sewerage and stormwater. The works all form part of RTIO's 320Mt Rail Duplication Project.

The GHD flora and fauna assessment included a desktop assessment and a field survey that was conducted during the period 7th to 11 th July 2008 and 4th to 8th August 2008. The results of the assessment are summarised below:

- The study area is generally curved and linear in shape, on the western side of the existing rail line between Wickham (north) and Roebourne (south). This area is largely covered by native vegetation with the exception of the rail line toward the northern margin of the study area.
- No reserves or conservation areas occur within the vicinity of the study area.
- The study area intersects a Schedule 1 area ('Non-permitted area' as defined under the Environmental Protection (Clearing of Native Vegetation) Regulations 2004) that occupies a 2 km buffer of the existing coastline.
- A number of waterways cross the study area. For the most part they are minor and ephemeral drainage lines. Closer to the coast in the northern section of the site, the waterways are influenced by the tidal movements. In the northern section of the site there are mangroves and tidal flats, which will be avoided.
- Particular attention will be required in the southern section of the site where gilgai (deep boggy holes) have been identified. Any site disturbance, including the clearing of native vegetation from these areas, is likely to exacerbate drainage problems and the formation of gilgai.
- Eight vegetation types have been identified within the study area:
  - 'Hummock grasslands (HG2) of *Triodia pungens* with scattered emergent shrubs.';
  - Rockpiles (HG1) that support herbaceous species and single individual trees such as *Ficus brachypoda, Terminalia canescens and Ehretia saligna*;
  - Acacia Type Creeklines (LW1, HG, S) with *Corymbia hamersleyana, Acacia*

colei, Gossypium robinsonii over *Triodia pungens, Rhynchosia minima* and mixed herbs and grasses;

- Tussock grasslands (TG)';
- 'Major Flowlines/Tidal inlets (LW2, H,TG)';
- 'Samphire and Halophytes (H, TG) with **Cenchrus ciliaris*';
- 'Mangroves (LW2, H)'; and
- 'Heavily Disturbed (HD)'.

- Within the Cape Lambert study area, the vegetation condition ranged considerably, from *Completely Degraded* to *Excellent*. The developed areas, roads, railway, ballast quarry, laydowns and other associated areas were predominantly cleared and were considered to be *Degraded* to *Completely Degraded*.
  The areas in the northern section of the site in the vicinity of the existing rail line are generally rated as *Degraded* to *Very Good.* In some isolated areas there is evidence of significant disturbances including previous earthworks, artificial piles of dirt and areas of rubbish dumping. The entire site is criss-crossed with informal access tracks frequently used by locals to access the coast.
  There are large areas in the west of the site that are relatively undisturbed. However, these areas have been subject to other disturbance factors, in particular frequent fire events which appears to have permanently altered the vegetation structure in the area.
- Based on the mapping by Beard (1970) and analysis of vegetation extent by Shepherd *et al.* (2002) and Shepherd, (2005), the vegetation type present within the study area, Vegetation Association 157 - Hummock grasslands grass steppe; hard Spinifex *Triodia wiseana* has approximately 100% of its extent remaining and falls into the status category of *Least Concern.*
- No Threatened Ecological Communities (TECs) were recorded within the study area. A Priority Ecological Communities (PECs) has been identified as occurring .in the southern section of the site on the Horse Flat Plains landsystem.
- Species diversity within the study area is considered to represent a medium degree of diversity. A total of 158 taxa from 34 families were recorded from the study area.
- No Declared Rare Flora or Priority Flora species were recorded within the study area.
- Only two weed species (**Cenchrus ciliaris* and **Aerva javanica*) were recorded from the study area, both of which are naturalised and widespread in the Pilbara region. Despite the low number of weed species present on the site, these two species (particularly the **Cenchrus ciliaris*) were widespread and present throughout the entire site, particularly in the north of the study area, forming thick monocultures.
- A total of 23 bird species, two mammal species and three reptile species were recorded during the brief reconnaissance survey within the Cape Lambert study

area.

- Two migratory bird species listed under the EPBC Act were identified in the study area: the White-bellied Sea-Eagle and Rainbow Bee-eater.
- There are a number of fauna species that have potential to occur within the study area; however, the habitat of the study area is not unique and there are large areas of suitable habitat for these species adjacent to the study area. The habitat within the study area cannot be thought of as 'significant habitat' for native species. Additionally, the study area has been subject to a long history of disturbance, particularly frequent fire events, grazing and weeds invasion all of which would impact on the use of the study area by native fauna species.
- Appropriate management measures will assist in mitigating potential impacts, such as erosion, weed spread and fauna mortality during clearing and earthworks.

1. Introduction

1.1 Background

Rio Tinto Iron Ore (RTIO) proposes to construct a rail marshalling yard, maintenance workshop and quarries, between Cape Lambert and Roebourne, in the Pilbara. The works all form part of RTIO's 320Mt Rail Duplication Project. GHD Pty Ltd (GHD) has been commissioned by RTIO to complete a baseline flora and fauna assessment of the project area to support a submission to the EPA under Part 5 of the *Environmental Protection Act 1986*. The GHD flora and fauna assessment included a desktop assessment and a field survey that was conducted from 7th to 11 th July 2008 and 4th to 8th August 2008.

1.2 Study Area

The study area is generally curved and linear in shape, roughly following a valley floor on western side of the rail line between Wickham (north) and Roebourne (south). The total study area comprises 1793 ha of land. The project area is comprised of five study areas (some of which are overlapping) (**Figure 1**, **Appendix A**). The site is largely covered by native vegetation with the exception of the rail line toward the northern margin of the study area.

1.3 Scope of Works

This flora and fauna assessment included both desktop and field assessments. The desktop assessment included:

- A review of the Department of Environment and Conservation's (DEC) Rare and Priority Flora databases;
- A review of the DEC's Threatened Ecological Community (TEC) and Priority Ecological Community (PEC) database;
- A review of the DEC's Threatened Fauna database;
- A review of local and regional significance of plant communities;
- A review of the Western Australian Museum database for threatened and endangered fauna;
- A review of the DEC's Environmentally Sensitive Areas (ESAs); and
- A review of the Department of the Environment, Water, Heritage and the Arts (DEWHA) database for matters listed under the *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)*.

The field survey verified the findings of the desktop study and provided a detailed assessment of the existing environment in the study area and its relationship to

adjoining areas. The field survey included the following:

- An inventory of the vascular plant species in the study area, undertaken through the survey of 50 m x 50 m quadrats and walking transect survey methods;
- A review of, and search for, significant flora species;
- An inventory of dominant exotic plants, including declared noxious plants and environmental weed species;
- Assessment on whether weeds are likely to spread to, and result in, environmental harm to adjacent areas of native vegetation that are in good or better condition;
- A description and location, including mapping, of plant communities;
- A rating of condition of the vegetation communities or areas using a published rating scale (Keighery, 1994);
- A review of the local and regional significance of the plant communities in terms of their intrinsic value, extent, rarity and condition;
- An inventory of the vertebrate fauna species in the study area through targeted searches and opportunistic recording of species;
- Review of the fauna species considered to be rare or in need of special protection;
- Review of the presence and abundance of pest, declared or feral animals; and
- Identification of any habitats of significance.

2. Desktop Assessment

2.1 Climate

The study area is located within the Pilbara region of Western Australia. This region is subject to an arid-tropical climate with two distinct seasons, a hot summer (October – April) and a mild winter (May – September). The average yearly evaporation exceeds rainfall by as much as 2,500 mm per year. Seasonally low and unreliable rainfall, together with high temperatures and high diurnal temperature variations are also characteristic climatic features of the region. This region has in the past experienced no rainfall in any month of the year, which is typical of a desert climate (Beard, 1975).

The majority of the Pilbara has a bimodal rainfall distribution, resulting in two rainfall maxima per year. From January to March, rain results from storms penetrating from the north, producing sporadic and intense thunderstorms. The region is also subject to occasional tropical cyclones usually between January and April which also cause heavy rainfall events. Tropical cyclones contribute 40% - 60% of the north coastal rainfall, reducing to less than 30% to the south and east of the region (ANRA, 2007). From May to June, cold fronts move east across Western Australia and occasionally reach the Pilbara Region. These fronts produce light winter rains that are generally ineffective for extensive plant growth.

The closest official Bureau of Meteorology weather recording station is at Roebourne, where climate data is available for records between 1887 and 2008 (Bureau of Meteorology, 2008) (**Table 1**). Mean maximum temperatures range from 26.7ºC (July) to 39.0ºC (December), and mean minimum temperatures range from 13.6ºC (July) to 26.2ºC (January and February). Annual rainfall is 312.6 mm over approximately 23 rain days, with the highest daily rainfall recorded at 233.7 mm (Bureau of Meteorology, 2008).

Table 1 Climate Data for Roebourne

Statistic Element	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean maximum temperature (ºC)	38.7	38.0	37.5	35.3	30.4	27.0	26.7	28.9	32.5	35.5	38.0	39.0	34.0
Mean minimum temperature (ºC)	26.2	26.2	25.4	22.2	18.3	15.3	13.6	14.5	16.8	19.6	22.6	24.9	20.5
Mean Monthly rainfall (mm)	58.8	66.7	65.8	29.3	27.9	29.2	14.0	5.2	1.2	0.7	1.3	11.0	312.6
Mean number of days of rain	3.4	4.8	3.6	1.5	2.5	2.6	1.6	0.9	0.3	0.2	0.3	1.2	22.9
Mean number of days of rain ≥ 1 mm	2.3	3.3	2.6	1.0	1.7	1.7	1.1	0.6	0.2	0.1	0.2	0.7	15.5

Source: Bureau of Meteorology, 2008.

The study area is considered to exhibit a similar climate to that recorded at Roebourne.

Preceding the site visit in July and August 2008 Roebourne rainfall was above average

during January and February, however there was no recorded rainfall in May, lower than average rainfall in June and no rainfall in July.

2.2 Geology and Landforms

The Pilbara Region comprises a portion of the ancient continental Western Shield that dominates the geology of Western Australia. It contains some of the earth's oldest rock formations and important mineral deposits, which are thought to be around 3.5 billion years old (Australian Natural Resources Atlas, 2007). The Western Shield is comprised of pre-Cambrian Proterozoic and Archaean rocks.

The study area lies within the North Pilbara Terrain region which is formed largely of Archaean mafic and minor felsic volcanics and sequence of clastic sediments, with chert and banded iron formation (CSIRO Land and Water, 2008). The geology of the region around the study area has been mapped and described by Ryan *et al.* (1966).

2.2.1 Geological Setting

The Pilbara Craton is composed of the 3.6-2.8 Ga North Pilbara granitoid-greenstone terrane and the overlying volcano-sedimentary sequences (Mount Bruce Supergroup) of the 2.77-2.3 Ga Hamersley Basin.

The survey area lies within the Roebourne Group of the Pilbara System. The Roebourne 1:250 000 Geological Survey of Western Australia map sheet (1969) indicates that the survey areas occurs within a mosaic of Archaean formations consisting of:

Pilbara system (Archaean)

- Gabbro: Medium grained to coarse grained, green or black and white intrusive, cut by granite, grades to amphibolite and ultrabasic rock in places.

Roebourne Group (Archaean)

- Cleaverville formation: Banded jaspilite, chert, hematite, shale, inter-bedded red shale and siltstone; some concordant green granular rocks.
- Regal formation: Intercalated altered basic volcanic rocks, pillow lavas, pyroclastic rocks; serpentinised basic rocks, calcareous and clastic rocks chert, granular and aphanitic concordant green rocks; epidosite; and undifferentiated intrusive rocks.
- Metamorphosed sedimentary rocks: Calcareous sedimentary rocks, amphibole schists, skarn rocks; andalusite schist, clastic rocks; banded chert with prase, fuchsite schist, blocky quartz-epidote-dolomite rock, tuff and lava; local conglomerate.

2.2.2 Topography and Soils

The region is low lying and consists of extensive plains from which low hills of pre-

Cambrian rock project. Physiography reflects the geology of the rocks, where granite and gneiss underlie the plain areas and altered basic volcanic rocks and jaspilite formations form the more upstanding ridges to the west.

The lower reaches of the Harding River catchment covers the area that encompasses the survey site. Rivers in the region are incised to coastal plains and only flow in the wet season following cyclonic rains. Rivers and drainage areas have a braided pattern and generally flow in a northerly direction. Rivers do not persist to the sea rather debouching on to extensive tidal plains. These tidal plains can extend to over six kilometres inland from the coast.

Regional soils near and around Roebourne are dominated by red earths and cracking clays. The coastal plain is a pediplain formed through the retreat of the scarp, and the soil, gravel and boulder beds are residual deposits of scarp retreat. Overlying the geological formations are the following recent features:

- Gravel: Downwash, scree, talus; slope deposits
- Alluvium: Creek deposits, flood out deposits, silt on high tidal flats
- Clay gravel: High-level clay plain with some older flood deposits and claypans.
- Red clay: High-level plain of red and mottled clay and silt; gilgais; intermittent silt and gravel veneer; some sheet kunkar.

As a consequence of the sparse vegetation cover and the erosive force of heavy summer cyclonic rains, much of the soil on hill slopes tends to be transported down to the valleys and plains. Plant species and associations of vegetation on the hills and slopes tend to be correlated to geology rather than soil type (Beard, 1975). Along drainage lines superficial deposits influence the distribution of vegetation; however, the presence of surface and groundwater is also a determining factor.

2.2.3 Hydrology

The hydrology of the Pilbara is one of extremes. Severe droughts and major floods can simultaneously occur over the vast region that covers an area of over 200,000 km^2 (Ruprecht and Ivanescu, 2000). The major rivers of the region are the De Grey, Ashburton, Fortescue, Yule, Sherlock, Cane, Robe, Harding, Maitland, and Turner. Stream flows in the Pilbara region are mostly a direct response to rainfall and are highly seasonal and variable. Most runoff occurs during the period from January to March with typically less runoff during December and April (Ruprecht and Ivanescu, 2000).

Rivers typically drain the upland areas in the region flowing northwards towards the coast. For Roebourne, the upland areas include Millstream, Chichester and its associated ranges. Rivers dissect into deep gorges in upland ranges dispersing to flows over extensive floodplains in the lower northern reaches.

Ephemeral flow patterns leave rivers and creeks dry for most of the year with occasional persistent pools where springs occur along watercourses. After heavy

rains, rivers often flood over the low sloping topography of the floodplain causing water to move as sheetflow rather than in channelised flows. The Harding River Dam (south of Karratha) has a catchment size of approximately 1071 km^2 with the river recorded to have one of the highest runoff rates for the region (Ruprecht, 1996).

There are no permanent watercourses or wetlands within the study area. There are a number of ephemeral creeklines within the study area which are small and would only flow after major rainfall events. The northern section of the study area is situated close to the coastline and consists of mangroves and tidal inlets.

2.2.4 Water Catchment Areas

Drinking water is supplied to Karratha, Dampier, Roebourne and Wickham from the Harding Dam Water Catchment Area, which combines (or alternates) supply from the Millstream aquifer and the Harding Dam. The Harding Dam is located ca. 27 kilometres south of Roebourne. The catchment management area for the Harding Dam does not encompass the survey area.

The Roebourne Water Reserve is a gazetted Public Drinking Water Source Area (PDWSA). This reserve is controlled under the *Country Areas Water Supply Act, 1947.*

2.2.5 Groundwater

There is significant surface water to groundwater interaction in the Pilbara Region. Along creeks and rivers in the Pilbara where riverine vegetation has established, it is likely that these are supported by groundwater in the river alluvium. These alluvium are predominantly recharged by surface runoff in the river channels; however, some recharge may also originate from subsurface seepage.

The study area is situated in the Roebourne Plains. In the Hamersley Basin, large amounts of groundwater are used for mining related purposes, principally from calcrete and pisolite valley fill aquifers, and from solution cavities in the Wittenoom Dolomite (Department of Fisheries, 2008).

2.3 Reserves and Conservation Areas

No reserves or conservation areas occur within the vicinity of the study area.

2.4 Environmentally Sensitive Areas (ESA)

The DEC's online Native Vegetation Viewer provides information on the location of ESAs, as declared by a Notice under section 51B of the *Environmental Protection Act 1986.* These databases also indicate areas where low impact mineral and petroleum activities are permitted as defined under Schedule 1 of the Environmental Protection (Clearing of Native Vegetation) Regulations 2004.

The DEC's online Native Vegetation Viewer was searched to determine the location of

any ESA's or Schedule 1 areas within the vicinity of the study area. There were no ESAs in the study area. The survey area intersects two Schedule 1 Areas. The areas are; a 2 km band that follows the coast line, and areas located at the intersection of the North West Coastal Highway and the Cape Lambert railway. A significant portion of the northern section of the study area falls into the Schedule 1 areas identified above.

2.5 Vegetation

2.5.1 Vegetation Description

In 2001-2 the (then) Department of Conservation and Land Management (CALM) undertook an extensive audit of the State's terrestrial biodiversity. Detailed information for the State's biogeographic subregions was collated at this time, including information on the vegetation within each survey area. The study area occurs within the Pilbara 1 – Chichester Sub-region. The environment of this sub-region is described in the Biodiversity Audit of Western Australia's 53 Biogeographical Subregions (Kendrick, 2001) and the vegetation types described for the study area are described as:

*"*Undulating Archaean granite and basalt plains include significant areas of basaltic ranges. Plains support a shrub steppe characterised *by Acacia inaequalitera* over *Triodia wiseana* hummock grasslands while *Eucalyptus leucophloia* tree steppes occur on ranges.*"*

Vegetation mapping by Beard (1975) of the Pilbara region at a scale of 1: 1,000,000 places the survey area in the Fortescue Botanical District. According to Beard (1975), the vegetation of the survey area and its surrounds are characterised as:

Grass Steppe

- *Triodia wiseana* with other hummock grasses, incomplete canopy with a projected foliage cover (PFC) of 10-30% on hills and heterogeneous (mixed and other) bunch grasses, mid-dense canopy with a PFC of 30-70% in valleys.

2.5.2 Vegetation Extent and Status

A vegetation type is considered underrepresented if there is less than 30 percent of its original distribution remaining. From a purely biodiversity perspective, and not taking into account any other land degradation issues, there are several key criteria now being applied to vegetation in States where clearing is still occurring (EPA, 2000).

- The "threshold level" below which species loss appears to accelerate exponentially at an ecosystem level is regarded as being at 30% of the pre-European / pre-1750 extent for the vegetation type;
- A level of 10% of the original extent is regarded as being a level representing *Endangered*; and

- Clearing which would put the threat level into the class below should be avoided.

Such status can be delineated into five (5) classes, where:

- *Presumed Extinct*: Probably no longer present in the bioregion
- *Endangered**: <10% of pre-European extent remains
- *Vulnerable**: 10-30% of pre-European extent exists
- *Depleted**: >30% and up to 50% of pre-European extent exists
- *Least Concern*: >50% pre-European extent exists and subject to little or no degradation over a majority of this area.

* or a combination of depletion, loss of quality, current threats and rarity gives a comparable status.

The native vegetation type represented in the study area, its regional extent and reservation status are drawn from Shepherd, *et al*. (2002), and Shepherd (2005). (Refer to **Table 2)**.

Table 2 Vegetation extent and status of the Cape Lambert study area (after Shepherd, *et al.*, 2002; Shepherd, 2005).

Vegetation Association	Vegetation Description	Pre-European Extent (ha)	Current Extent (ha)	% Remaining	% in IUCN Class I-IV Reserves	% Other Reserves
157	Hummock grasslands, grass steppe; hard spinifex *Triodia wiseana*	542,861	542,861	100	17.6	0.0

The vegetation type within the survey area and surrounds is considered to remain at 100 percent of its pre-European extent. This vegetation association is not considered to be at threat, and is of *Least Concern*.

2.5.3 Threatened Ecological Communities (TECs)

Ecological communities are defined as 'naturally occurring biological assemblages that occur in a particular type of habitat' (English and Blythe, 1997). TECs are ecological communities that have been assessed and assigned to one of four categories related to the status of the threat to the community, i.e. Presumed Totally Destroyed, Critically Endangered, Endangered, and Vulnerable.

Some TECs are protected under the *EPBC Act*. Although TECs are not formally protected under the State *Wildlife Conservation Act 1950,* the loss of, or disturbance to, some TECs triggers the *EPBC Act*. The Environmental Protection Authority's (EPA's)

position on TECs states that proposals that result in the direct loss of TECs are likely to require formal assessment.

2.5.4 Priority Ecological Communities

Possible TECs that do not meet survey criteria are added to the DEC's Priority Ecological Community (PEC) Lists under Priorities 1, 2 and 3 (DEC, 2008) These are ecological communities that are adequately known; are rare but not threatened, or meet criteria for Near Threatened. PECs that have been recently removed from the threatened list are placed in Priority 4. These ecological communities require regular monitoring. Conservation Dependent ecological communities are placed in Priority 5.

The DEC's TEC database was queried for known occurrences of TECs near the study area. There are no recorded occurrences of TECs within the study area.

Consultation with the DEC (Stephen Van Leeuwin, *pers. com.*, 10 September 2008) identified a portion of the study area that is potentially a PEC. The portion of the site is the section of the study area at the intersection of the Cape Lambert Railway and the Great Northern Highway.

The potential PECs are *Sorghum* grass on Gilgai, Cracking Clay community and Roebourne Plains coastal grasslands. The presence of the Cracking Clay has implications from both an environmental perspective as well as for the project in general with the cracking clay soils being unstable and forming deep gilgai (deep boggy holes) often up to 1 m wide.

2.6 Flora

2.6.1 Significant Flora

Commonwealth

Species of significant flora are protected under both State and Commonwealth Acts. Any activities that are deemed likely to have a significant impact on species that are recognised by the *EPBC Act* and the *Wildlife Conservation Act 1950* can trigger referral to the DEWHA and/or the EPA.

A description of Conservation Categories delineated under the *EPBC Act* is detailed in **Table 5**, **Appendix C**. These are applicable to threatened flora and fauna species.

A search of the *EPBC Act* Protected Matters Search Tool identified no Commonwealth protected flora species within 10 km of the study area.

State

In addition to the *EPBC Act,* significant flora in Western Australia is protected by the *Wildlife Conservation Act 1950*. This *Act*, which is administered by the DEC, protects Declared Rare Flora (DRF) species. The DEC also maintains a list of Priority listed

flora species. Conservation codes for flora species are assigned by the DEC to define the level of conservation significance. Priority Flora are not currently protected under the *Wildlife Conservation Act 1950*. Priority Flora may be rare or threatened, but cannot be considered for declaration as rare flora until adequate surveys have been undertaken of known sites and the degree of threat to these populations clarified. Special consideration is often given to sites that contain Priority Flora, despite them not having formal legislatory protection. A description of the DEC's Conservation Codes that relate to flora species is provided in **Table 6 Appendix C**.

Table 6A search of the DEC's Rare Flora Database and records of the Western Australian Herbarium (WAHERB) was performed. Records identified no DRF and four Priority Flora species to occur within 10 km of the Cape Lambert study area. Species recorded by the DEC and WAHERB are outlined in **Table 3**.

Table 3 Significant flora present within a 10 km radius of the Cape Lambert study area

Species	Conservation Code	Description	Data Source
Acacia glaucocaesia	Priority 3	Dense, glabrous shrub or tree, 1.8–6 m high. Flowers. yellow, flowering time July to September. Known to occur on red loam, sandy loam, clay, in floodplains.	DEC, WAHERB
Goodenia pascua	Priority 3	Ascending to erect herb, to 0.5 m high. Flowers. yellow, flowering time May to August. Known to occur on red sandy soils on basaltic plains.	DEC
Helichrysum oligochaetum	Priority 1	Erect annual, herb, to ca 0.25 m high. Flowers. yellow, flowering time August to November. Known to occur on red clay on alluvial plains	WAHERB
Abutilon trudgenii[1]	(Priority 3)	Is a low herb approximately 0.6m tall. It has a tendency to occur in recently burnt areas.	WAHERB

1: This species was identified in the WAHERB data search but no longer has a Priority status.

2.6.2 Weeds

The Pilbara Region has a number of noxious weeds that have invaded rangelands and watercourse areas. Major weed species present in the region include Buffel grass (**Cenchrus ciliaris*), Ruby Dock (**Acetosa vesicaria*), Kapok Bush (**Aerva javanica*) and Weeds of National Significance (WONS): Mimosa Bush (**Vachellia farnesiana*), Mesquite (**Prosopis* spp.) and Parkinsonia (**Parkinsonia aculeata*). Weed spread in the Region is also maximised by cyclonic events and flooding, which can carry seeds beyond their current range.

Weed species compete with native grass species and reduce available food sources for both native animals and grazing stock. Large, dense stands of these species shade groundcover and grasses and cause productivity of native grasses to decrease or cease. Woody weed species are commonly covered in spines that injure wildlife and stock and excess consumption of seedpods can be poisonous.

2.7 Fauna

2.7.1 Fauna Species

The Western Australian Museum (WAM) *FaunaBase* online search was conducted for a 20 km buffer of the study area (an expanded search area was required as there are no official records close to the study area). The search identifies terrestrial vertebrate species recorded in the collections of the WAM. The search identified the presence of 10 mammal, 24 bird and 31 reptile species and 2 amphibian species recorded.

A full list of species recorded from the WAM *FaunaBase* is presented in **Table 14**, **Appendix C**.

It should be noted that some of the records of the Museum are historical and some of the recorded species may now be locally extinct. Additionally these records may include species (particularly bird species) that are vagrants or present in the general area but not present within the study area due to lack of suitable habitat.

2.7.2 Significant Fauna Species

The conservation of fauna species is currently assessed under the *Western Australian Wildlife Conservation Act* 1950; *Wildlife Conservation (Specially Protected Fauna) Notice 2003,* and the *EPBC Act 1999*.

The significance levels for fauna used in the *EPBC Act* are those recommended by the International Union for the Conservation of Nature and Natural Resources (IUCN). A description of Conservation Categories delineated under the *EPBC Act* is detailed in

Table 5, **Appendix C** and the circumstances under which a project will trigger referral to the DEWHA are described in **Appendix D**. The *WA Wildlife Conservation Act 1950* uses a set of Schedules but also classifies species using some of the IUCN categories. These Schedules are described in **Table 12**, **Appendix D**. The *EPBC Act* also protects migratory species under various International Agreements:

- Listed migratory species also include species identified in other international agreements approved by the Commonwealth Environment Minister; and
- The *EPBC Act* also protects marine species on Commonwealth lands and waters.

In Western Australia, the DEC also produces a supplementary list of Priority Fauna, these being species that are not considered Threatened under the Western Australian *Wildlife Conservation Act 1950* but for which the Department feels there is a cause for concern. These species have no special legislative protection, but their presence would normally be assessed. Such taxa need further survey and evaluation of conservation status before consideration can be given to declaration as threatened fauna. Levels of Priority are described in **Table 13**, **Appendix D**.

The DEWHA maintains a database of matters of national environmental significance

that are protected under the *EPBC Act.* An *EPBC Act* Protected Matters Report was generated (from the website of the DEWHA), for the matters of significance that may occur in, or may relate to, the study area.

A search of the DEC's Threatened Fauna database for any rare and priority species that may occur in the study area was undertaken.

From the DEC and DEWHA databases and the records of the Western Australian Museum (WAM), a number of threatened fauna species were identified as potentially occurring within the study area. These records are included in **Table 14**, **Appendix D**.

It should be noted that some species that appear in the *EPBC Act* Protected Matters Search Tool are often not likely to occur within the specified area, as the search provides an approximate guidance to matters of national significance that require further investigation. The records from the DEC searches of threatened fauna provide more accurate information for the general area; however some records of sightings or trappings can be dated and often misrepresent the current range of threatened species.

3. Field Assessment

3.1 Field Survey Methods

3.1.1 Vegetation and Flora

The flora assessment included desktop investigations and field surveys, conducted with regard to the EPA's Guidance Statement No. 51, where possible. GHD's qualified ecologists conducted the field flora survey between the 7th to 11th July 2008 and 4th to 8th of August 2008.

The flora and vegetation survey was conducted by undertaking walking transects across the study area and establishing 50 m x 50 m quadrats in representative vegetation communities over the Cape Lambert study area. Quadrat data provided information on substrate, condition, foliage coverage, species present and the dominant species in each vegetation type. Quadrat data is presented in Table 8 and **Table 9**, **Appendix B**. The walking transects included recording of flora species, mapping of vegetation types and condition class (including weed status). In addition, areas identified as potential habitat for significant flora taxa were surveyed thoroughly.

A list of flora species collated from the quadrats and walking transects was generated for the study area Table 7 **Appendix B** . Where identification of flora species was uncertain, confirmation was made at the Western Australian State Herbarium. Vegetation was also compared to DEC list to determine the presence of TECs within the study area. Aerial photography was used to assist in the delineation of vegetation types present in the study area.

3.1.2 Fauna

GHD's qualified ecologists conducted the fauna investigation in conjunction with the flora investigation. The fauna survey included desktop investigations and field surveys, where possible, in line with to the EPA's Guidance Statement No. 56, where possible.

The fauna survey was an opportunistic survey and did not involve any fauna trapping. The survey involved visual and aural surveys for any fauna species utilising the study area. The study area was also searched for any fauna signs, such as tracks, scats, bones, diggings and feeding signs.

Surveys also included systematic searching across all habitat types., This involved searching through microhabitats where reptiles are known to frequent, including turning over logs or rocks, turning over leaf litter and examining hollow logs. Reptiles were also sighted as they basked during the day.

Species – specific search strategies were used to identify any protected species in the area or evidence that they utilise the study area.

3.1.3 Nomenclature

Nomenclature used in this report follows that used by the DEC's *FloraBase* program and Western Australian Museum *FaunaBase* program as they are deemed to contain the most up-to-date species information for Western Australia.

3.1.4 Limitations

Complete flora and fauna surveys can require multiple surveys, at different times of year, and over a period of a number of years, to enable observation of all species present.

Some flora species, such as annuals, are only available for collection at certain times of the year, and others are only identifiable at certain times (such as when they are flowering). Additionally, climatic and stochastic events (such as fire) may affect the presence of plant species. Species that have a very low abundance in the area are more difficult to locate, due to above factors. Therefore, while this flora survey was relatively exhaustive, and was conducted at a time of year when the majority of the flora species would be able to be identified, there is the possibility that some species with low abundance in the area have been overlooked.

The flora surveys were also restricted to predominantly flowering plants, with consideration of some other vascular plants such as cycads. Non-vascular plants were not systematically searched for, as the information available on these plants is generally limited.

The fauna survey undertaken was a reconnaissance survey only and thus only sampled those species that can be easily seen, heard or have distinctive signs, such as tracks, scats, diggings etc. Many cryptic and nocturnal species would not have been identified during a reconnaissance survey. Extensive detailed fauna surveys, involving trapping surveys, are required to obtain a more comprehensive list of fauna species that may utilise the site.

This survey was aimed at identifying the terrestrial vertebrate fauna of the study area; no sampling for invertebrates or aquatic species was undertaken.

3.2 Vegetation and Flora

3.2.1 Vegetation Description

The vegetation of the Cape Lambert study area was classified into eight vegetation types based on the standardised broad categories for vegetation mapping developed by Rio Tinto. Generally there is very little variation in the vegetation across the study area. Creeklines are ephemeral and with the exception of the distribution of *Acacia colei* and *Corymbia hamersleyana* and some minor herbaceous species, the vegetation is very similar to that found elsewhere on the flatter areas, The exposed hills support species that are not present on the low-lying areas such as rock fig and some minor

herbaceous species.,.

These vegetation types have been mapped at **Figure 3** (**Appendix A**) and are summarised below:

- **Hummock Grasslands (HG 2):** This is the main vegetation type across the study area and is reasonably uniform in species composition across the entire site. Variations in species composition within this vegetation type are due primarily to disturbances such as clearing, grazing and fire frequency. This vegetation type is represented by *Triodia pungens* with emergent and very scattered shrub species typically being *Acacia bivenosa, Acacia inaequilatera, Acacia pyrifolia, Acacia stellaticepts,* Grevillea *wickhamii*, *Grevillea pyramidalis* and *Hakea lorea* subsp. *lorea*. The scattered shrubs usually occur in discreet single species locations over *Triodia pungens* with mixed herbs and grasses.

  Occurrence on site – This is the main vegetation type across the site.

- **Rockpiles (HG 1):** Typically the vegetation on the rock piles is sparse and generally appears to be less impacted by disturbances. Typically the slopes leading up from the valley floors are *Triodia pungens* and/or *Triodia epactia*. Drainage lines and swales within the rock piles are generally weed infested with **Cenchrus ciliaris*, **Aerva javanica* as well as native disturbance opportunists such as *Cleome viscoa, Trachymene oleracea* and *Trichodesma zeylanicum*. Tops of the rock piles have herbaceous species and single individual trees such as *Ficus brachypoda, Terminalia canescens and Ehretia saligna*.

  Occurrence on site - The Rockpiles in the study area generally run on a north easterly direction along the eastern side of the site.

- **Minor Flow Lines (LW1, HG, S):** The minor flow lines are ephemeral. The banks of the flow lines are clearly delineated. With the exception of some herbaceous species such *Indigofera linifolia, Triumfetta clementii, Waltheria indica, Hybanthus aurantiacus* and **Cenchrus ciliaris,* there is generally little vegetation in the actual creek beds. The banks of the minor flow lines are vegetated by *Corymbia hamersleyana, Acacia colei, Gossypium robinsonii* over *Triodia pungens, Rhynchosia minima* and mixed herbs and grasses.

  Occurrence on site – There are five Acacia-Type Flow Lines within the study area that generally flow in a northerly direction towards the coast.

- **Tussock Grasslands (TG):** This vegetation type is found in the southern section of the site on the Roebourne Plains. The grasses are generally mixed and include: **Cenchrus ciliaris, Eragrostis xerophyllum* and *Aristida contorta* with occasional shrubs and mixed herbs.

  Occurrence on site – Tussock grasslands occur on the southern section of the site on the Roebourne Plains in the region of North West Coastal Highway. On the northern side of the highway there are obvious gilgai (deep holes) in the substrate.

- **Major Flow line/Tidal Inlets (LW2, H, TG):** A single major flow line is located in the northern section of the site. The flow line has broad sandy base and is lined with *Avicennia marina* over *Frankenia ambita* and *Tecticornia indica* subsp. *leiostachya.*

  Occurrence on site – The major flowlines/tidal flats occur in the northern section of the site. These flow lines are regularly inundated by tidal flows but are also seasonal flow lines capturing runoff from elsewhere in the catchment. Raised road and railway culverts prevent the movement of water from the tidal flats on the western side of the railway to the east.

- **Samphires and Halophytes (H, TG):** Samphires and halophytes occur primarily in degraded land and are associated on the site with **Cenchrus ciliaris* and other mixed herbs. Samphires present include *Tecticornia indica* subsp *leiostachya* and *Frankenia ambita.*

  Occurrence on site- The samphire flats occur in the low lying region in the northern section of the site on the western side of the railway line.

- **Mangroves (LW 2, H):** The coastal region of the site is comprised of tidal flats dominated by *Avicennia marina.* White beach sands on the landward side of the Mangroves support a few dominant herbaceous species including: *Spinifex longifolius, Canavalia rosea* and *Ipomoea costata.*

  Occurrence on site – Mangroves occur along the coast in the northern portion of the site.

- **Heavily Disturbed (HD):** Predominantly cleared but some disturbance opportunists such as *Sesbania cannabina* (a weedy native), grasses, including **Cenchrus ciliaris*, and chenopods such as *Salsola tragus.* There is one heavily disturbed area associated with disused stock yards that is dominated by Mulga.

  Occurrence on site - Sections of the site that have previously been cleared, including tracks, laydown areas and flats adjacent to the northern quarry site.

Photographs of each of the vegetation type are shown in **Table 9** and **Table 10, Appendix B** as well as vegetation information collated from quadrat data.

3.2.2 Vegetation Condition

The vegetation condition of the site was rated using the vegetation condition rating scale developed by Keighery (1994) that recognises the intactness of vegetation, which is defined by the following:

- Completeness of structural levels;
- Extent of weed invasion;
- Historical disturbance from tracks and other clearing or dumping; and

- The potential for natural or assisted regeneration.

The scale therefore consists of six (6) rating levels from pristine or nearly so to completely degraded. The Vegetation Condition Rating Scale is outlined in **Table** 4**, Appendix B**

The vegetation condition within the Cape Lambert study area ranged considerably, from *Completely Degraded* to *Excellent*. The existing quarry areas, workshops, tracks, laydowns and other associated areas were predominantly cleared and were considered to be *Degraded* to *Completely Degraded*.

There is some native vegetation still present adjacent to the disturbed areas; however, this vegetation has been disturbed and contains cleared areas, soil degradation and weed invasion. The areas close to Wickham townsite and road verges were generally rated as *Degraded* to *Very Good*. In some isolated areas there is evidence of significant disturbances including previous earthworks, artificial piles of dirt and areas of rubbish dumping.

The entire survey area has been frequently burnt and it is difficult to assess the intactness of the vegetation in many areas due to the presence of only new growth. Other areas, particularly in the western leg, which hasn't been recently burnt, consist of hummock grasslands with very little variation in the vegetation structure. Within this vegetation type it is difficult to assign a bushland condition rating as the structural intactness cannot be used as an assessment criterion.

There is evidence of multiple and long term disturbances across the entire site. There are multiple informal access tracks that are frequently used by locals to access the coast, dilapidated fencing which is evidence of past grazing, stock yards, vegetation clearing (both formal and apparently informal), powerlines, gas pipeline, railway lines, access roads, rubbish dumping, frequent fire events and weed encroachment.

Vegetation condition has been mapped in **Figure 4**, **Appendix A**.

3.2.3 Threatened Ecological Communities (TECs)

No TECs were recorded during the field survey.

Advice from the DEC (Stephen Van Leeuwin, *pers com,* 10 September 2008) is that the southern section of the site near North West Coastal Highway (Figure 3, Appendix A) is a PEC and potentially a TEC. Site assessment by the DEC will be required to confirm this.

3.2.4 Flora Species

Vegetation within the study area is considered to represent a medium degree of species diversity. A total of 158 taxa from 34 families were recorded from the study area. This list includes subspecies (subsp.), variations (var.), affinities (aff.) and hybrids (x). Five collections could only be tentatively identified to species level due to

lack of flowering parts or fruiting bodies.

Dominant families recorded included:

- Poaceae (grasses): 26 taxa
- Papilionaceae (peas): 15 taxa
- Mimosaceae (wattles): 14 taxa
- Amaranthaceae (mulla-mullas): 13 taxa
- Malvaceae (mallows) 12 taxa
- Chenopodiaceae (samphires) 6 taxa

Dominant genera recorded from the study area included:

- *Acacia* 16 taxa
- *Ptilotus* 7 taxa
- *Eriachne* 6 taxa
- *Eragrostis* *6 taxa*

A full list of flora species present in the study area is provided in Table 7, **Appendix D**.

This survey provides a description of the flora present in the site at the time of survey, and therefore the species inventory is influenced by factors such as climate (season) and the subsequent presence/absence of ephemeral species and the variety of habitats surveyed. The 2008 botanical season was highly variable and generally poor for the Pilbara Region due to lack of summer rainfall (Van Leeuwen, *pers. comm.,* 10 September 2008), which means that ephemeral and annual species may have been underrepresented in this survey.

3.2.5 Significant Flora Species

No DRF or Priority Flora species were recorded from the study area during this survey.

3.2.6 Introduced Species

Two introduced species were recorded during the survey within the study area. The introduced species present in these areas included those that are naturalised and widespread in the Pilbara region, including Buffel Grass (**Cenchrus ciliaris*) and Kapok (**Aerva javanica*).

Despite the low number of weed species recorded, the impact of the weeds recorded across the site is considerable with areas particularly in the northern and eastern portion of the site being virtual monocultures of **Cenchrus ciliaris*. This weed is so

widespread across the site that there were no areas including hill tops, saline areas and creeklines that did not have this species present.

There are several native disturbance response species such as *Sesbania cannabina*, *Salsola tragus* and *Cleome viscosa* that are common across the site. This provides further indication of the impact of continuous disturbances not just in the immediate vicinity of human activity roads and infrastructure but also within the creeklines and floodplains, tidal flats and hilltops.

3.3 Fauna

3.3.1 Fauna Species

A total of 23 bird species, 2 mammal species, and 3 reptile species were recorded during the reconnaissance survey within the Cape Lambert study area (**Table 15**, **Appendix D**). Two listed migratory birds were identified from the study area, the White-bellied Sea-Eagle and Rainbow Bee-eater. The White-bellied Sea-Eagle was identified nesting on a high voltage power pole in a highly disturbed area in the north eastern corner of the study area.

This survey only provides a brief snapshot of those species present at the time of sampling (daytime), in one season, in one year.

3.3.2 Significant Fauna Species

The desktop surveys indicated that a number of protected fauna may occur within the study area. The habitat requirements of these species and the likelihood of their occurrence in the site (with information from the field surveys) are considered below.

Northern Quoll (*Dasyurus hallucatus*) Schedule 1 Endangered

This species of quoll once occurred across the majority of northern Australia but its range has contracted seriously. It still occurs in the Pilbara region but in disjunct populations, predominantly in the larger conservation reserves. The Northern Quoll inhabits a range of vegetation types but is especially abundant in rocky eucalypt woodland within 200 km of the coast.

Habitat Assessment This species occurs in scattered populations in the Pilbara and it would be unlikely to occur in the study area.

Banded Hare Wallaby, Mernine (*Lagostrophus fasciatus fasciatus*) Schedule 1 Vulnerable

This small macropod occurs in low shrubland. There are known populations on offshore islands where they are protected from feral cats and foxes.

Habitat Assessment They form runs in dense shrub. No dense shrub was present on the site. The entire Cape Lambert Study areas has been impacted by multiple long-term disturbances including clearing, grazing and repeated burning resulting in no

dense shrub or suitable habitat for the Banded Hare Wallaby.

Australian Bustard (*Ardeotis australis*) Priority 4

The Australian Bustard occurs across much of Australia, including across most of Western Australian, excepting heavily wooded areas in the south. The Australian Bustard occurs mainly in open country, such as low heath or lightly wooded grassland.

Habitat Assessment The Australian Bustard has a scattered distribution in the Pilbara area and there is the potential for it to occur within the study area; however, the site does not contain significant habitat for this species.

Western Pebble-mouse - Ngadji (*Pseudomys chapmani*) Priority 4

The Western Pebble-mound Mouse is confined to central and eastern Pilbara. This species is found on stony hillsides with hummock grassland, where it shelters in complex burrow systems below collected mounds of pebbles.

Habitat Assessment This species may occur within the general area but is unlikely to utilise the study area as appropriate habitat is limited and much of the site is disturbed. In addition no Western Pebble-mouse mounds were recorded during the survey.

Migratory Species

A number of the species included in the list of significant fauna species that could potentially occur in the study area were migratory terrestrial, marine and wetland species. There is the potential for terrestrial, marine and wetland migratory bird species to occur occasionally within the study area. Tidal inlets and the mangroves in the northern section of the site are possibly the most significant habitats for migratory species.

3.3.3 Introduced Species

There is evidence of a long history of livestock grazing on the southern portion of the site to the south of North West Coastal Highway. This area remains fenced and although no cattle were observed during the field survey, there was evidence it has recently been grazed.

3.3.4 Fauna Habitat

Habitat Types

The site assessment of the fauna covered a number of different fauna habitats, including:

- Shrubland over hummock (Spinifex) grassland on rocky hills and slopes;
- Shrubland over mixed grassland on plains;
- Minor rocky drainage lines with denser vegetation;

- Tidal inlets;
- Rock crevices on the “rock pile” hills;
- Artificial cliff faces in the quarry.

Frequent fire events across the entire site have resulted in very much reduced litter and logs that provide habitat for ground dwelling taxa. Additionally, the lack of large trees and nesting hollows would also reduce habitat values in the general area. Mature trees were only noted in the mangrove areas along the coast and lining the drainage line close to the coast. A few isolated fig trees were noted on the hill tops.

The above mentioned habitat types include some habitats that support specific taxa such as the cliff face of the quarry in the northern area where a Nankeen Kestrel (*Falco cenchroides*) was observed nesting. A White-bellied Sea-Eagle (*Haliaeetus leucogaster*) was noted nesting on the top of the high voltage power poles in the northern portion of the site. Zebra finches (*Taeniopygia guttata*) were common in the more shrubby sites particularly along the watercourses and they were also observed in scattered emergent shrubs in the more open ground across the site. The rock crevices on the “rock piles” were observed to be the preferred nesting site for Painted Finches (*Emblema pictum*). The Red Kangaroo (*Macropus rufus*) and Common Wallaroo (*Macropus robustus*) (including scats) were only observed on the rock piles.

No natural permanent or semi-permanent fresh water points were located within the study area. Tidal inlets in the northern section of the study area provide protected habitat and feeding grounds for wading birds. One species of wading bird, the Red Capped Plover (*Charadrius ruficapillus*), was identified using the tidal inlet during the field survey. Tracks of a large monitor (*Varanus* sp.) were noted in the sandy banks of the mangroves.

Habitat Value

The existing infrastructure and activities within the Cape Lambert study area has reduced the habitat value of the study area. There are numerous roads and tracks that dissect the study area. Additionally, there is a section of the Cape Lambert railway, the Dampier Natural Gas pipeline, high voltage powerlines, an existing quarry and relic stock yards present within the site. Other impacts include grazing by livestock which results in the preferential browsing of particular plant species (particularly grasses), and the disturbance of the soil surface. Frequent fire events have also impacted on the habitat values of the site particularly on the emergent shrub layer on the Spinifex plains. The vegetation types present at the site are the dominant vegetation types within the surrounding area, and the surrounding area is generally in as good if not better condition than that within the study area. No habitats were recorded that are considered to be specific to the study area or a significant habitat type.

Habitat Linkages

Habitat linkages are important to allow animals to move between areas of resource

availability. Habitat linkage is important for ground and aerial fauna, providing cover, resources, and linking areas suitable for rest and reproduction.

Fragmentation of habitat limits the resources available to species, particularly sedentary species, which means they may be more vulnerable to natural disasters or habitat changes over time. Fragmentation of habitat can also lead to edge effects, leading to degradation of the habitat. Where the distance between habitat fragments is small, species may still be able to move between these habitat areas, but may be more exposed to predation pressures in the cleared areas.

Clearing within the study area is not considered likely to cause any significant breaks to habitat linkages, as it is completely surrounded by relatively unaltered vegetation in as good or better condition than that present at the site.

4. Assessment of Flora and Fauna Impacts

4.1 Potential Flora and Fauna Impacts

The main impacts on flora and fauna are:

- *Vegetation Clearing:* Most of the study area has been impacted in the past, either by low level disturbance factors such as grazing, rubbish dumping and repeated fire events, or by major disturbances, such as clearing for infrastructure including, roads railway, gas pipeline and powerlines. With the exception of localised disturbances associated with tracks and roads and a ballast quarry the vegetation condition was rated as condition 4 (*Good*) or above.
- *Soil degradation and erosion*: Native vegetation serves an important role in the stabilisation of soil within the landscape. Removal of vegetation can cause land degradation, including erosion. With the exception of a proposed extension of the existing quarry in the middle northern portion of the Cape Lambert Study area, the main purpose of the vegetation clearing is for the construction of an additional rail loop, rail workshop and marshalling yards. A key consideration for the construction of the rail loop is to keep it within the wide valley floors avoiding the less stable hills which are currently in better condition than the lower lying areas. Soil erosion may become an issue in the sandy regions at the base of the hills. Additionally, gilgai (deep boggy holes) have been identified in the southern section of the site in proximity to the North West Coastal Highway. These gilgai are indicative of cracking clays with an unstable base. Vegetation clearing on the cracking clays may exacerbate gilgai formation resulting in an unstable land base for infrastructure development.
- *Weed introduction and invasion*: An assessment of the weed status indicated that the native vegetation contains a few weedy species, and a number that are particularly widespread including Buffel Grass and Kapok. Given that there has been a long history of disturbance at the site, including clearing, grazing and frequent fire events, weeds that are present, in particular Buffel Grass, have been spread throughout most of the site (including the rocky hills). However, there is a potential for new weed species to be introduced through the introduction of soil or other material that may contain weed propagules.
- *Hydrological Changes:* Changes to natural drainage from clearing or other activities may impact on both vegetation structure and fauna habitat in adjoining areas. However, as the site is relatively flat and contains few drainage areas, impact from this factor is likely to be low.
- *Habitat loss and damage*: The habitat value of the majority of the site is low; and as the area required for clearing is small relative to the habitat areas surrounding the study area, the impacts on fauna species are expected to be minimal.

- *Death or harm to fauna species*: Any construction works have the potential to cause death or harm to fauna species. Vegetation clearing and vehicle movements are likely to result in an increased incidence of animal death or injury. Slower moving land animals (including mammals, reptiles and amphibians) are most at risk, as they are often unable to vacate disturbed areas of vegetation quickly enough to avoid harm.

4.2 Management of Issues

Impacts on flora and fauna can be minimised and managed by a number of measures:

- For any clearing occurring on site, the clearing line should be clearly defined in order to prevent impact on native vegetation that is not to be cleared.
- Avoid clearing or impacting areas with good quality vegetation (where possible use already cleared or degraded areas in preference to the better quality vegetation remnants on the outside edge of the study area).
- Implement management measures to ensure clearing does not cause appreciable land degradation, including preventing erosion from the cleared areas.
- Implement management measures to minimise the introduction and spread of weeds, such as avoiding movement of soils containing weedy species.
- Implement measures to prevent impacts on adjacent flora and fauna from pollution, such as litter and accidental hydrocarbon spills.
- Implement measures to reduce the risk of fire starting from activities at site.

Management measures should be implemented for the life of the project, and where required be continued after completion of the construction of the 320 Mt railway duplication, associated workshops and marshalling yard in the Cape Lambert area.

5. Conclusions

The study area comprises a total land area of 1793 hectares which is generally linear and curved in shape. The study area is comprised of five separate areas (some of which are overlapping). With the exception of a portion of the site adjacent to an existing quarry that includes a rockpile hill, most of the study area is contained within the broad low lying Roebourne plains. The study area for the most part is covered with native vegetation, the exception being the northern section of the site where the railway traverses in a north-south orientation.

5.1 Protected Matters

A desktop assessment of the environmental constraints of the study area identified no TECs or PECs located within the study area however consultation with the DEC (Stephen Van Leeuwin, *pers. comm.,* 10 September 2008) suggested a portion of the site in the region of the North West Coastal Highway may potentially is a PEC and may potentially be a TEC. The identification of the potential TEC on the site requires additional survey. The DEC (Stephen Van Leeuwin, *pers.comm* 27 October 2008) considers the 2008 wet season to be too dry for the Cape Lambert region to be adequately surveyed for the range of species required to identify the presence of a TEC (Roebourne Plains Grasslands) within the study area boundary. .

A significant portion of the study area falls within the Schedule 1 area represented by a 2 km buffer of the coastline. Additionally the study area intersects a Schedule 1 area on the eastern side of the Cape Lambert Railway in the vicinity of North West Coastal Highway.

5.2 Vegetation and Flora

5.2.1 Vegetation units

The vegetation unit mapped by Beard (1975) for the entire study area is identified as: Hummock grasslands; grass steppe; hard spinifex *Triodia wiseana.*

Clearing of native vegetation for this project will have a minor impact on the pre European vegetation extent for the mapped vegetation unit that covers the site as such the project will not change the status of the vegetation extent from >50% remaining which is considered to be of least concern.

Site assessment of the vegetation units allows for a more detailed analysis of the vegetation units present within the study area. Vegetation units were mapped following ground truthing of the study area. Eight vegetation types were identified that broadly fall into the Beard Mapped vegetation unit.

For the most part, the vegetation identified within the study area is hummock grassland (**HG2** on **Figure 3**) intersected by flowlines, some of which are dominated by *Acacia colei* (**LW1, Hg, S** on **Figure 3).** The hills (**HG1** on **Figure 3**) within the hummock grasslands are a minor component of the study area. The flat plains in the southern section of the site supported tussock grasslands (**TG** on **Figure 3**) which occur on clay plains with gilgai (deep boggy holes).

The northern section of the site is has many disturbed areas. Vegetation types in this area are largely influenced by the tide and the confluence of a number of flowlines (**LW2, H, TG** on **Figure 3**). Low lying areas which become seasonally inundated with brackish water as a result of the mixing of sea water and inland runoff, appear to have undergone a change in vegetation type and now support a combination of samphire, halophytes and Buffel Grass (**HTG** on **Figure 3**).

Located along the coastline in the northern section of the study area are tidal flats with mangroves (**LW2, H**on **Figure 3**).

5.2.2 Vegetation Condition

Vegetation condition across the entire site has been impacted by multiple and long term disturbances. While hummock grasslands are a natural vegetation unit in the Pilbara, it is difficult to ascertain whether the vast expanse of this vegetation type within the study area is natural or due to long term frequent disturbances such as frequent fire events that have resulted in a permanent change in the vegetation structure by favouring the faster maturing species such as Spinifex grasses.

The site is traversed by numerous informal tracks that allow access to the coast from nearby towns and communities. This informal access has also resulted in appreciable land degradation in particular rubbish dumping.

5.2.3 Weeds

Weeds are widespread across the entire site, including largely inaccessible areas such as the tops of rockpiles. In the northern section of the site, weeds in places form monocultures particularly as a direct result of ground disturbances and historical grazing.

5.2.4 Flora

A total of 158 taxa from 34 families were identified from the study area. This represents a moderate degree of diversity. No rare or priority taxa were identified from the site. The species composition across the site was reasonably cosmopolitan with few species identified as being restricted to particular vegetation types or locations.

5.3 Fauna

Twenty three birds, two mammals and three reptiles were identified during the field survey. Two EPBC listed migratory species were identified from the site. They are the White-bellied Sea-Eagle and the Rainbow Bee-eater.

6. Report Limitations

This report presents the results of a Flora and Fauna Assessment prepared for the purpose of this commission. The data and advice provided herein relate only to the project and structures described herein and must be reviewed by a competent scientist/botanist before being used for any other purpose. GHD accepts no responsibility for other use of the data.

Where previous reports, flora surveys and similar work have been preformed and recorded by others the data is included and used in the form provided by others. The responsibility for the accuracy of such data remains with the issuing authority, not with GHD.

An understanding of site conditions depends on the integration of many pieces of information, some regional, some site specific, some structure specific and some experience based. Hence, this report should not be altered, amended or abbreviated, issued in part or incomplete in any way without prior checking and approval by GHD. GHD accepts no responsibility for any circumstances that arise from the issue of the report that has been modified in any way as outlined above.

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Appendix A

Figures

Figure 1 Location Map

Figure 2 Environmental Constraints

Figure 3 Vegetation Type

Figure 4 Vegetation Condition

505,000 510,000 515,000

7,715,000 7,710,000 7,705,000

Locality Map

INDIAN OCEAN

DAMPIER
WICKHAM
KARRATHA
ROEBOURNE

Study Area B
Study Area C
Study Area D
Study Area E
Study Area A

LEGEND

- Study Area 'A' - RTIO - 20080711
- Study Area 'C' - RTIO - 20080711
- Study Area 'D' - RTIO - 20080711
- Study Area 'E' - RTIO - 20080711
- Study Area 'B' - RTIO - 20080701
- Railway - Geoscience Australia - 200407

1:50,000 at A3

0 250 500 1,000 1,500 2,000

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 50

N

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Job Number 6122636
Revision 0
Date 27 October 2008

Location of Study Areas

Figure 1

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505,000 510,000 515,000

7,715,000 7,710,000 7,705,000

Study Area B
Study Area C
Study Area D
Study Area E
Study Area A

LEGEND

- Study Area 'B' - RTIO - 20080701
- Study Area 'A' - RTIO - 20080711
- Study Area 'C' - RTIO - 20080711
- Study Area 'D' - RTIO - 20080711
- Study Area 'E' - RTIO - 20080711

Declared Rare & Priority Species - DEC - 20080611

- (R) Declared Rare Flora - Extant Taxa
- Priority 1 - Poorly Known Taxa
- Priority 2 - Poorly Known Taxa
- Priority 3 - Poorly Known Taxa
- Priority 4 - Rare Taxa

Public Drinking Water Source Areas - DoW - 20080618

- Protection Area-P1
- Protection Area-P2
- Protection Area-P3
- Protection Area-NotAssigned

- Aboriginal Heritage Sites - DIA - 200802
- Environmentally Sensitive Areas - DEC - 20050530
- Clearing Regulations - Schedule One Areas - DEC - 20050310
- Railway - Geoscience Australia - 200407

1:50,000 at A3

0 250 500 1,000 1,500 2,000

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 50

N

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Environmental Contraints

Figure 2

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510,000 512,000 514,000

7,716,000 7,714,000 7,712,000

Adjoins Mapsheet 2

Vegetation Code	Vegetation Description
H, TG	Samphires and Halophytes with *Cenchrus ciliaris*
HG, TG	(Typically) Mixed Hummock Grassland and Tussock Grassland
HG1	Hummock Grassland; *Triodia epactia,* herbs (variable) may have scattered shrubs and emergent tree species
HG2	Hummock Grassland; *Triodia pungens (* may have scattered shrubs)
LW1, HG, S	Low Woodland (variable), Shrubland (variable), Hummock Grassland (variable); *Acacia colei* and or *C.hamerslyana, Acacia* species, over Mixed Herbs, Grasses and *Triodia pungens*
LW2, H	*Avicennia marina, Spinifex longifolia, Cajunus cinereus* and *Carnivalea rosea* on beaches
LW2, H, TG	Low Woodland *Avicennia marina,* samphires and halophytes with *Cenchrus ciliaris*
TG	Tussock grassland (variable), herbs (variable) may have scattered shrubs
HD	Heavily Disturbed

LEGEND

Study Area 'A' - RTIO - 20080711
Study Area 'C' - RTIO - 20080711
Study Area 'D' - RTIO - 20080711
Study Area 'E' - RTIO - 20080711
Study Area 'B' - RTIO - 20080701

Vegetation Type - GHD - 20081006
H, TG
HG, TG
HG1
HG2
LW1, HG, S
LW2, H
LW2, H, TG
TG
HD

Railway - Geoscience Australia - 200407

1:20,000 at A3
0 100 200 400 600 800
Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 50

N

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Vegetation Type Mapsheet 1 of 3

Figure 3

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506,000 508,000 510,000

7,714,000 7,712,000 7,710,000

HG2 LW1, HG, S HG1 HG2 LW1, HG, S HG1 HG1 HG2 LW1, HG, S HG2 HG2 HG2 HG1 HG1 HG1 HG2 HG2 HG2

Adjoins Mapsheet 1

Adjoins Mapsheet 3

Vegetation Code	Vegetation Description
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TG	Tussock grassland (variable), herbs (variable) may have scattered shrubs
HD	Heavily Disturbed

LEGEND

- Study Area 'A' - RTIO - 20080711
- Study Area 'C' - RTIO - 20080711
- Study Area 'D' - RTIO - 20080711
- Study Area 'E' - RTIO - 20080711
- Study Area 'B' - RTIO - 20080701

Vegetation Type - GHD - 20081006

- H, TG
- HG, TG
- HG1
- HG2
- LW1, HG, S
- LW2, H
- LW2, H, TG
- TG
- HD

Railway - Geoscience Australia - 200407

1:20,000 at A3

0 100 200 400 600 800

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 50

N

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Vegetation Type
Mapsheet 2 of 3

Job Number 6122636
Revision 0
Date 27 October 2008

Figure 3

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508,000 510,000 512,000

7,708,000 7,706,000 7,704,000

Adjoins Mapsheet 2

HG2
HC, TG
HG2
HG2
LW1, HG, S
HG2
LW1, HG, S
HG1
HG2
TG
HC, TG
TG
HG2
HG2
LW1, HG, S
HG1
HG2
HC, TG
HG2
HC, TG
TG
TG

Vegetation Code	Vegetation Description
H, TG	Samphires and Halophytes with **Cenchrus ciliaris*
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LW2, H, TG	Low Woodland *Avicennia marina,* samphires and halophytes with **Cenchrus ciliaris*
TG	Tussock grassland (variable), herbs (variable) may have scattered shrubs
HD	Heavily Disturbed

LEGEND

Study Area 'A' - RTIO - 20080711
Study Area 'C' - RTIO - 20080711
Study Area 'D' - RTIO - 20080711
Study Area 'E' - RTIO - 20080711
Study Area 'B' - RTIO - 20080701

Vegetation Type - GHD - 20081006
H, TG
HG, TG
HG1
HG2
LW1, HG, S
LW2, H
LW2, H, TG
TG
HD

Railway - Geoscience Australia - 200407

1:20,000 at A3
0 100 200 400 600 800
Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 50

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Vegetation Type Mapsheet 3 of 3

Job Number	6122636
Revision	0
Date	27 October 2008

Figure 3

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510,000 512,000 514,000

7,716,000 7,714,000 7,712,000

Adjoins Mapsheet 2

2-3 3-4 3 3 4 4 6

LEGEND

- Study Area 'A' - RTIO - 20080711
- Study Area 'C' - RTIO - 20080711
- Study Area 'D' - RTIO - 20080711
- Study Area 'B' - RTIO - 20080701
- Study Area 'E' - RTIO - 20080711
- Railway - Geoscience Australia - 200407

Vegetation Condition - GHD - 20080930

1. Pristine or nearly so
2. Excellent
3. Very Good
4. Good
5. Degraded
6. Completely degraded

1:20,000 at A3

0 100 200 400 600 800

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 50

N

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Vegetation Condition
Mapsheet 1 of 3

Job Number	6122636
Revision	0
Date	27 October 2008

Figure 4

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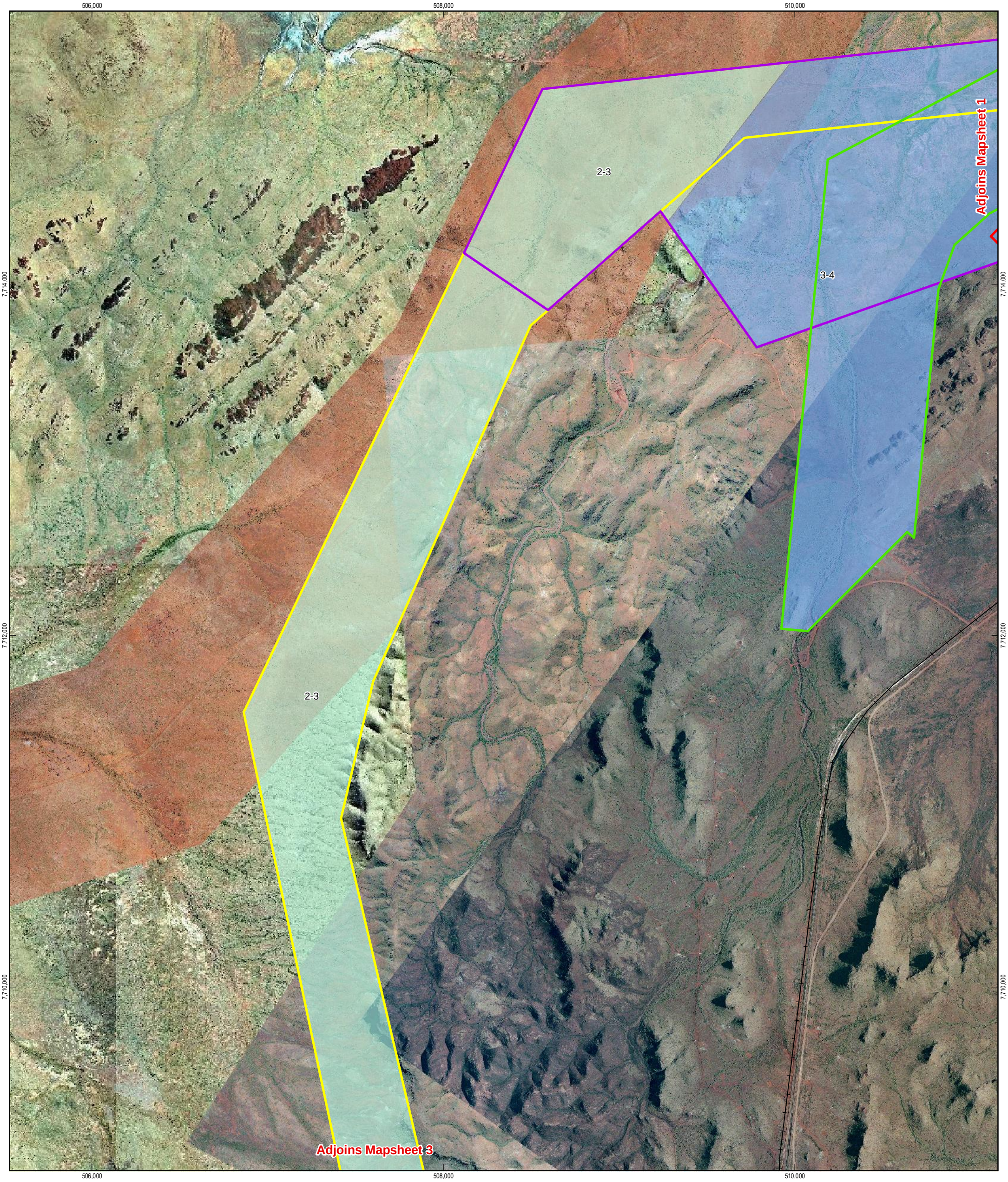

LEGEND

- Study Area 'A' - RTIO - 20080711
- Study Area 'C' - RTIO - 20080711
- Study Area 'D' - RTIO - 20080711
- Study Area 'B' - RTIO - 20080701
- Study Area 'E' - RTIO - 20080711
- Railway - Geoscience Australia - 200407

Vegetation Condition - GHD - 20080930

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2. Excellent
3. Very Good
4. Good
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6. Completely degraded

1:20,000 at A3

0 100 200 400 600 800

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
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Vegetation Condition Mapsheet 2 of 3

Job Number	6122636
Revision	0
Date	27 October 2008

Figure 4

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239 Adelaide Terrace Perth WA 6004 Australia **T** 61 8 6222 8222 **F** 61 8 6222 8555 **E** permail@ghd.com.au **W** www.ghd.com.au

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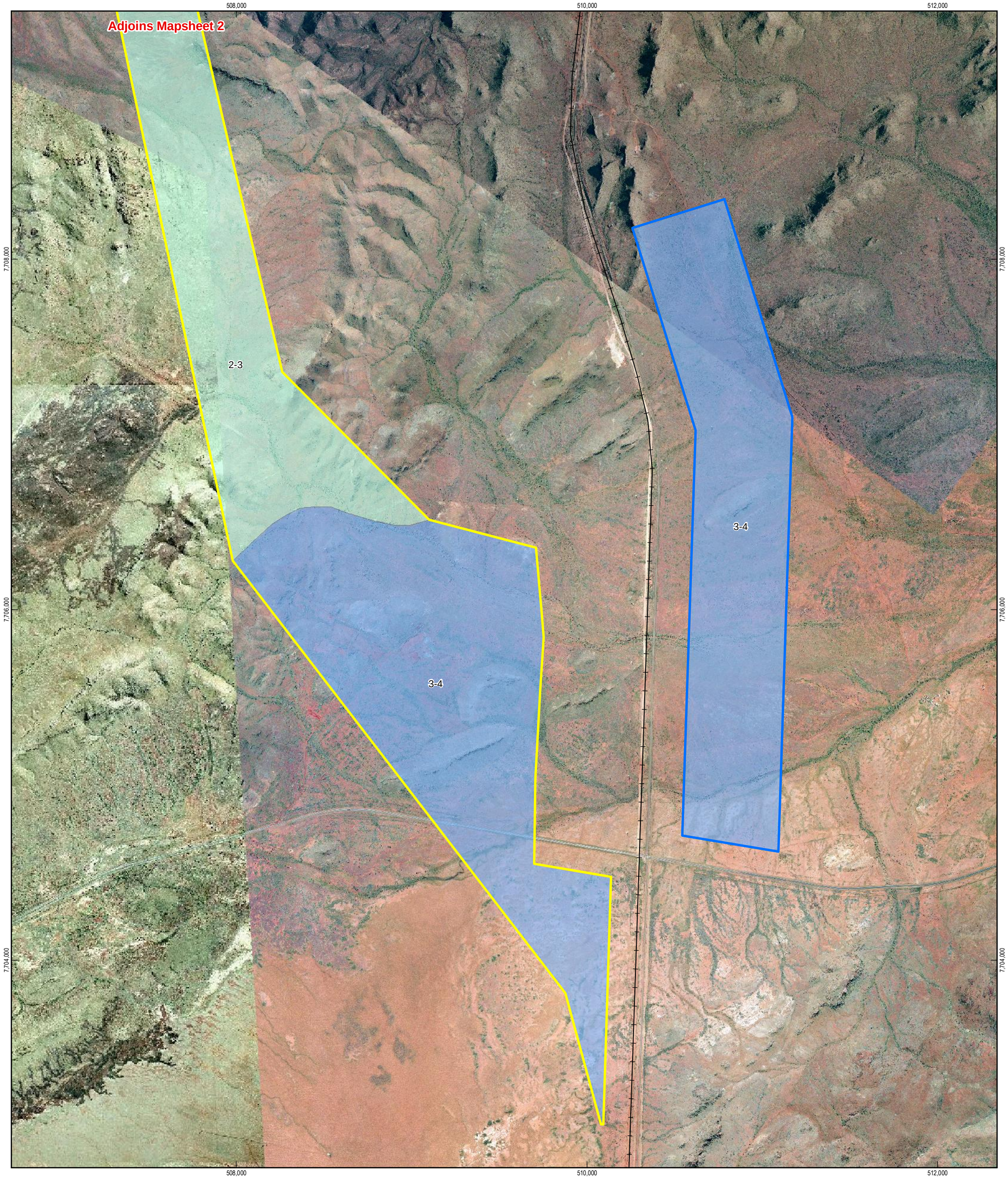

LEGEND

- Study Area 'A' - RTIO - 20080711
- Study Area 'C' - RTIO - 20080711
- Study Area 'D' - RTIO - 20080711
- Study Area 'B' - RTIO - 20080701
- Study Area 'E' - RTIO - 20080711
- Railway - Geoscience Australia - 200407

Vegetation Condition - GHD - 20080930

1. Pristine or nearly so
2. Excellent
3. Very Good
4. Good
5. Degraded
6. Completely degraded

1:20,000 at A3

0 100 200 400 600 800

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 50

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Vegetation Condition Mapsheet 3 of 3

Job Number	6122636
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Figure 4

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Appendix B

Vegetation

Quadrat and Transect Data

Study Area Vegetation Types

Vegetation Condition Rating Scale

Table 4 Vegetation condition rating scale (after Keighery, 1994).

Vegetation Condition Rating	Vegetation Condition	Description
1	*Pristine or Nearly So.*	No obvious signs of disturbance.
2	*Excellent*	Vegetation structure intact, disturbance affecting individual species, and weeds are non-aggressive species.
3	*Very Good*	Vegetation structure altered, obvious signs of disturbance.
4	*Good*	Vegetation structure significantly altered by very obvious signs of multiple disturbances retains basic vegetation structure or ability to regenerate it.
5	*Degraded*	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not in a state approaching good condition without intensive management.
6	*Completely Degraded*	The structure of the vegetation is no longer intact and the area is completely or almost without native species.

Appendix C

Flora

Conservation Categories and Definitions for EPBC Act Listed Flora and Fauna Species

Conservation Codes and Descriptions for DEC Declared Rare and Priority Flora Species

Flora Species Recorded During the Field Survey of the Study Area - July and August 2008

Table 5 Conservation Categories and Definitions for *EPBC Act* Listed Flora and Fauna Species.

Conservation Category	Definition
Extinct	Taxa not definitely located in the wild during the past 50 years
Extinct in the Wild	Taxa known to survive only in captivity
Critically Endangered	Taxa facing an extremely high risk of extinction in the wild in the immediate future
Endangered	Taxa facing a very high risk of extinction in the wild in the near future
Vulnerable	Taxa facing a high risk of extinction in the wild in the medium-term
Near Threatened	Taxa that risk becoming Vulnerable in the wild
Conservation Dependent	Taxa whose survival depends upon ongoing conservation measures. Without these measures, a conservation dependent taxon would be classified as Vulnerable or more severely threatened.
Data Deficient (Insufficiently Known)	Taxa suspected of being Rare, Vulnerable or Endangered, but whose true status cannot be determined without more information.
Least Concern	Taxa that are not considered Threatened

Table 6 Conservation Codes and Descriptions for DEC Declared Rare and Priority Flora Species.

Conservation Code	Description
R: Declared Rare Flora – Extant Taxa	Taxa which have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection, and have been gazetted as such.
P1: Priority One – Poorly Known Taxa	Taxa which are known from one or a few (generally <5) populations which are under threat, either due to small population size, or being on lands under immediate threat, e.g. road verges, urban areas, farmland, active mineral leases, etc., or the plants are under threat, e.g. from disease, grazing by feral animals etc. May include taxa with threatened populations on protected lands. Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey.
P2: Priority Two – Poorly Known Taxa	Taxa which are known from one or a few (generally<5) populations, at least some of which are not believed to be under immediate threat (i.e. not currently endangered). Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey.
P3: Priority Three – Poorly Known Taxa	Taxa which are known from several populations, and the taxa are not believed to be under immediate threat (i.e. not currently endangered), either due to the number of known populations (generally >5), or known populations being large, and either widespread or protected. Such taxa are under consideration for declaration as 'rare flora' but are in need of further survey.
P4: Priority Four – Taxa in need of monitoring	Taxa which are considered to have been adequately surveyed and which, whilst being rare (in Australia), are not currently threatened by any identifiable factors. These taxa require monitoring every 5 – 10 years.

Table 7 Flora species recorded during field survey of the study area – July and August 2008

Family	Genus	Species	Common Name
Adiantaceae	*Cheilanthes*	*austrotenuifolia*	Rock Fern
Amaranthaceae	*Achyranthes*	*asper*	
Amaranthaceae	*Aerva*	*javanica*	Kapok
Amaranthaceae	*Alternarthera*	*nodiflora*	
Amaranthaceae	*Gomphrena*	*cunninghamii*	
Amaranthaceae	*Ptilotus*	*aeroides*	
Amaranthaceae	*Ptilotus*	*calostachyus*	Weeping Mulla Mulla
Amaranthaceae	*Ptilotus*	*clementii*	
Amaranthaceae	*Ptilotus*	*gomphreniodes var gomphrenoides*	
Amaranthaceae	*Ptilotus*	*helipteriodes*	Hairy Mulla Mulla
Amaranthaceae	*Ptilotus*	*obivatus*	Cotton Bush
Amaranthaceae	*Ptilotus*	*polystachyus*	
Amaranthaceae	*Ptilotus*	*exaltatus*	Tall Mulla Mulla
Amaranthaceae	*Ptilotus*	*fusiformis*	
Apiaceae	*Trachymene*	*oleracea*	
Asteraceae	*Ixiochlamys*	*cuneifolia*	
Asteraceae	*Oleraria*	*dampieri*	
Asteraceae	*Pluchea*	*rubelliflora*	
Asteraceae	*Pterocaulon*	*sphacelatum*	Apple Bush
Asteraceae	*Rhodanthe*	*humboldtiana*	
Asteraceae	*Streptoglossa*	*odera*	
Avicenniaceae	*Avicennia*	*marina*	
Boraginaceae	*Ehretia*	*saligna*	False Cedar

Family	Genus	Species	Common Name
Boraginaceae	*Heliotropium*	*pachyphyllum*	
Boraginaceae	*Trichodesma*	*zeylanicum*	Camel Bush
Brassicaceae	*Lepidium*	*pedicellosum*	
Caesalpiniaceae	*Senna*	*artemisioides subsp. helmsii*	
Caesalpiniaceae	*Senna*	*glutinosa subsp. glutinosa*	
Caesalpiniaceae	*Senna*	*venusta*	
Caesalpiniaceae	*Senna*	*glutinosa subsp. X luerssenii*	
Caesalpiniaceae	*Senna*	*notabilis*	Cockroach Bush
Capparaceae	*Capparis*	*spinosa*	Split Jack
Capparaceae	*Cleome*	*vicosa*	Tickweed
Caryophylaceae	*Polycarpaea*	*holtzei*	
Caryophyllaceae	*Polycarpaea*	*corymbosa*	
Caryophyllaceae	*Polycarpaea*	*holtzei*	
Chenopodiaceae	*Atriplex*	*bunburyana*	
Chenopodiaceae	*Atriplex*	*lindleyi*	
Chenopodiaceae	*Dysphania*	*plantaginella*	Green Crumb
Chenopodiaceae	*Enchylaena*	*tomentosa*	
Chenopodiaceae	*Maireana*	*tomentosa*	
Chenopodiaceae	*Rhagodia*	*preissii*	
Chenopodiaceae	*Salsola*	*tragus*	Roly-Poly
Chenopodiaceae	*Tetracornia*	*auriculata*	
Chenopodiaceae	*Threlkeldia*	*diffusa*	
Convolvulaceae	*Bonamia*	*erecta*	
Convolvulaceae	*Bonamia*	*rosea*	

Family	Genus	Species	Common Name
Convolvulaceae	*Evolvulus*	*alisinoides var villisicalyx*	Tropical speed weed
Convolvulaceae	*Ipomoea*	*muelleri*	
Convolvulaceae	*Ipomoea*	*polymorphia*	
Convolvulaceae	*Operculina*	*aequisepala*	
Cucurbitaceae	*Cucumis*	*maderaspatanus*	Indian Vine
Cyperaceae	*Cryperus*	*blakeanus*	
Cyperaceae	*Cyperus*	*vaginatus*	Stiff leaf sedge
Cyperaceae	*Fimbristylis*	*elegans*	
Cyperaceae	*Fimbristylis*	*simulans*	
Euphorbiacaeae	*Euphorbia*	*coghlanii*	Nanama
Euphorbiaceae	*Adriana*	*urticoides*	Bitter Bush
Euphorbiaceae	*Euphorbia*	*australis*	
Euphorbiaceae	*Euphorbia*	*boophthona*	
Euphorbiaceae	*Euphorbia*	*drummondii*	
Frankeniaceae	*Frankenia*	*ambita*	
Goodeniaceae	*Goodenia*	*microptera*	
Goodeniaceae	*Goodenia*	*sp*	
Goodeniaceae	*Goodenia*	*triodiophila*	
Lamiaceae	*Clerodendrum*	*tomentosum*	
Malvaceae	*Abutilon*	*dioicum*	
Malvaceae	*Abutilon*	*lepidium*	
Malvaceae	*Gossypium*	*australe*	Native Cotton
Malvaceae	*Gossypium*	*robinsonii*	Wild Cotton
Malvaceae	*Hibiscus*	*austrinus*	Yellow hibiscus
Malvaceae	*Hibiscus*	*coastesii*	
Malvaceae	*Hibiscus*	*lepidium*	

Family	Genus	Species	Common Name
Malvaceae	*Hibiscus*	*leptocladus*	
Malvaceae	*Hibiscus*	*sturtii*	
Malvaceae	*Sida*	*arenicola*	
Malvaceae	*Sida*	*echinocarpa*	
Malvaceae	*Sida*	*rohlenii subsp rohlenii*	
Mimosaceae	*Acacia*	*ampliceps*	
Mimosaceae	*Acacia*	*aneura*	
Mimosaceae	*Acacia*	*colei*	Cole Wattle
Mimosaceae	*Acacia*	*coriaceae subsp coriaceae*	
Mimosaceae	*Acacia*	*inaequilatera*	Baderi
Mimosaceae	*Acacia*	*maitlandii*	Maitland Wattle
Mimosaceae	*Acacia*	*pruinocarpa*	Gidgee
Mimosaceae	*Acacia*	*pyrifolia*	Ranji Bush
Mimosaceae	*Acacia*	*stellaticepts*	
Mimosaceae	*Acacia*	*synchronicia*	
Mimosaceae	*Acacia*	*tracycarpa*	
Mimosaceae	*Acacia*	*bivenosa*	
Mimosaceae	*Acacia*	*coriaceae subsp coriaceae*	
Mimosaceae	*Vachellia*	*farnesiana*	Mimosa Bush
Molluginaceae	*Mollugo*	*molluginensis*	
Moraceae	*Ficus*	*brachypoda*	Rock Fig
Moraceae	*Ficus*	*scobina*	Sandpaper fig
Myporaceae	*Eremophila*	*longifolia*	
Myporaceae	*Erempholia*	*latrobei subsp glabra*	
Myrtaceae	*Corymbia*	*hamersleyana*	

Family	Genus	Species	Common Name
Oleariaceae	*Jasminum*	*didymum*	
Papilionaceae	*Alysicarpus*	*meullerii*	
Papilionaceae	*Cajanus*	*cinereus*	
Papilionaceae	*Carnivalia*	*rosea*	
Papilionaceae	*Crotalaria*	*cunninghamii*	
Papilionaceae	*Crotalaria*	*medicaginea*	Trefoil Rattlepod
Papilionaceae	*Cullen*	*leucanthum*	
Papilionaceae	*Indigofera*	*colutea*	Sticky indigo
Papilionaceae	*Indigofera*	*linifolia*	Native Indigo
Papilionaceae	*Indigofera*	*monophylla*	
Papilionaceae	*Indigofera*	*rugosa*	
Papilionaceae	*Indigofera*	*trita*	
Papilionaceae	*Isotropis*	*atropurpurea*	
Papilionaceae	*Neptunia*	*dimorphantha*	
Papilionaceae	*Rhynchosia*	*minima*	Rhynchosia
Papilionaceae	*Sesbania*	*cannabina*	
Papilionaceae	*Swainsonia*	*formosa*	Sturts Desert Pea
Papilionaceae	*Swainsonia*	*pterostylis*	
Papilionaceae	*Tephrosia*	*rosea*	Flinders River Poison
Papilionaceae	*Vigna*	*lanceolata*	
Papilionaceae	*Zornia*	*muelleriana*	
Poaceae	*Aristida*	*contorta*	Bunched Kerosine grass
Poaceae	*Cenchrus*	*ciliaris*	Buffel Grass
Poaceae	*Cymbopogon*	*ambiguus*	Scent Grass

Family	Genus	Species	Common Name
Poaceae	*Dichanthium*	*sericeum*	Queensland Blue Grass
Poaceae	*Eragrostis*	*eriopoda*	
Poaceae	*Eragrostis*	*setifolia*	Neverfail
Poaceae	*Eragrostis*	*tenellula*	
Poaceae	*Eragrostis*	*xerophylla*	Knotty Butt Never Fail
Poaceae	*Eriachne*	*aristidea*	
Poaceae	*Eriachne*	*lanata*	
Poaceae	*Eriachne*	*mucronata*	Mountain Wanderrie Grass
Poaceae	*Eriachne*	*pulchella subsp. dominii*	
Poaceae	*Iseilema*	*membranaceum*	Small Flinders Grass
Poaceae	*Panicum*	*decompositum*	Native Millet
Poaceae	*Paspalidium*	*basicladum*	
Poaceae	*Sorghum*	*timorense*	
Poaceae	*Spinifex*	*longifolius*	
Poaceae	*Themeda*	*sp.*	Kangaroo Grass
Poaceae	*Triodia*	*epactia?*	
Poaceae	*Triodia*	*longicepts?*	
Poaceae	*Triodia*	*pungens*	
Portulacaeae	*Calandrinia*	*ptychosperma*	
Portulaceae	*Portulaca*	*conspicua*	
Proteaceae	*Grevillea*	*pyramidalis*	Caustic Tree
Proteaceae	*Grevillea*	*wickihamii*	
Proteaceae	*Hakea*	*lorea subsp lorea*	Jingibrand

Family	Genus	Species	Common Name
Scrophulariaceae	*Stemodia*	*viscosa*	
Solanaceae	*Solanum*	*diversifolium*	
Solanaceae	*Solanum*	*lasiophyllum*	
Solanaceae	*Solanum*	*phlomoides*	
Sterculiaceae	*Waltheria*	*indica*	
Tiliaceae	*Corchorus*	*laniflorus*	
Tiliaceae	*Corchorus*	*walcottii*	Woolly Corchorus
Tiliaceae	*Triumfetta*	*apendiculata*	
Tiliaceae	*Triumfetta*	*clementii*	
Violaceae	*Hybanthus*	*aurantiacus*	Orange Spade Flower
Zygophyllaceae	*Tribulus*	*hirsutus*	
Zygophyllaceae	*Tribulus*	*suberosus*	Cork Bush
Zygophyllaceae	*Zygophyllum*	*retivalve*	

* introduced

Table 8 Flora Quadrat Data Cape Lamb

Family	Genus	Species	Common Name	Status	1	2a Plains	2b Hill	3	4	5	6	7	8	9	10	11	12	13	WB 5	WB 3	WB 4	WB 2	WB1	A1	A2	A2 Creek	A3	A4
Amaranthaceae	*Aerva*	*javanica*	Kapok	*			+								+													
Amaranthaceae	*Gomphrena*	*cunninghamii*				+	+	+					+								+				+	+		
Amaranthaceae	*Ptilotus*	*calostachyus*	Weeping Mulla Mulla					+		+						+		+			+			+				
Amaranthaceae	*Ptilotus*	*clementii*					+						+		+	+		+										
Amaranthaceae	*Ptilotus*	*helipteriodes*	Hairy Mulla Mulla		+			+						+														
Amaranthaceae	*Ptilotus*	*obovatus*	Cotton Bush			+		+				+				+				+				+				+
Amaranthaceae	*Ptilotus*	*polystachyus*											+									+	+	+				
Amaranthaceae	*Ptilotus*	*exaltatus*	Tall Mulla Mulla		+	+	+		+				+						+							+		
Amaranthaceae	*Ptilotus*	*fusiformis*																				+						+
Apiacaea	*Trachymene*	*oleraceae*							+			+										+				+		
Asteraceae	*Pterocaulon*	*sphacelatum*	Apple Bush					+	+												+							
Boraginaceae	*Heliotropium*	*pachyphyllum*				+																						
Boraginaceae	*Trichodesma*	*zeylanicum*	Camel Bush						+			+	+						+			+			+	+		
Brassicaceae	*Lepidium*	*pedicellosum*					+																					
Caesalpiniaceae	*Senna*	*artemisoides subsp helmsii*																	+									
Caesalpiniaceae	*Senna*	*glutinosa subsp. glutinosa*								+											+						+	
Caesalpiniaceae	*Senna*	*glutinosa subsp. pruinosa*									+																	
Caesalpiniaceae	*Senna*	*glutinosa subsp. X luerssenii*					+	+							+		+											+
Caesalpiniaceae	*Senna*	*notabilis*	Cockroach Bush		+	+		+		+			+			+			+			+	+	+				+
Capparaceae	*Capparis*	*umbonata*	Wild Orange				+													+								
Capparaceae	*Cleome*	*vicosa*	Tickweed		+		+													+		+	+			+		
Caryophylaceae	*Polycarpaea*	*holtzei*					+	+		+																		+
Caryophyllaceae	*Polycarpaea*	*corymbosa*					+																					
Chenopodiaceae	*Dysphania*	*plantaginella*	Green Crumb			+															+							
Chenopodiaceae	*Salsola*	*tragus*	Roly-Poly		+	+		+																				
Convolvulaceae	*Bonamia*	*erecta*			+														+									
Convolvulaceae	*Convolvulus*	*sp*							+												+	+	+					
Convolvulaceae	*Evolvulus*	*alisinoides var villisicalyx*	Tropical speed weed			+	+					+							+			+				+		+
Convolvulaceae	*Ipomoea*	*muelleri*																						+				
Convolvulaceae	*Operculina*	*aequisepala*			+																						+	
Cucurbitaceae	*Cucumis*	*maderaspatanus*	Indian Vine				+																		+	+		

Family	*Genus*	*Species*	Common Name	Status	1	2a Plains	2b Hill	3	4	5	6	7	8	9	10	11	12	13	WB 5	WB 3	WB 4	WB 2	WB1	A1	A2	A2 Creek	A3	A4
Cyperaceae	*Cryperus*	*blakeanus*																						+				
Cyperaceae	*Fimbristylis*	*simulans*																								+		
Euphorbiacaeae	*Euphorbia*	*coghlanii*	Nanama			+															+			+				
Euphorbiaceae	*Euphorbia*	*australis*																									+	
Euphorbiaceae	*Euphorbia*	*drummondii*			+	+													+	+	+			+	+	+		
Frankeniaceae	*Frankenia*	*ambita*																										
Goodeniaceae	*Goodenia*	*microtera*				+													+					+		+		+
Goodeniaceae	*Goodenia*	*triodiophila*			+																							
Lamiaceae	*Clerodendum*	*tomentosum*																										
Malvaceae	*Abutilon*	*dioicum*					+					+									+	+					+	
Malvaceae	*Abutilon*	*lepidium*																										
Malvaceae	*Gossypium*	*australe*	Native Cotton				+		+											+								
Malvaceae	*Gossypium*	*robinsonii*	Wild Cotton																	+								
Malvaceae	*Hibiscus*	*coastesii*																								+		
Malvaceae	*Hibiscus*	*sturtii*																										+
Malvaceae	*Sida*	*arenicola*			+					+		+	+			+	+		+	+		+	+			+	+	
Malvaceae	*Sida*	*echinocarpa*			+					+		+	+			+	+		+	+		+	+			+	+	
Marsileaceae	*Marsilea*	*hirsuta*																								+		
Mimosaceae	*Acacia*	*aneura*																								+	+	
Mimosaceae	*Acacia*	*colei*	Cole Wattle					+	+												+					+		
Mimosaceae	*Acacia*	*coriaceae subsp coriaceae*						+			+				+						+							
Mimosaceae	*Acacia*	*inaequilatera*	Baderi							+		+				+	+		+	+							+	
Mimosaceae	*Acacia*	*maitlandii*	Maitland Wattle													+												
Mimosaceae	*Acacia*	*pruinocarpa*	Gidgee								+																	
Mimosaceae	*Acacia*	*pyrifolia*	Ranji Bush			+		+	+					+	+				+		+			+		+	+	+
Mimosaceae	*Acacia*	*stellaticepts*						+				+		+			+				+			+				+
Mimosaceae	*Acacia*	*synchronicia*						+			+				+						+							
Mimosaceae	*Acacia*	*tracycarpa*						+				+			+			+	+		+							
Mimosaceae	*Acacia*	*bivenosa*					+		+			+	+		+		+	+		+	+						+	
Mimosaceae	*Acacia*	*coriaceae subsp coriaceae*																										
Mimosaceae	*Vachellia*	*farnesiana*	Mimosa Bush	+			+																					
Molluginaceae	*Mollugo*	*molluginensis*																	+			+						
Moraceae	*Ficus*	*brachypoda*	Rock Fig				+																					

Family	*Genus*	*Species*	Common Name	Status	1	2a Plains	2b Hill	3	4	5	6	7	8	9	10	11	12	13	WB 5	WB 3	WB 4	WB 2	WB1	A1	A2	A2 Creek	A3	A4
Myrtaceae	*Corymbia*	*hamersleyana*							+											+	+				+	+		
Papilionaceae	*Alysicarpus*	*meullerii*																							+	+		
Papilionaceae	*Crotalaria*	*medicaginea*	Trefoil Rattlepod					+										+			+		+			+		
Papilionaceae	*Indigofera*	*linifolia*	Native Indigo		+		+		+											+		+			+	+	+	
Papilionaceae	*Indigofera*	*monophylla*							+			+			+	+	+	+	+	+		+			+	+		+
Papilionaceae	*Indigofera*	*rugosa*					+																					
Papilionaceae	*Indigofera*	*trita*																					+					
Papilionaceae	*Rhynchosia*	*minima*	Rhynchosia		+		+		+										+	+		+	+		+	+	+	
Papilionaceae	*Sesbania*	*cannabina*							+														+					
Papilionaceae	*Swainsonia*	*formosa*	Sturts Desert Pea													+						+						
Papilionaceae	*Tephrosia*	*rosea*	Flinders River Poison				+													+	+		+			+		+
Papilionaceae	*Vigna*	*lanceolata*																										
Papilionaceae	*Zornia*	*muelleriana*			+																		+			+		
Poaceae	*Aristida*	*contorta*	Bunched Kerosine grass		+	+		+		+		+				+			+									
Poaceae	*Cenchrus*	*ciliaris*	Buffel Grass	+			+		+	+	+	+							+	+	+	+	+		+	+	+	
Poaceae	*Cymbopogon*	*ambiguus*	Scent Grass						+										+			+						
Poaceae	*Enneapogon*	*caerulescens*	Limestone grass																+					+				
Poaceae	*Eragrostis*	*eriopoda*																		+		+						
Poaceae	*Eragrostis*	*setifolia*	Neverfail		+																+							
Poaceae	*Eragrostis*	*tenellula*									+								+									
Poaceae	*Eragrostis*	*xerophylla*	Knotty Butt Never Fail		+																							
Poaceae	*Eriachne*	*aristidea*																							+			
Poaceae	*Eriachne*	*mucronata*	Mountain Wanderrie Grass			+													+	+								
Poaceae	*Eriachne*	*pulchella subsp. dominii*																						+				
Poaceae	*Iseilema*	*membranaceum*	Small Flinders Grass																									
Poaceae	*Panicum*	*decompositum*	Native Millet				+																				+	
Poaceae	*Sorghum*	*timorense*																							+			
Poaceae	*Triodia*	*epactia?*				+		+		+	+		+	+	+		+	+		+		+	+					
Poaceae	*Triodia*	*pungens*								+														+	+		+	+
Portulaceae	*Portulaca*	*conspicua*			+	+	+	+	+										+					+				
Proteaceae	*Grevillea*	*pyramidalis*	Caustic Tree										+															
Proteaceae	*Grevillea*	*wickihamii*																		+								+

Family	*Genus*	*Species*	Common Name	Status	1	2a Plains	2b Hill	3	4	5	6	7	8	9	10	11	12	13	WB 5	WB 3	WB 4	WB 2	WB1	A1	A2	A2 Creek	A3	A4
Proteaceae	*Hakea*	*lorea subsp lorea*	Jingibrand																			+		+				+
Solanaceae	*Solanum*	*diversifolium*																	+									
Solanaceae	*Solanum*	*lasiophyllum*																										+
Sterculiaceae	*Waltheria*	*indica*							+											+	+		+			+	+	
Tiliaceae	*Corchorus*	*laniflorus*			+																							
Tiliaceae	*Corchorus*	*walcottii*	Woolly Corchorus			+			+										+		+				+	+		
Tiliaceae	*Triumfetta*	*clementii*			+		+	+				+				+			+		+	+		+			+	
Violaceae	*Hybanthus*	*aurantiacus*	Orange Spade Flower						+			+													+				+
Zygophyllaceae	*Tribulus*	*hirsutus*					+						+																
Zygophyllaceae	*Tribulus*	*suberosus*	Cork Bush				+																						

Table 9 Cape Lambert Quadrat Descriptions

Quadrat No.	Easting	Northing	Photo	General Vegetation Description	Bushland condition	Bare Ground	Substrate	Dominant species	% Cover	Disturbances
1	509969.775	7704268.885		*Tussock Grasslands* Grass Plains	3	30%	Red Sand Flood plains with small rocks	*Eragrostis xerophylla* *Senna notablis* *Aristida contorta*	50 5 5	Site has been grazed and burnt.
2	509368.903	7705211.399		*Rockpile* Rocky hill rising up from the sand plain. Rock pile	2	40%	Rock pile	**Cenchrus ciliaris* *Cleome viscosa*	25 10	Disturbances minimal. Some weeds mainly buffel grass
3	508873.265	7705684.235		*Tussock Grasslands* Floodplain grasses with emergent Acacia	¾	50%	Red Sand Flood plains with small rocks	grasses spinifex *Acacia pyrifolia*	50 1 1	Site has been burnt and cleared signs of other disturbances

Quadrat No.	Easting	Northing	Photo	*General Vegetation Description*	Bushland condition	Bare Ground	Substrate	Dominant species	% Cover	Disturbances
4	509492.277	7706147.560		*Hummock Grasslands* Spinifex with emergent *A. bivenosa,* creekline	2/3	60%	Sand and Rocks	Spinifex *A. bivinosa*		Minor disturbances. Possible frequent fire resulting in a reduced shrub layer
5	508122.220	7706978.831		*Hummock Grasslands* Spinifex with a single *C. hamerslyana*, *A.victorea*, *A.colei* and *A. bivenosa*	2/3	50%	Gentle slope leading to creekline rocks	Spinifex *C. hamerslyana* *A.victorea* *A.bivinosa*	50 1 1 1	Site appears to have been cleared in the past possibly during the gas pipeline construction.
6	508024.114	7707372.486		*Hummock Grasslands* Spinifex with emergent gidgee	2/3	50%	Red sand and rocks	Spinifex Gidgee	50 2	Minor disturbances. Open ground and limited shrub layer indicative of frequent fire events.

Quadrat No.	Easting	Northing	Photo	*General Vegetation Description*	Bushland condition	Bare Ground	Substrate	Dominant species	% Cover	Disturbances
7	508031.639	7707928.758		*Hummock Grasslands* Spinifex with emergent Acacia	2/3		Red sand at the base of a hill	Spinifex Acacia	50 25	Minor disturbances. Open ground and limited shrub layer indicative of frequent fire events.
8	507741.533	7708634.181		*Hummock Grasslands* Spinifex with scattered herbs	2/3	60	Plain with rocky outcrop	Spinifex *Indigofera linearifolia* *Tribulis hirsuitus* *Grevillea pyamidalis*	40% 30% 5% <5	Site has been recently burnt
9	507088.724	7710271.232		*Hummock Gras slands* Spinifex with emergent *Acacia stellaticepts* no common herbs	2/3	60	Gentle slope at base of rock pile. Rocks over red sand with quartz.	Spinifex *Acacia stellaticeps*	40% 10%	Old fences indicates historical grazing.

Quadrat No.	Easting	Northing	Photo	*General Vegetation Description*	Bushland condition	Bare Ground	Substrate	Dominant species	% Cover	Disturbances
10	507168.370	7711037.632		*Hummock Grasslands* Spinifex with emergent Acacias no common herbs	2/3	50%	Gentle slope at base of rock pile. Rocks over red sand with quartz.	Spinifex *Acacia bivenosa*	50% 15%	Old fences indicate historical grazing.
11	507334.514	7711573.055		*Hummock Grasslands* Spinifex with emergent Acacia some herbs	2/3	70%		Spinifex	30%	Old fences indicate historical grazing. Site has been recently burnt
12	507571.632	7712138.722		*Hummock Grasslands* Spinifex with emergent *Acacia stellaticepts* not many herbs	2/3	40% bare ground		Spinifex *Acacia stellaticepts* *Acacia bivenosa*	60% 10% 5%	Minor disturbances. Open ground and limited shrub layer indicative of frequent fire events.

Quadrat No.	Easting	Northing	Photo	*General Vegetation Description*	Bushland condition	Bare Ground	Substrate	Dominant species	% Cover	Disturbances
13				*Hummock Grasslands* Spinifex with emergent Acacia		30%		Spinifex	70%	
	507907.828	7713081.915			2/3			Mulga	10%	
WB5				*Hummock Grasslands* Spinifex with emergent Acacia and *C.hamersleyana*			Red sand Flood plain leading to creekline	Spinifex Acacia	50% 2%	Site recently burnt
	509752.418	7705956.841			2/3			*C. hamerslyana*	2%	
WB3				*Acacia Type Flow Line* Spinifex with emergent Acacia and creekline with *C.hamersleyana* and *A.colei*		40%	Red sand Flood plain rocky creekline	Spinifex *A. colei* *c. hamersleyana*	60% 2% 2%	Site disturbance tracks and dumped cars. Weedy.
	510223.185	7712387.262			¾					

Quadrat No.	Easting	Northing	Photo	*General Vegetation Description*	Bushland condition	Bare Ground	Substrate	Dominant species	% Cover	Disturbances
WB 4	510065.924	7711924.290		*Hummock Grasslands* Spinifex with emergent Acacia	4/5	90%	Red sand plain	Spinifex Acacia	10% 2%	Site very disturbed. Looks like it has been cleared
WB 2	512801.435	7714589.222		*Hummock Grasslands* Spinifex with emergent *A. inaequaliteria*	2/3	60%	rocky plain	Spinifex *A. inaequaliteria*	30% 2%	Site has been recently burnt
WB1	513012.717	7714688.798		*Hummock Grasslands* Spinifex with emergent Acacia	4	70	Red sand plain	Mixed herbs no dominants		Site burnt and degraded. May have been cleared and grazed.

Quadrat No.	Easting	Northing	Photo	*General Vegetation Description*	Bushland condition	Bare Ground	Substrate	Dominant species	% Cover	Disturbances
A 1				*Hummock Grasslands* Flood plain	4	50	Red Sand Plain	Mixed herbs and grasses no dominants		Site barren has been burnt. May have been cleared and grazed.
A 2				Tussock Grasslands on cracking Clays	3/4	50	Clay plains	Mixed herbs and grasses no dominants		Site barren has been burnt. May have been cleared and grazed.
A 3				Hummock Grasslands	3/4	50	Red sand and stone plain	Spinifex and mixed herbs		Site appeared to be recovering from burn

Table 10 Flora Transect Data Cape Lambert

Family	Genus	Species	Common Name	Status	Opportunistic A	D1	B1	B2	B4	B5	B6	B7	B8	B9	C1
Adiantaceae	*Cheilanthes*	*austrotenuifolia*	Rock Fern												+
Amaranthaceae	*Achyranthes*	*asper*													+
Amaranthaceae	*Aerva*	*javanica*	Kapok	*		+		+	+		+				+
Amaranthaceae	*Alternarthera*	*nodiflora*								+					
Amaranthaceae	*Gomphrena*	*cunninghamii*			+	+		+			+				+
Amaranthaceae	*Ptilotus*	*aeroides*				+									
Amaranthaceae	*Ptilotus*	*calostachyus*	Weeping Mulla Mulla			+		+							
Amaranthaceae	*Ptilotus*	*clementii*						+							
Amaranthaceae	*Ptilotus*	*gomphreniodes var gomphrenoides*				+							+		
Amaranthaceae	*Ptilotus*	*helipteriodes*	Hairy Mulla Mulla				+	+							
Amaranthaceae	*Ptilotus*	*obivatus*	Cotton Bush			+		+				+			
Amaranthaceae	*Ptilotus*	*polystachyus*					+			+			+		+
Amaranthaceae	*Ptilotus*	*exaltatus*	Tall Mulla Mulla		+	+	+	+	+		+		+	+	+
Amaranthaceae	*Ptilotus*	*fusiformis*			+			+							+
Apiaceae	*Trachymene*	*oleracea*			+	+		+							+
Asteraceae	*Oleraria*	*dampieri*									+				
Asteraceae	*Ixiochlamys*	*cuneifolia*												+	
Asteraceae	*Pluchea*	*rubelliflora*													
Asteraceae	*Pterocaulon*	*sphacelatum*	Apple Bush		+	+	+	+						+	
Asteraceae	*Rhodanthe*	*humboldtiana*					+		+						
Asteraceae	*Streptoglossa*	*odera*					+			+					+
Avicenniaceae	*Avicennia*	*marina*							+						

Family	Genus	Species	Common Name	Status	Opportunistic A	D1	B1	B2	B4	B5	B6	B7	B8	B9	C1
Boraginaceae	*Ehretia*	*saligna*	False Cedar		+	+									+
Boraginaceae	*Heliotropium*	*pachyphyllum*									+				
Boraginaceae	*Trichodesma*	*zeylanicum*	Camel Bush		+		+	+	+	+			+		+
Caesalpiniaceae	*Senna*	*artemisioides subsp. helmsii*			+	+				+					+
Caesalpiniaceae	*Senna*	*glutinosa subsp. glutinosa*			+		+	+							
Caesalpiniaceae	*Senna*	*venusta*				+		+							+
Caesalpiniaceae	*Senna*	*glutinosa subsp. X luerssenii*				+									+
Caesalpiniaceae	*Senna*	*notabilis*	Cockroach Bush		+	+	+	+		+	+		+		+
Capparaceae	*Capparis*	*spinosa*	Split Jack			+									+
Capparaceae	*Cleome*	*vicosa*	Tickweed		+	+		+			+	+			+
Caryophyllaceae	*Polycarpaea*	*holtzei*													+
Caryophyllaceae	*Polycarpaea*	*corymbosa*			+										+
Chenopodiaceae	*Atriplex*	*bunburyana*				+	+			+			+		+
Chenopodiaceae	*Atriplex*	*lindleyi*							+						
Chenopodiaceae	*Enchylaena*	*tomentosa*					+			+			+	+	
Chenopodiaceae	*Maireana*	*tomentosa*					+		+	+				+	
Chenopodiaceae	*Rhagodia*	*preissii*			+				+	+			+		
Chenopodiaceae	*Tetracornia*	*auriculata*							+				+		
Chenopodiaceae	*Threlkeldia*	*diffusa*							+	+		+	+		
Chenopodiaceae	*Dysphania*	*plantaginella*	Green Crumb			+				+			+		+
Chenopodiaceae	*Salsola*	*tragus*	Roly-Poly		+	+	+		+	+	+	+	+	+	+
Cucurbitaceae	*Cucumis*	*maderaspatanus*	Indian Vine		+	+			+		+	+	+	+	+
Convolvulaceae	*Bonamia*	*erecta*									+				
Convolvulaceae	*Bonamia*	*rosea*									+				
Convolvulaceae	*Evolvulus*	*alisinoides var villisicalyx*	Tropical speed weed		+	+	+	+		+	+		+	+	+

Family	Genus	Species	Common Name	Status	Opportunistic A	D1	B1	B2	B4	B5	B6	B7	B8	B9	C1
Convolvulaceae	*Ipomoea*	*muelleri*			+	+							+	+	
Convolvulaceae	*Ipomoea*	*polymorphia*				+						+			
Convolvulaceae	*Operculina*	*aequisepala*				+									+
Cyperaceae	*Cryperus*	*blakeanus*								+					
Cyperaceae	*Cyperus*	*vaginatus*	Stiff leaf sedge										+		
Cyperaceae	*Fimbristylis*	*elegans*			+										
Euphorbiacaeae	*Euphorbia*	*coghlanii*	Nanama					+							+
Euphorbiaceae	*Adriana*	*urticoides*	Bitter Bush			+									
Euphorbiaceae	*Euphorbia*	*australis*						+							
Euphorbiaceae	*Euphorbia*	*boophthona*									+				+
Euphorbiaceae	*Euphorbia*	*drummondii*			+	+		+	+			+			+
Frankeniaceae	*Frankenia*	*ambita*							+				+		
Goodeniaceae	*Goodenia*	*microptera*			+	+		+			+				
Goodeniaceae	*Goodenia*	*triodiophila*					+							+	
Goodeniaceae	*Goodenia*	*sp*						+					+		+
Lamiaceae	*Clerodendrum*	*tomentosum*									+				
Malvaceae	*Abutilon*	*dioicum*			+	+		+		+					+
Malvaceae	*Abutilon*	*lepidium*			+	+									+
Malvaceae	*Gossypium*	*australe*	Native Cotton			+									+
Malvaceae	*Gossypium*	*robinsonii*	Wild Cotton			+		+			+				
Malvaceae	*Hibiscus*	*austrinus*	Yellow hibiscus							+					
Malvaceae	*Hibiscus*	*coastesii*			+	+									+
Malvaceae	*Hibiscus*	*lepidium*				+									
Malvaceae	*Hibiscus*	*leptocladus*											+		+
Malvaceae	*Hibiscus*	*sturtii*			+						+				
Malvaceae	*Sida*	*arenicola*			+	+	+	+	+				+		

Family	Genus	Species	Common Name	Status	Opportunistic A	D1	B1	B2	B4	B5	B6	B7	B8	B9	C1
Malvaceae	*Sida*	*echinocarpa*			+	+	+	+	+						
Malvaceae	*Sida*	*rohlenii subsp rohlenii*			+	+				+					+
Mimosaceae	*Acacia*	*ampliceps*								+					
Mimosaceae	*Acacia*	*aneura*			+	+		+							+
Mimosaceae	*Acacia*	*colei*	Cole Wattle			+		+	+		+	+			+
Mimosaceae	*Acacia*	*inaequilatera*	Baderi		+	+	+	+						+	+
Mimosaceae	*Acacia*	*pruinocarpa*	Gidgee												+
Mimosaceae	*Acacia*	*pyrifolia*	Ranji Bush			+	+	+							+
Mimosaceae	*Acacia*	*stellaticepts*				+		+	+	+			+	+	+
Mimosaceae	*Acacia*	*synchronicia*				+	+								
Mimosaceae	*Acacia*	*tracycarpa*			+										
Mimosaceae	*Acacia*	*bivenosa*			+	+		+			+			+	+
Mimosaceae	*Acacia*	*coriaceae subsp coriaceae*							+				+	+	
Mimosaceae	*Vachellia*	*farnesiana*	Mimosa Bush	+	+	+	+							+	+
Molluginaceae	*Mollugo*	*molluginensis*							+						
Moraceae	*Ficus*	*brachypoda*	Rock Fig		+										+
Moraceae	*Ficus*	*scobina*	Sandpaper fig					+							+
Myporaceae	*Eremophila*	*longifolia*			+										+
Myporaceae	*Erempholia*	*latrobei subsp glabra*										+			
Myrtaceae	*Corymbia*	*hamersleyana*			+	+		+			+				
Oleariaceae	*Jasminum*	*didymum*			+	+									+
Papilionaceae	*Alysicarpus*	*meullerii*									+				
Papilionaceae	*Cajanus*	*cinereus*										+			
Papilionaceae	*Carnivalia*	*rosea*										+			
Papilionaceae	*Crotalaria*	*cunninghamii*				+			+						
Papilionaceae	*Crotalaria*	*medicaginea*	Trefoil Rattlepod		+			+		+			+		+

Family	Genus	Species	Common Name	Status	Opportunistic A	D1	B1	B2	B4	B5	B6	B7	B8	B9	C1
Papilionaceae	*Cullen*	*leucanthum*													+
Papilionaceae	*Indigofera*	*colutea*	Sticky indigo							+					
Papilionaceae	*Indigofera*	*linifolia*	Native Indigo		+	+		+					+		+
Papilionaceae	*Indigofera*	*monophylla*			+	+									
Papilionaceae	*Indigofera*	*rugosa*					+	+			+				+
Papilionaceae	*Indigofera*	*trita*						+	+				+		+
Papilionaceae	*Isotropis*	*atropurpurea*			+						+				+
Papilionaceae	*Neptunia*	*dimorphantha*							+						
Papilionaceae	*Rhynchosia*	*minima*	Rhynchosia		+	+	+	+		+			+	+	+
Papilionaceae	*Sesbania*	*cannabina*			+		+		+	+			+		
Papilionaceae	*Swainsonia*	*formosa*	Sturts Desert Pea		+	+		+			+				+
Papilionaceae	*Swainsonia*	*pterostylis*				+				+			+		
Papilionaceae	*Tephrosia*	*rosea*	Flinders River Poison		+						+		+		+
Papilionaceae	*Vigna*	*lanceolata*			+		+	+		+					
Papilionaceae	*Zornia*	*muelleriana*			+	+									
Poaceae	*Aristida*	*contorta*	Bunched Kerosine grass		+						+				+
Poaceae	*Cenchrus*	*ciliaris*	Buffel Grass	+	+	+	+	+	+	+	+	+	+	+	+
Poaceae	*Cymbopogon*	*ambiguus*	Scent Grass		+	+		+							+
Poaceae	*Dichanthium*	*sericeum*	Queensland Blue Grass		+										
Poaceae	*Eragrostis*	*eriopoda*													+
Poaceae	*Eragrostis*	*setifolia*	Neverfail												
Poaceae	*Eragrostis*	*tenellula*			+	+		+			+				
Poaceae	*Eriachne*	*aristidea*			+								+		
Poaceae	*Eriachne*	*lanata*							+						

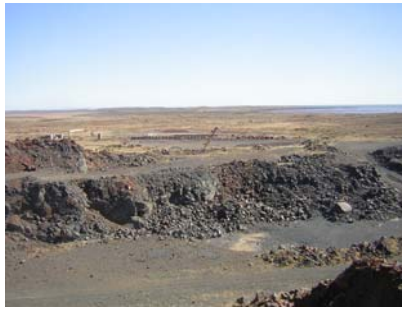
Family	Genus	Species	Common Name	Status	Opportunistic A	D1	B1	B2	B4	B5	B6	B7	B8	B9	C1
Poaceae	*Eriachne*	*mucronata*	Mountain Wanderrie Grass		+			+							+
Poaceae	*Iseilema*	*membranaceum*	Small Flinders Grass				+								
Poaceae	*Panicum*	*decompositum*	Native Millet												
Poaceae	*Paspalidium*	*basicladum*			+										
Poaceae	*Sorghum*	*timorense*			+										
Poaceae	*Spinifex*	*longifolius*										+			
Poaceae	*Themeda*	*sp.*	Kangaroo Grass			+		+							+
Poaceae	*Triodia*	*epactia?*			+										+
Poaceae	*Triodia*	*longicepts?*			+	+				+					+
Poaceae	*Triodia*	*pungens*			+	+	+	+	+		+			+	+
Portulacaeae	*Calandrinia*	*ptychosperma*						+			+				
Portulaceae	*Portulaca*	*conspicua*					+								+
Proteaceae	*Grevillea*	*pyramidalis*	Caustic Tree		+	+		+							+
Proteaceae	*Grevillea*	*wickihamii*			+	+	+				+				
Proteaceae	*Hakea*	*lorea subsp lorea*	Jingibrand		+	+	+								+
Scrophulariaceae	*Stemodia*	*viscosa*											+	+	
Solanaceae	*Solanum*	*diversifolium*			+	+					+				+
Solanaceae	*Solanum*	*lasiophyllum*			+	+									+
Solanaceae	*Solanum*	*phlomoides*				+									+
Sterculiaceae	*Waltheria*	*indica*				+		+		+	+		+		+
Tiliaceae	*Corchorus*	*laniflorus*			+	+		+							+
Tiliaceae	*Corchorus*	*walcottii*	Woolly Corchorus				+	+			+			+	+
Tiliaceae	*Triumfetta*	*apendiculata*				+					+				
Tiliaceae	*Triumfetta*	*clementii*			+	+	+	+						+	+

Family	Genus	Species	Common Name	Status	Opportunistic A	D1	B1	B2	B4	B5	B6	B7	B8	B9	C1
Violaceae	*Hybanthus*	*aurantiacus*	Orange Spade Flower					+			+				+
Zygophyllaceae	*Tribulus*	*hirsutus*			+			+	+	+			+		
Zygophyllaceae	*Tribulus*	*suberosus*	Cork Bush		+	+		+							+
Zygophyllaceae	*Zygophyllum*	*retivalve*													+

Table 11 Cape Lambert Transect Descriptions

D 1		***Minor Flowline*** **Spinifex with herbs**	**3/4**	**70**	**Stony flowline**	**Spinifex and mixed herbs**	**Some site clearing and rehabilitation.**
B 1		**Flood plain dominated by buffel grass and *Salsola kali***	**4/5**	**60**	**Red sand and stones**	**Salsola kali and Buffel grass**	**Site appears to have been cleared in the past . Now very degraded and dominated by weeds.**
B2			**3/4**	**80**	**Stoney plain**		**Site burnt appears to have been cleared.**

B3		***Hummock Grasslands*** **Spinifex with emergent *Acacia stellaticepts* not many herbs**	**2/3**	**Minor disturbances. Open ground and limited shrub layer indicative of frequent fire events.**
C1		***Hummock Grasslands***	**3/4**	**Minor disturbances. Open ground and limited shrub layer indicative of frequent fire events.**
C2		***Hummock Grasslands*** **Gully at base of rocky hills**	**3/4**	**Flow line has weeds including Buffel grass and Kapok Spinifex clumps reduced in size due to frequent fire events.**

C3		**Quarry**	**6**	**Existing rail ballast quarry**
B4		***Samphire and Halophytes with*** **Buffel grass**	**4/5**	**Site appears to have been previously cleared. Lots of weeds**
B5		***Samphire and Halophytes***	**3/4**	**Site disturbed informal tracks leading tot coast. Rubbish dumping**

B6		***Major Flowline*** **Creek near railway Mud and salt crystals Acacia, Mangroves chenopods and grass**	**3/4**	**Creek banks are dominated by buffel grass.**
B7		***Samphire and Halophytes with*** **Buffel grass**	**4/5**	**Very weedy site appears to have been cleared.**
B8		***Tussock Grass lands***	**4/5**	

B9		***Hummock Grasslands***	**4/5**	**Site very weedy. Cleared for powerlines and gas pipeline.**

Appendix D

Fauna

Western Australian Wildlife Conservation Act 1950 Conservation Codes

DEC Priority Fauna Codes

Fauna Species observed in the Cape Lambert Study area

Table 12 *Western Australian Wildlife Conservation Act 1950* Conservation Codes

Conservation Code	Description
Schedule 1	"…fauna that is rare or likely to become extinct, are declared to be fauna that is in need of special protection."
Schedule 2	"…fauna that is presumed to be extinct, are declared to be fauna that is in need of special protection."
Schedule 3	"…birds that are subject to an agreement between the governments of Australia and Japan relating to the protection of migratory birds and birds in danger of extinction, are declared to be fauna that is in need of special protection."
Schedule 4	"…fauna that is in need of special protection, otherwise than for the reasons mentioned [in Schedule 1 – 3]"

Table 13 DEC Priority Fauna Codes

(Species not listed under the *Wildlife Conservation Act 1950*, but for which there is some concern)

Conservation Code	Description
Priority 1	Taxa with few, poorly known populations on threatened lands.
Priority 2	Taxa with few, poorly known populations on conservation lands. Taxa which are known from few specimens or sight records from one or a few localities on lands not under immediate threat of habitat destruction or degradation, e.g. national parks, conservation parks, nature reserves, State forest, vacant Crown Land, water reserves, etc.
Priority 3	Taxa which are known from few specimens or sight records, some of which are on lands not under immediate threat of habitat destruction or degradation.
Priority 4	Rare taxa. Taxa which are considered to have been adequately surveyed and which, whilst being rare (in Australia), are not currently threatened by any identifiable factors. These taxa require monitoring every 5 – 10 years.
Priority 5	Taxa in need of monitoring. Taxa which are not considered threatened but are subject to a specific conservation program, the cessation of which would result in the species becoming threatened within five years.

EPBC Act Fauna Conservation Categories

Listed threatened species and ecological communities

An action will require approval from the Environment Minister if the action has, will have, or is likely to have a significant impact on a species listed in any of the following categories:

- extinct in the wild,
- critically endangered,
- endangered, or
- vulnerable.

An action will also require approval from the Environment Minister if the action has, will have, or is likely to have a significant impact on an ecological community listed in any of the following categories:

- critically endangered, or
- endangered.

Critically endangered and endangered species

An action has, will have, or is likely to have a significant impact on a critically endangered or endangered species if it does, will, or is likely to:

- lead to a long-term decrease in the size of a population, or
- reduce the area of occupancy of the species, or
- fragment an existing population into two or more populations, or
- adversely affect habitat critical to the survival of a species, or
- disrupt the breeding cycle of a population, or
- modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline, or
- result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat*, or
- introduce disease that may cause the species to decline, or
- interfere with the recovery of the species.

**Introducing an invasive species into the habitat may result in that species becoming established. An invasive species may harm a critically endangered or endangered species by direct competition, modification of habitat, or predation.*

Vulnerable species

An action has, will have, or is likely to have a significant impact on a vulnerable species if it does, will, or is likely to:

- Lead to a long-term decrease in the size of an important population of a species, or
- reduce the area of occupancy of an important population, or
- fragment an existing important population into two or more populations, or
- adversely affect habitat critical to the survival of a species, or

– disrupt the breeding cycle of an important population, or
– modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline, or
– result in invasive species that are harmful a vulnerable species becoming established in the vulnerable species' habitat*, or
– introduce disease that may cause the species to decline, or
– interferes substantially with the recovery of the species.

An important population is one that is necessary for a species' long-term survival and recovery. This may include populations that are:

– key source populations either for breeding or dispersal,
– populations that are necessary for maintaining genetic diversity, and/or
– populations that are near the limit of the species range.

*Introducing an invasive species into the habitat may result in that species becoming established. An invasive species may harm a vulnerable species by direct competition, modification of habitat, or predation.

Listed migratory species

An action will require approval from the Environment Minister if the action has, will have, or is likely to have a significant impact on a listed migratory species. Note that some migratory species are also listed as threatened species. The criteria below are relevant to migratory species that are not threatened.

An action has, will have, or is likely to have a significant impact on a migratory species if it does, will, or is likely to:

– substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat of the migratory species, or
– result in invasive species that is harmful to the migratory species becoming established* in an area of important habitat of the migratory species, or
– seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of the species.

An area of important habitat is:

– habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species, or
– habitat utilised by a migratory species which is at the limit of the species range, or
– habitat within an area where the species is declining.

Listed migratory species cover a broad range of species with different life cycles and population sizes. Therefore, what is an ecologically significant proportion of the population varies with the species (each circumstance will need to be evaluated).

*Introducing an invasive species into the habitat may result in that species becoming established. An

invasive species may harm a migratory species by direct competition, modification of habitat, or predation.

The Commonwealth marine environment

An action will require approval from the Environment Minister if:

- the action is taken in a Commonwealth marine area and the action has, will have, or is likely to have a significant effect on the environment, or
- the action is taken outside a Commonwealth marine area and the action has, will have, or is likely to have a significant effect on the environment in a Commonwealth marine area.

An action has, will have or is likely to have a significant impact on the environment in a Commonwealth marine area if it does, will, or is likely to:

- result in a known or potential pest species becoming established in the Commonwealth marine area*, or
- modify, destroy, fragment, isolate or disturb an important or substantial area of habitat such that an adverse impact on marine ecosystem functioning or integrity in a Commonwealth marine area results, or
- have a substantial adverse effect on a population of a marine species or cetacean including its life cycle (eg breeding, feeding, migration behaviour, and life expectancy) and spatial distribution, or
- result in a substantial change in air quality** or water quality (including temperature) which may adversely impact on biodiversity, ecological integrity, social amenity or human health, or
- result in persistent organic chemicals, heavy metals, or other potentially harmful chemicals accumulating in the marine environment such that biodiversity, ecological integrity, social amenity or human health may be adversely affected.

**Translocating or introducing a pest species may result in that species becoming established.*

***The Commonwealth marine area includes any airspace over Commonwealth waters.*

(Department of Environment and Heritage, 2006)

Table 14 Listing of Potentially Occurring Significant, Rare and Priority Fauna Species within the Study Area, Protected Matters EPBC search

Roebourne	**WAM FaunaBase search approx 20km buffer**				
Family	Genus	Species	Common Name	EPBC Status	DEC Priority Status
Reptiles					
Agamidae	*Ctenophorus*	*caudicinctus*	Ring-tailed Dragon		
Agamidae	*Ctenophorus*	*caudicinctus caudicinctus*	Ring-tailed Dragon		
Agamidae	*Ctenophorus*	*isolepis isolepis*	Central Military Dragon		
Agamidae	*Ctenophorus*	*nuchalis*	Central Netted Dragon		
Agamidae	*Lophognathus*	*longirostris*	Long-nosed Dragon		
Boidae	*Antaresia*	*perthensis*	Anthill Python		
Colubridae	*Fordonia*	*leucobalia*	White-bellied Mangrove Snake		
Elapidae	*Demansia*	*psammophis cupreiceps*	Western Copper-headed Whipsnake		
Elapidae	*Demansia*	*rufescens*	Rufous Whipsnake		
Elapidae	*Furina*	*ornata*	Orange-naped Snake		
Elapidae	*Hydrelaps*	*darwiniensis*	Black-ringed Mangrove Snake		
Elapidae	*Pseudonaja*	*nuchalis*	Western Brown Snake		
Elapidae	*Suta*	*fasciata*	Rosen's Snake		
Elapidae	*Suta*	*punctata*	Little Spotted Snake		
Gekkonidae	*Gehyra*	*punctata*	Spotted Dtella		

Roebourne	WAM FaunaBase search approx 20km buffer				
Gekkonidae	*Gehyra*	*variegata*	-		
Gekkonidae	*Heteronotia*	*binoei*	Bynoe's Gecko		
Gekkonidae	*Strophurus*	*ciliaris aberrans*	Northern Spiny-tailed Gecko		
Pygopodidae	*Delma*	*pax*	-		
Pygopodidae	*Lialis*	*burtonis*	Burton's Legless Lizard		
Scincidae	*Ctenotus*	*grandis titan*	-		
Scincidae	*Ctenotus*	*pantherinus ocellifer*	Leopard Ctenotus		
Scincidae	*Ctenotus*	*saxatilis*	Rock Ctenotus		
Scincidae	*Ctenotus*	*serventyi*	-		
Scincidae	*Lerista*	*bipes*	-		
Scincidae	*Lerista*	*muelleri*	-		
Scincidae	*Menetia*	*greyii*	-		
Scincidae	*Tiliqua*	*multifasciata*	Centralian Blue Tongue		
Typhlopidae	*Ramphotyphlops*	*grypus*	-		
Varanidae	*Varanus*	*acanthurus*	Spiny-tailed Monitor		
Varanidae	*Varanus*	*brevicauda*	Short-tailed Pygmy monitor		
Varanidae	*Varanus*	*eremius*	Pygmy Desert Monitor		
Mammals					
Dasyuridae	*Dasykaluta*	*rosamondae*	Little Red Kaluta		
Dasyuridae	*Dasyurus*	*hallucatus*	Northern Quoll	Endangered	Schedule 1
Dugongidae	*Dugong*	*dugon*	Dugong		Schedule 4

Roebourne	WAM FaunaBase search approx 20km buffer				
Macropodidae	*Lagostrophus*	*fasciatus fasiatus*	Banded Hare Wallaby		Schedule 1
Macropodidae	*Macropus*	*robustus erubescens*	Biggada		
Muridae	**Mus*	*musculus*	House Mouse		
Muridae	*Pseudomys*	*chapmani*	Western Pebble-mound Mouse		Priority 4
Muridae	*Pseudomys*	*delicatulus*	Little Native Mouse		
Muridae	*Pseudomys*	*hermannsburgensis*	Sandy Inland Mouse		
Muridae	**Rattus*	*rattus*	Black Rat		
Vespertilionidae	*Chalinolobus*	*gouldii*	Gould's Wattled Bat		
Vespertilionidae	*Vespadelus*	*finlaysoni*	Finlayson's Cave Bat		
Vespertilionidae	*Vespadelus*	*regulus*	Southern Forest Bat		
Birds					
Acanthizidae	*Gerygone*	*tenebrosa*	Dusky Gerygone		
Accipitridae	*Circus*	*assimilis*	Spotted Harrier	Migratory	
Alaudidae	*Mirafra*	*javanica horsfieldii*	Australasian Lark		
Anatidae	*Anas*	*gracilis*	Grey Teal		
Anatidae	*Anas*	*rhynchotis rhynchotis*	Australasian Shoveler		
Anatidae	*Chenonetta*	*jubata*	Australian Wood Duck		
Artamidae	*Artamus*	*cinereus*	Black-faced Woodswallow		
Campephagidae	*Coracina*	*novaehollandiae subpallida*	Black-faced Cuckoo-Shrike		

Roebourne	WAM FaunaBase search approx 20km buffer			
Charadriidae	*Charadrius*	*ruficapillus*	Red-capped Plover	
Columbidae	*Geopelia*	*humeralis*	Bar-shouldered Dove	
Cuculidae	*Cuculus*	*saturatus optatus*	Horsfield's Cuckoo	
Halcyonidae	*Todiramphus*	*chloris pilbara*	Collared Kingfisher	
Meliphagidae	*Lichenostomus*	*penicillatus*	White-plumed Honeyeater	
Meliphagidae	*Melithreptus*	*gularis laetior*	Black-chinned Honeyeater	
Muscicapidae	*Ficedula*	*cyanomelana cyanomelana*	-	
Otididae	*Ardeotis*	*australis*	Australian Bustard	Priority 4
Pachycephalidae	*Pachycephala*	*lanioides*	The White-breasted Whistler	
Passeridae	*Emblema*	*pictum*	Painted Finch	
Passeridae	*Neochmia*	*ruficauda*	Star Finch	
Passeridae	*Neochmia*	*ruficauda clarescens*	Star Finch	
Petroicidae	*Eopsaltria*	*pulverulenta*	Mangrove Robin	
Phasianidae	*Coturnix*	*ypsilophora cervina*	Brown Quail	
Podargidae	*Podargus*	*strigoides*	Tawny Frogmouth	
Podargidae	*Podargus*	*strigoides brachypterus*	Tawny Frogmouth	
Sylviidae	*Acrocephalus*	*australis gouldi*	Australian Reed Warbler	
Zosteropidae	*Zosterops*	*luteus balstoni*	Yellow White-eye	
Amphibians				
Hylidae	*Cyclorana*	*maini*	Main's Frogs	

Roebourne	WAM FaunaBase search approx 20km buffer		
Hylidae	*Litoria*	*rubella*	Desert Tree Frog

Table 15 Fauna Species Observed within the Study Area – July and August 2008

Family	Genus	Species	Common name
Mammals			
Macropodidae	Macropus	rufus	Kangaroo
Macropodidae	Macropus	robustus	Common Wallaroo
Birds			
Accipitridae	Aquila	audax	Wedge-tailed Eagle
Artamidae	Artamus	personatus	Masked Woodswallow
Psittacidae	Cacatua	sanguinea	Little Corella
Charadriidae	Charadrius	ruficapillus	Red Capped Plover
Accipitridae	Circus	assimilis	Spotted Harrier
Campephagidae	Coracina	novaehollandiae	Black-faced Cuckoo-shrike
Cracticidae	Cracticus	nigrogularis	Pied Butcherbird
Cuculus	Cuculus	pallidus	Pallid Cuckoo
Passeridae	Emblema	pictum	Painted Finch
Falconidae	Falco	cenchroides	Nankeen Kestrel
Alcedinidae	Geopelia	cuneata	Diamond Dove
Accipitridae	Haliaeetus	leucogaster	White-bellied Sea-Eagle
Accipitridae	Haliastur	sphenurus	Brahminy Kite
Accipitridae	Hieraaetus	morphnoides	Little Eagle
Meliphagidae	Lichenostomus	virescens	Singing Honeyeater
Meliphagidae	Lichenostomus	keartlandi	Grey-headed Honeyeater
Accipitridae	Lophoictinia	isura	Square-tailed Kite
Meliphagidae	Manorina	flavigula	Yellow-throated Minor
Psittacidae	Melopsittacus	undulatus	Budgerigar
Meropidae	Merops	ornatus	Rainbow Bee-eater
Alcedinidae	Ocyphaps	lophotes	Crested Pigeon

Family	Genus	Species	Common name	
Dicruridae	Rhipidura	leucophrys	Willie Wagtail	
Passeridae	Taeniopygia	guttata	Zebra Finch	
Reptiles				
Varanidae	Varanus	sp		Tracks only
Agamidae	Amphibolurus	longirostris	Long Nosed Dragon	
Agamidae	Ctenophorus	isolepis isolepis	Central Military Dragon	

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