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Main Roads Western Australia

Great Northern Highway
SLK 568 Pit Expansion

Biological Survey

November 2010



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Executive Summary

A biological survey of the SLK 568 pit expansion areas was undertaken by qualified ecologists in August 2010. The following conclusions were made:

- ▶ Vegetation of the Project Area occurs in an area of *Least Concern* with approximately 100% of the pre-European vegetation extent remaining;
- ▶ The Project Area occurs within the buffer of a Priority Ecological Community associated with a banded ironstone formation ridgeline. This formation will not be impacted by the proposed works;
- ▶ A total of eight Priority Flora taxa were indicated from database records to occur or potentially occur within the vicinity of the Project Area;
- ▶ A search of threatened flora databases identified four Priority taxa, two EPBC Act *Vulnerable*, and one WC Act Schedule 1 species potentially occurring in the Project Area. A number of Migratory and Marine Listed taxa have also been indicated to occur in the Project Area;
- ▶ One vegetation type was recorded within the Project Area, deemed to be similar to the Vegetation Association indicated by the desktop assessment;
- ▶ The vegetation within the Project Area was considered to be in Excellent to Very Good condition within little impact from weed invasion, but obvious impact from grazing by livestock, feral and native fauna;
- ▶ Three Priority Flora taxa were recorded from the Project Area:
 - *Stenanthemum mediale* (Priority 1);
 - *Euryomyrtus recurva* (Priority 3); and
 - *Dicrastylis linearifolia* (Priority 3).
- ▶ None of the Priority Flora recorded from the Project Area had been indicated by the database searches to be present;
- ▶ Habitat for the Priority Flora taxa recorded is deemed to be common within the local and regional area in as good or better condition. Depending on the final design of the proposed material extraction pit, the impact to these taxa remains uncertain;
- ▶ A total of seven birds, four mammals (three introduced) and one reptile were recorded from the Project Area;
- ▶ No threatened fauna species were recorded from the Project Area. One Marine listed species was recorded from the Project Area. This taxon, Black-faced Cuckoo-shrike, is common in Western Australia and not considered to be under threat.
- ▶ Fauna habitat recorded in the Project Area is common in the local and regional area. Fauna linkages are not considered to be interrupted by the proposed project;



- ▶ An assessment of the project was undertaken against the 10 Clearing Principles. The project was deemed to “may be at variance” against Principle (a) only if Priority Plant locations cannot be avoided. If the plant locations can be avoided, this project is deemed to be “not at variance”.

GHD recommends that Main Roads Western Australia liaise with the DEC with regards to the presence of Priority Flora within the Project Area. The finalisation of extraction pit design is considered likely to assist in this process.



1. Introduction

1.1 Background

Main Roads Western Australia (Main Roads) has commissioned GHD Pty Ltd (GHD) to undertake biological survey of a proposed strategic material source area west of the Great Northern Highway. The proposed pit expansion (the Project) is located north of Mt Magnet at approximately 568 Standard Length Kilometres (SLK).

The Project location and GHD survey area is presented in Figure 1. The area immediately to the north of the Project was previously surveyed by GHD in 2008.

1.2 Scope of Work

Main Roads has commissioned GHD Pty. Ltd. (GHD) to undertake a biological survey of the Project Area. This included a desktop assessment prior to the field survey in order to consider biological constraints in or adjacent to the Project Area.

The purpose of the survey is to provide an appropriate examination and description of the receiving environment to ensure that issues of biological/ecological significance are identified and recorded.



2. Methodology

2.1 Project Area

The survey area to be examined as part of this Project is approximately 40 hectares in size.

2.2 Desktop Assessment

The desktop assessment included a literature review of the following factors:

- ▶ Listed wetlands (refer to Section 3.3);
- ▶ Public drinking water catchment areas (refer to Section 3.4);
- ▶ Adjoining land use, including conservation reserves or other listed areas such as Bush Forever sites or Red Book sites (refer to Section 3.5 and 3.6);
- ▶ Environmentally Sensitive Areas (refer to Section 3.6.1);
- ▶ Broad vegetation types shown in existing mapping (refer to Section 3.7.1);
- ▶ Remnant vegetation clearing in relation to statutory requirements (refer to Section 3.7);
- ▶ Threatened Ecological Communities (refer to Section 3.7.3);
- ▶ Threatened or otherwise protected Flora (refer to Section 3.8.1);
- ▶ Threatened or otherwise protected Fauna (refer to Section 3.9.3).

2.3 Vegetation and Flora Survey

Suitably qualified GHD Ecologists undertook a biological survey of the Project Area between 11 and 13 August 2010, with reference to the Environmental Protection Authority (EPA) (2004a): Guidance Statement No. 51 Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia.

The survey was undertaken according to the following process:

- ▶ Assessment of the vegetation within the Project Area was undertaken by examining two quadrats and a wandering transect throughout the Project Area inside the bounding co-ordinates of the Project Area;
- ▶ The vegetation types and their boundaries were delineated, recording vegetation composition, condition rating, weed species and evidence of disturbance;
- ▶ Vegetation types were identified by a combination of aerial photography and field observation;
- ▶ The vegetation in the Project Area was given a condition rating based on the Bush Forever Volume 2 vegetation condition ratings scale (Keighery, 1994);
- ▶ The presence of potential Threatened Ecological Communities (TECs) in the area was assessed;



- ▶ A search of the Department of Environment and Conservation's (DEC's) Declared Rare and Priority Flora databases (DEC, 2009a) and the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) Protected Matters Search Tool (DEWHA, 2009a) was undertaken to identify significant flora known or considered likely to occur in the area;
- ▶ Suitable habitat for Declared Rare and Priority Flora species was searched during the survey to determine the presence of recorded and previously unrecorded threatened flora; and
- ▶ Where field identification of plant taxa was not possible, specimens were collected in a systematic manner so that they could be later identified at the Western Australian Herbarium by comparison with the reference collection and use of identification keys. Nomenclature of the species follows that of *FloraBase* (DEC, 2009b).

2.4 Fauna Survey

Suitably qualified GHD Ecologists undertook an opportunistic fauna survey concurrently with the flora survey between 11 and 13 August 2010, with reference to the EPA (2004b) Guidance Statement No. 56: Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia. The fauna survey was undertaken according to the following process:

- ▶ An opportunistic recording of species, including pest, declared or feral animals;
- ▶ Identification of any habitats of significance; and
- ▶ An assessment of the value of the Project Area in providing habitat and facilitating movement between conservation areas.

The fauna survey was limited to terrestrial and vertebrate species.

2.5 Field Assessments of Wetland and Drainage

The field survey included the following with regards to wetlands and drainage:

- ▶ An assessment and description of existing drainage patterns with respect to topography, and to flora and fauna communities; and
- ▶ An inventory and brief description of wetlands in the Project Area, and their conservation value.



3. Desktop Assessment

3.1 Climate

The Project Area is best described as having an arid to semi-arid warm Mediterranean climate (Australian Government, 2009a). The Bureau of Meteorology station located closest to the Project Area is at Mount Magnet airport. Recorded climatic data is summarised as follows:

- ▶ Mean Maximum Temperature: 38.2 °C in January to 18.7 °C in July;
- ▶ Mean Minimum Temperature: 22.2 °C in January to 6.7 °C in July;
- ▶ Mean Annual Rainfall: 238.4 mm;
- ▶ Mean Annual Rain Days: 29.8.

(Source: Bureau of Meteorology, 2010).

3.1.1 Climate 2010

The field survey was undertaken in late winter – early spring, following the Winter rainfall period. Mount Magnet received 65.4 millimetres (mm) in winter 2010 against a long term average of 79.0 mm. The area received 143.4 mm of rainfall in the 6 months prior to the survey, against a long-term average of 147.9 mm.

3.2 Geology and Soils

The Project Area is located in the Yalgoo Plains Zone of the Murchison Province. Hardpan wash plains with sandplains, hills and stony plains on granite rock of the Yilgarn Craton characterise this zone. Red-brown hardpan shallow loams and Red shallow sands and deep sandy duplexes are located in this area (Tille, 2006).

The Geological Survey of Western Australia (2010) describes the soils of the Project Area as comprising:

Ab: Metamorphosed basic and ultrabasic volcanic and intrusive rocks; and

Agn: Granit and Gneiss

3.3 Rivers and Wetlands

No rivers or wetlands are located within the Project Area.

WetlandBase (2009) identifies a wetland area within 20 km of the Project Area, identified as a *non-perennial* lake. This is the southern arm of Lake Austin. This lake will not be impacted by the proposed works.

3.4 Public Drinking Water Supply Areas

The Project Area is not located within any gazetted Public Drinking Water Supply Areas protected under the Country Areas Water Supply Act 1947. The nearest Public



Drinking Water Supply Area identified is Mount Magnet (Genga) Water reserve, located approximately 12 km south of the Project Area (Department of Water, 2010).

3.5 Land Use

Australian Government (2009b) identifies surrounding land uses to the Project Area as:

- ▶ No known intensive use; and
- ▶ Other minimal use.

3.6 Reserves and Conservation Areas

No reserves or conservation areas were located near the Project Area.

3.6.1 Environmentally Sensitive Areas

No Environmentally Sensitive Areas (ESA's) have been recorded within the vicinity of the Project Area (Department of Environment and Conservation, 2009c).

3.7 Vegetation

3.7.1 Vegetation Types

Beard (1974) identifies the Project Area as likely to contain Vegetation Association 18:

- ▶ Low woodland, mulga (*Acacia aneura*).

3.7.2 Vegetation in a Regional Context

A vegetation type is considered underrepresented if there is less than 30% of its original extent remaining. From a biodiversity perspective, and taking no account of any other land degradation issues, there are several key criteria applied to vegetation where clearing is still occurring (EPA Position Statement No. 2, December 2000).

- ▶ The “threshold level” below which species loss appears to accelerate exponentially at an ecosystem level is regarded as being at a level of 30% of the pre-European extent of the vegetation type. Vegetation communities where less than 30% of the original vegetation extent remain are referred to as “Vulnerable”; and
- ▶ A level of 10% of the original vegetation extent is regarded as being a level representing an “Endangered” vegetation community. Clearing which would put a vegetation type into this category should be avoided.

Such Vegetation community status can be delineated into five 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 remains;
- ▶ *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 percent of pre-European vegetation that remains for vegetation associations within each Interim Biogeographic Regionalisation of Australia (IBRA) region are provided by Shepherd (2005) to give an indication of the regional impact of proposed clearing.

Vegetation Association 18 is indicated to retain 100% of the original regional vegetation extent remaining intact as at 2005 and is classified as "Least Concern". Clearing of this vegetation is not considered contradictory to the EPA's recommendations stated in Position Statement No. 2.

Table 1 Regional Assessment of Vegetation Extent for the Eastern Murchison Bioregion

Vegetation Association	Description	Pre-European Extent (Ha)	Current Extent (Ha)	% Remaining (2005)	Status
18	Low woodland; <i>Acacia aneura</i> (mulga)	10,269,894.52	10,269,894.52	100	Least Concern

Source: Shepherd (2005)

3.7.3 Threatened Ecological Communities

Ecological communities are defined as 'naturally occurring biological assemblages that occur in a particular type of habitat' (English and Blythe, 1997). Threatened Ecological Communities (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 trigger the EPBC Act. The EPA's position on TECs states that proposals that result in the direct loss of TECs are likely to require formal assessment. 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. These are ecological communities that area 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.

No TECs protected under the *Environment Protection and Biodiversity Conservation Act 1999* are known to be present within vicinity of the Project Area (Department of the Environment, Water, Heritage and the Arts, 2009a). Investigation via Natural



Resource Management (NRM) Shared Land Information Portal (SLIP) showed no TECs within or near the Project Area (Natural Resource Management, 2009).

The Project Area is known to occur within the buffer zone of Priority 1 PECs associated with Banded Ironstone Formation (BIF) vegetation located within the vicinity of Lake Austin (c. 20 km to the north-east of the Project Area) and Mount Magnet (c. 10 km to the east of the Project Area). Neither BIF will be impacted by the proposed works.

3.7.4 Diseases and Pathogens

Phytophthora cinnamomi threatens over 2,300 (40%) of different plant species in Western Australia. Once the pathogen infects the roots, the plant may begin to show symptoms of 'dying back', hence the common name used for the pathogen: Dieback. However, for many species 'sudden death' is a better description. Introduced following European settlement, *Phytophthora cinnamomi* is a soil-borne pathogen that kills a wide range of native plant species in the south west of Western Australia by attacking their root system. *Phytophthora cinnamomi* can also survive and reproduce on a wide range of native plant species without killing them. It has a widespread but discontinuous range in areas of the south-west with an annual rainfall above 400 mm (Dieback Consultative Council, 2001).

Indigenous species most affected by *Phytophthora cinnamomi* belong to four families: Proteaceae, Ericaceae, Fabaceae, and Myrtaceae. Not all genera within a family or all species within a genus are necessarily susceptible. The Project Area occurs outside this area, with a mean annual rainfall of 238.4 mm (Bureau of Meteorology, 2010). The Project Area is therefore not considered likely to be susceptible to the impacts of the *Phytophthora cinnamomi* pathogen.

3.8 Flora

3.8.1 Threatened and Priority Flora

Flora species considered to be significant are listed under the *Wildlife Conservation Act* (1950) and the *Environmental Protection and Biodiversity Conservation Act 1999*. The Department of Environment and Conservation (DEC) also keeps a list of Priority Species that are not listed under legislation but for which the DEC feels there is a cause for concern, or for which not enough information is known.

Commonwealth

An *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act 1999) Protected Matters Search (DEWHA, 2009a) was undertaken for the Project Area. No EPBC Act protected flora species were identified as being likely to occur within a 10 km buffer of the Project Area.

State

A search was undertaken through the DEC Threatened (*Declared Rare*) Flora Database and the *Western Australian Herbarium Specimen* (WAHERB) database for



Threatened and Priority Flora taxa located within the search co-ordinates 27°51' - 28°01' S and 117°43' - 117°56' E.

Table 5 (Appendix A) provides a description of those species recorded on the WAHERB database for DEC's search area. NO Declared Rare Flora taxa were identified as having been recorded within the vicinity of the search area. However, seven priority species were recorded. Recorded locations of these species are presented in Figure 1.

No results were recorded for the search areas from the Threatened (Declared Rare) Flora Database.

The DEC search also includes results from their *Declared Rare and Priority Flora* list. The species in this list are those known to exist in the general surrounds and not to this Survey Area specifically. Two species were recorded on this list and are identified in Table 5 with the WAHERB database results.

Assessment

Of the Threatened and Priority Flora listed from the database searches, only one taxon is considered likely to occur in the Project Area: *Ptilotus luteolus* (Priority 3).

The Project Area is considered not to contain preferred habitat for the remaining taxa.

The GHD (2008) survey of the pit expansion area located immediately to the north of the Project Area did not record any significant flora taxa.

3.9 Fauna

3.9.1 Fauna Habitat

The dominant habitat types located at the Project Area is likely to be Low Woodland; *Acacia aneura* (Section 3.7.1). This vegetation type is likely to provide shelter for a wide range of fauna species.

It has been estimated that approximately 100% of the pre-European extent of the dominant vegetation type remains within the region (refer to Table 1).

3.9.2 Existing Fauna Records

A search of *NatureMap* Records (sourced from the DEC and records of the Western Australian Museum) (DEC and WAM, 2009) was undertaken for the Project Area, inclusive of a 15 km buffer. The *NatureMap* records show that one mammal, three bird and 18 reptile species have been officially recorded as present within the search area (Table 10, Appendix B).

3.9.3 Threatened and Priority Fauna

The conservation of fauna species and their significance status is currently assessed under both State and Commonwealth Acts. The acts include the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* and the Western



Australian *Wildlife Conservation Act* (1950).

Commonwealth

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* and the circumstances under which a project will trigger referral to the DEWHA are described Appendix B.

The *EPBC Act* also protects migratory species that are listed under the following International Agreements:

- ▶ Appendices to the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animals) for which Australia is a range state under the Convention;
- ▶ The Agreement between the Government of Australia and the Government of the People's Republic of China for the Protection of Migratory Birds and their Environment (CAMBA);
- ▶ The Agreement between the Government of Japan and the Government of Australia for the Protection of Migratory Birds and Birds in Danger of Extinction and their Environment (JAMBA);
- ▶ The Agreement between the Government of Australia and the Government of the Republic of Korea on the Protection of Migratory Birds (ROKAMBA); and
- ▶ Listed migratory species also include species identified in other international agreements approved by the Commonwealth Environment Minister.

The Act also protects marine species on Commonwealth lands and waters.

State

The *Wildlife Conservation Act* (1950) uses a set of Schedules but also classifies species using some of the IUCN categories (Table 8, Appendix B).

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 considered. 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 9, Appendix B.

Assessment

DEWHA Protected Matters Search Tool (DEWHA, 2009a) and the DEC threatened fauna database search (DEC, 2009d), identified four Priority, two EPBC Act *Vulnerable*, and one WC Act Schedule 1 species potentially occurring in the Project Area (Table 10, Appendix B). A number of Migratory and Marine Listed taxa have also been indicated to occur in the Project Area.



3.9.4 Introduced Species

The following introduced exotic mammal species are known to occur in the region:

- ▶ **Mus domesticus* (House Mouse)
- ▶ **Canis lupus dingo* (Dingo);
- ▶ **Vulpes vulpes* (Red Fox);
- ▶ **Felis catus* (Cat);
- ▶ *Oryctolagus cuniculus* (European Rabbit);
- ▶ **Equus caballus* (Brumby, Horse);
- ▶ **Bos taurus* (European Cattle);
- ▶ **Capra hircus* (Goat); and
- ▶ **Ovis aries*(Sheep).
- ▶ **Equus asinus* (Donkey)
- ▶ **Camelus dromedarius* (Dromedary Camel).

Source: Australian Government (2009).



4. Field Investigation

4.1 Physical Environment

4.1.1 Influence of Climate

The Project Area received a slightly reduced average Winter rainfall, and as a consequence, this has been reflected in annual flora species being collected in areas where water has pooled for an increased period.

Grass species were poorly recorded in the Project Area, considered to be result of a combination of below-average rainfall and grazing by livestock, feral and native fauna.

During the field survey, the weather was mild and very windy (11 to 12 August) and cool wet and windy (13 August). The windy weather reduced the numbers of bird species recorded, and the season (Winter) resulted in a paucity of reptile records.

4.1.2 Soil

Soils of the Project Area were generally uniform, with minor areas of gravel visible at the surface. Soils were typically red-brown sandy loam across the Project Area.

4.2 Field Assessment of Wetlands and Drainage

No permanent wetlands or watercourses occur in the Project Area.

One small ephemeral drainage line occurs in the western third of the Project Area, draining higher ground and small outcrops from the north of the Project Area to the south.

A slightly larger drainage line occurs immediately to the south-east of the Project Area. Evidence of sheetwash was present in the south-east corner of the Project area. This is considered likely to only occur after heavy rain events.

The extraction of material within the Project Area is not considered to significantly alter local and regional flow of water, or impact on the quality of surface or ground waters.

4.3 Vegetation

4.3.1 Vegetation Description

Two quadrats were surveyed within the Project Area. Both quadrats indicated that the Project Area is dominated by mulga (*Acacia aneura* varieties) with other mixed *Acacia* species, over *Eremophila* and *Aluta* dominated shrublands.

Specifically, the Project Area was deemed to contain one vegetation type, ranging from a Low Open Woodland dominated by *Acacia aneura* variants on heavier soils in flatter areas to an Open Scrub dominated by *Acacia ramulosa* on higher sandier portions over Open Shrubland to Low Open Shrubland of *Aluta aspera subsp. hesperia*,



Eremophila forrestii subsp. *forrestii*, *E. georgei*.

Within the Project Area there are scattered emergent Eucalyptus species: *E. kingsmillii* on heavier soils and *E. oldfieldii* in sandier areas.

4.3.2 Local and Regional Significance of Vegetation

The National Objectives and Targets for Biodiversity Conservation 2001-2005 (Commonwealth of Australia, 2001) recognise that the retention of 30 per cent or more of the pre-clearing extent of each ecological community is necessary if Australia's biological diversity is to be protected.

The vegetation type recorded from the field survey can be considered to be comparable to the Vegetation Association 18 described by Beard.

4.3.3 Vegetation Condition

The vegetation in the Project Area was given a condition rating based on the Bush Forever Volume 2 vegetation condition ratings scale (Keighery, 1994).

The ratings in this scale are described in Table 6, Appendix A.

The condition of vegetation within the Project Area was considered to be uniform, with main impacts caused by grazing of livestock, feral and native fauna, and a large sheetwash flow across the south-east portion. No weed species were recorded within the Project Area. The vegetation of the Project Area was rated as Excellent to Very Good, with a vegetation structure generally intact, no weed species, and disturbance limited to grazed palatable flora (especially grasses).

4.3.4 Threatened and Priority Ecological Communities

The vegetation type identified during the time of survey is not considered to represent any Threatened or Priority Ecological Community. GHD does not consider vegetation types within the Project Area to hold particular conservation significance.

4.4 Flora

The field survey was conducted in late in the season of greatest rainfall, so as to maximise the chances of recording annual taxa, as recommended by Guidance Statement No. 51 (EPA, 2004a). The winter rainfall received by the Project Area was approximately just below average, and as such, the timing of the survey and the representation of annuals in the Project Area is considered adequate. Only three taxa could not be adequately identified during the survey, due to lack of flowering material.

Results from the field survey revealed a total of 79 taxa from 27 families (no introduced species). This is considered to be a good representation of the local and regional flora.

The dominant families were:

- Fabaceae (wattles, peas, sennas) 14 taxa;

- ▶ Asteraceae (daisies) 13 taxa;
- ▶ Scrophulariaceae (poverty bushes) eight taxa; and
- ▶ Myrtaceae (eucalypts, myrtles) seven taxa.

The dominant genera were:

- ▶ *Acacia* (wattles) 10 taxa;
- ▶ *Eremophila* (poverty bushes) eight taxa; and
- ▶ *Ptilotus* (mulla mullas) three taxa.

A full list of flora identified in the Project Area is provided in

4.4.1 Threatened and Priority Flora Species

No Declared Rare Flora taxa were recorded from the Project Area.

Three Priority Flora taxa were recorded from the Project Area. None of the taxa recorded were indicated as likely to occur within the vicinity of the Project Area as a result of database searches. The Priority Flora recorded from the Project Area are:

- ▶ *Stenanthemum mediale* (Priority 1);
- ▶ *Euryomyrtus recurva* (Priority 3); and
- ▶ *Dicrastylis linearifolia* (Priority 3).

An assessment of the significance of these records is provided below. Location of these taxa within the Project Area is provided in Figure 2.

Stenanthemum mediale

According to *FloraBase*, *Stenanthemum mediale* is an erect shrub, growing to approximately 0.35 m high, with a preferred habitat of red clayey sand with gravel on ridges. This species is known to flower between April and August. There are 25 records of this taxon indicated to occur by *NatureMap*, with nine specimen records in *FloraBase*. The nearest known record is approximately 12 km south of the Project Area, growing on a BIF ridge. Niche Environmental Services (2010) indicate that this species is known from numerous records in areas surrounding the Project Area, with few individuals expected to be impacted by proposed clearing within the Project Area.



Plate 1 *Stenanthemum mediale* (specimen JF4805) recorded within the Project Area.

Within the Project Area, approximately five plants were recorded (at 576493 E, 6908733 N) growing up to 0.5 m tall at the base of *Acacia* trees in gravelly soil.

Euryomyrtus recurva

According to *FloraBase*, *Euryomyrtus recurva* is a shrub 0.3 to one metre high, with white to pink flowers occurring between July and September. This species is indicated to prefer yellow-red sands, to brown-yellow sandy clays. This species has been recorded from gravel pits and catchment slopes. There are 38 records of this species known, according to *NatureMap*, with 23 specimen records known on *FloraBase* with the majority of records north-east of Dalwallinu.

The specimen from the Project Area is approximately 12 km south of the nearest known record, with this record at its most northerly known extent. At that location this species was recorded growing on red sand over laterite, a similar habitat to that noted in the Project Area.



Plate 2 *Euryomyrtus recurva* (specimen JF4825) recorded from the Project Area.

Within the Project Area three small shrubs (<0.3 m) of *Euryomyrtus recurva* were recorded. All plants were noted to be in poor condition, apparently grazed.

Dicrastylis linearifolia

According to *FloraBase* this widely distributed shrub grows one to three metres high, preferring red sands and sandplain areas. Plants known from the vicinity of Mount Magnet occur in the most easterly portion of its known range. There are 25 records of this species on *NatureMap*, and 28 specimen records on *FloraBase*, with most records known from the south and east of Overlander. The nearest known record is approximately 38 km south from the Project Area growing on a sand ridge on Iowna Station.

Within the Project Area, there were five plants of *Dicrastylis linearifolia* recorded growing up to 1.4 m tall on sandy soils close to the main east-west access track.



Plate 3 *Dicrastylis linearifolia* (specimen JF4845) growing within the Project Area

Assessment

The Priority Flora recorded from the Project Area have not been recorded from the vicinity (10 km) of the Project Area previously. Habitat for these species is not considered to be restricted to the Project Area, and all species are known from the greater Mount Magnet area (within 50 km).

Depending on the final design for the proposed material extraction area, these taxa may not be impacted by the proposed works.

4.4.2 Other Significant Species

No taxa at the end of their known range or exhibiting an extension to their known range were recorded from the Project Area.

4.4.3 Weed Species

No weed species were recorded from the Project Area.

4.5 Fauna

Fauna records from the Project Area were considered to be poor, due to weather conditions experienced at the time of survey. The survey recorded seven bird species, four mammals and one reptile. Three of the four mammal taxa recorded are exotic



species (Table 10, Appendix B).

4.5.1 Threatened and Priority Fauna Assessment

Gilled Slender Bluetongue

The Gilled Slender Bluetongue (*Cyclodomorphus branchialis*) is a ground-dwelling, largely nocturnal skink that prefers loamy soils in Acacia woodlands and rocky areas. This species often shelters in spinifex, leaf litter and under fallen logs. Little is known of the habitat preferences of this species. Specimens have been observed under artificial habitat in *Acacia* scrub on hard red clay soils, under rocks floodplains, under laterite boulders on top of a limestone ridge in *Acacia* scrub, and below the soil surface in gravelly sand and leaf litter (Shea and Miller, 1995).

The Gilled Slender Bluetongue is known from a few locations scattered in Western Australia, from the Irwin River, north to the Murchison River and inland to Mount Magnet. *NatureMap* also indicates 36 records in Western Australia, with two locations recorded from the vicinity of Mount Magnet in August 2005.

Assessment:

This species may occur in the Project Area. Habitat appears to be minimal, with the majority of the survey area open Mulga woodlands, with isolated areas where leaf litter is concentrated. It was not observed during the field survey.

Australian Bustard

The Australian Bustard were once common in large flocks across much of mainland Australia, but have suffered a long-term decline in numbers such that they have all but disappeared in south-eastern Australia (Australian Wildlife Conservancy, 2010). They are found in grasslands, open grassy woodlands, low shrublands and chenopod flats and plains, and often occur in areas opened up by fire. The Bustard moves nomadically in response to local variations in the supply of a preferred diet of insects, small vertebrates, seeds and fruit. Due to its nomadic nature, the abundance can vary locally and seasonally from scarce to common, largely according to the abundance of grasshoppers (Johnstone and Storr, 1998).

The Bustard is sensitive to altered fire regimes, cattle grazing, and weed invasion. As they lay their eggs on the ground they are also vulnerable to predation by introduced predators and trampling from cattle.

The conservation status of the Australian Bustard in the 2004 IUCN Red List of Threatened Animals is "lower risk/near threatened". Morecombe (2004) describes this bird as remaining common away from more heavily settled regions.

Assessment:

Preferred habitat for the Bustard is not considered to be present within the Project Area; however, it is considered to be common in the local and regional surrounds. This species is nomadic and not considered to be impacted by the project.

Bush Stone-curlew

The Bush Stone-curlew is a sedentary species known to inhabit open woodlands, lightly timbered country, mallee and mulga – with a groundcover of small sparse shrubs, grass or litter of twigs (Morcombe, 2000), often adjacent to watercourses.

Introduced predators are considered to have a major impact on this ground-dwelling species. This is a nocturnal species and rarely observed unless disturbed.

Assessment:

Habitat for this species is deemed to be present within the Project Area, however, due to the localised nature of the proposed clearing it is not considered to have an impact on the this species.

Rufous Fieldwren

This species lives in low, sparse heath, saltmarsh or samphire, with or without emergent trees and feed on insects, spiders and seeds.

They are endemic to the south-western Western Australian Wheatbelt where average annual rainfall is between 3000 and 600 mm, and, in lower densities, in some coastal heathlands to the south-west (Garnett and Crowley, 2000).

Assessment:

Habitat for this bird species is not considered to be present in the Project Area. It is considered unlikely, that if present, this species of conservation significance would rely on the Project Area for habitat and food. Therefore, impacts from the proposed clearing associated with the Project are expected to be low.

Malleefowl

The Malleefowl is a large and distinctive ground-dwelling bird that grows up to 60 cm in length and can weigh up to 2.5 kg. The Malleefowl occurs in semi-arid and arid zones of temperate Australia, where it occupies shrublands and low woodlands that are dominated by mallee vegetation. In Western Australia, the Malleefowl is mostly located to the south and west of a line extending from Cape Farquhar, which lies north of Carnarvon, to the Eyre Bird Observatory in the south-east of Western Australia (DEWHA, 2009e).

In areas of cleared or open land, Malleefowl travel through corridors of dense, native vegetation. The fragmentation of the remnant native habitats that are occupied by

Malleefowl provides a barrier to dispersal, jeopardising the survival of many small and isolated Malleefowl populations (DEWHA, 2009e).

Assessment:

The Malleefowl is known to occur in the region and it is likely that this species is present in the local area. Based on the small area of vegetation in the Project Area, the Malleefowl are unlikely to rely on the vegetation in the Project Area for its survival. No nest mounds were recorded in the Project Area during the field survey.



Slender Billed Thornbill

The Slender-billed Thornbill occurs in arid and semi-arid regions from Carnarvon, east through central Western Australian, and across the Nullarbor Plain to Whyalla, Port Augusta and Port Davis in South Australia. It usually occurs in chenopod scrublands and occasionally *Acacia* shrublands and mangroves adjacent to this preferred habitat. It feeds on insects, spiders and centipedes as well as the stems and foliage of some plants. It is a sedentary species and is not known to undertake any long-distance movements (DEWHA, 2009e).

Assessment:

The current extent of the species range is not thought to extend to the Project Area. This species is considered unlikely to occur in the Project Area. Preferred habitat does not occur within the Project Area.

Brine Shrimp

Branchinella simplex occurs in Lake Austin to the north of the Project Area. This species will not be impacted by the proposed works.

Assessment:

No habitat for this species occurs within the Project Area.

Marine and Migratory Listed Species

Marine and Migratory Listed species, protected under the *Environment Protection and Biodiversity Conservation Act 1999*, were recorded during the desktop survey (Table 10, Appendix B). Vegetation clearing for the Project is considered unlikely to adversely impact on these Migratory and Marine Listed species, based on their mobile nature. One Marine Listed species *Coracina novaehollandiae* (Black-faced Cuckoo-shrike) was recorded from the Project Area.

Assessment:

Many of these migratory species are considered common in Western Australia and do not have special protection under the Western Australian *Wildlife Conservation Act 1950*.

The proposed project is not considered to have a significant impact on Marine and Migratory Listed species.

4.5.2 Introduced Fauna Species

Three introduced fauna species were recorded from the Project Area: Feral Goat, Feral Cat and European Rabbit.

4.5.3 Habitat Types and Habitat Linkages

One habitat is known from the Project Area: *Acacia* woodlands and shrublands. Within this habitat, there are areas where stands of *Eucalyptus* species form small groves, and an ephemeral flowline. Habitat within the Project Area is considered to be

common in the local and regional area. Habitat is contiguous with vegetation immediately adjacent to the Project Area, interrupted only by pastoral tracks, mining exploration tracks, and small existing material pits.



Plate 4 Typical fauna habitat observed within the Project Area.

The clearing of vegetation within the Project Area is considered to have minimal impact on fauna habitat and linkages.

4.5.4 Potential Fauna Impacts

Clearing of vegetation in the Project Area is considered to have minimal impact on fauna species, as no species are thought to use the Project Area exclusively. It is not considered that the clearing of vegetation will significantly alter the fauna habitat of the region. Disturbance is most likely to occur on a local scale, impacting individual animals, rather than a species. The Project Area is wholly surrounded by similar continuous vegetation.

Potential impacts are likely to occur to individual animals and include:

- ▶ Minor loss of habitat and feeding areas. This is not considered to be a substantial impact on current extent of habitat. There will be a minor loss of refuge vegetation and associated foraging resources; and
- ▶ Harm/deaths/displacement of individual animals. This may occur during clearing activities.



5. Vegetation Clearing

Any clearing of native vegetation requires a permit under Part V of the *Environmental Protection Act* (1986) except where exemptions apply under Schedule 6 of the Act or are prescribed in the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*. These exemptions do not apply in Environmentally Sensitive Area's (ESA's).

Main Roads have been granted a Purpose Clearing Permit (CPS 818/4) under the provisions of the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*. This permit provides for Main Roads to conduct such clearing associated with roadwork projects in accordance with additional requirements as set out in the Purpose Permit.

5.1 Assessment against the 'Ten Clearing Principles'

This Project has been assessed against the 'Ten Clearing Principles' (Appendix C), and may be at variance with Clearing Principle (a) only if Priority Plant locations cannot be avoided. If the plant locations can be avoided, this project is deemed to be "not at variance".

6. Conclusions and Recommendations

6.1 Conclusions

A biological survey of the SLK 568 pit expansion area was undertaken by qualified ecologists in August 2010. The following conclusions were made:

Desktop Assessment

- ▶ Vegetation of the Project Area occurs in an area of *Least Concern* with approximately 100% of the pre-European vegetation extent remaining;
- ▶ The Project Area occurs within the buffer of a Priority Ecological Community associated with a banded ironstone formation ridgeline. This formation will not be impacted by the proposed works;
- ▶ A total of eight Priority Flora taxa were indicated from database records to occur or potentially occur within the vicinity of the Project Area;
- ▶ A search of threatened flora databases identified four Priority taxa, two EPBC Act *Vulnerable*, and one WC Act Schedule 1 species potentially occurring in the Project Area. A number of Migratory and Marine Listed taxa have also been indicated to occur in the Project Area.

Field Assessment

- ▶ One vegetation type was recorded within the Project Area, deemed to be similar to the Vegetation Association indicated by the desktop assessment;
- ▶ The vegetation within the Project Area was considered to be in Excellent to Very Good condition within little impact from weed invasion, but obvious impact from grazing by livestock, feral and native fauna;
- ▶ Three Priority Flora taxa were recorded from the Project Area:
 - *Stenanthemum mediale* (Priority 1);
 - *Euryomyrtus recurva* (Priority 3); and
 - *Dicrastylis linearifolia* (Priority 3).
- ▶ None of the Priority Flora recorded from the Project Area had been indicated by the database searches to be present;
- ▶ Habitat for the Priority Flora taxa recorded is deemed to be common within the local and regional area in as good or better condition. Depending on the final design of the proposed material extraction pit, the impact to these taxa remains
- ▶ uncertain;
- ▶ A total of seven bird, four mammal (three introduced) and one reptile were recorded from the Project Area.
- ▶ No threatened fauna species were recorded from the Project Area. One Marine listed species was recorded from the Project Area – this taxon (Black-faced;



- ▶ Cuckoo-shrike) is common in Western Australia and not considered to be under threat;
- ▶ Fauna habitat recorded in the Project Area is common in the local and regional area. Fauna linkages are not considered to be interrupted by the proposed project;
- ▶ An assessment of the project was undertaken against the 10 Clearing Principles. The project was deemed to be “may be at variance” against Principle (a).

6.2 Recommendations

GHD recommends that Main Roads Western Australia liaise with the DEC with regards to the presence of Priority Flora within the Project Area. The finalisation of extraction pit design is considered likely to assist in this process.

7. Limitations

7.1 Survey Limitations

An outline of the limitations of this survey is provided in Table 2.

Table 2 Limitations and Constraints

Variable	Impact on Survey Outcomes
Date of Site Survey	11-13 August 2010
Access Problems	Nil
Experience Levels	<p>The ecologists who executed these surveys were practitioners suitably qualified in their respective fields.</p> <p>Coordinating Botanist: Joshua Foster (Senior Ecologist);</p> <p>Field Staff: Flora Taxonomy: Joshua Foster (Senior Ecologist); Fauna Taxonomy: Joshua Foster (Senior Ecologist); Data Interpretation: Joshua Foster (Senior Ecologist).</p>
Timing ¹ , Weather, Season	<p>Flora composition changes over time, with flora species having specific growing periods, especially annuals and ephemerals (some plants lasting for a markedly brief time, some only a day or two). Therefore, the results of future botanical surveys in this location may differ from the results of this survey.</p>
Completeness	<p>As the survey was conducted only once, rather than several times over the course of a year, some annual , ephemeral condition specific species may be present that were not recorded in the survey.</p> <p>Species that were senescent or immature were identified in the field to Genus or Family level only (where possible).</p> <p>A comprehensive species list has not been prepared for areas that do not constitute a natural vegetation area, such as gardens or areas that have been totally cleared.</p>
Determination	<p>This survey makes inferences about vegetation types that have the potential to be TECs. However, a</p>

¹ EPA Guidance Statement 51 (2004) stipulates that flora and vegetation surveys should be undertaken following the season that contributes the greatest rainfall in the region. In the Northern Province, this is after summer. In the Eremaean Province, rainfall is sporadic, and in the South-west Province the main rain is in winter, requiring surveys to be undertaken in spring. Short term variances in normal weather patterns (e.g. drought,) may necessitate supplementary survey work at other times of year or in later years to take into account temporal changes in diversity.



Variable	Impact on Survey Outcomes
	decision as to the presence or absence of TECs at the site remains the responsibility of the DEC's Species and Communities Branch. The taxonomy and conservation status of the Western Australian flora are dynamic. This report was prepared in reliance on taxonomy and conservation current at the time, but it should be noted this may change.

7.2 Report Limitations

This report presents the results of a Biological Survey, and desktop findings, prepared for the purpose of this commission. The data and advice provided herein relate only to the project described herein and must be reviewed by a competent scientist before being used for any other purpose. GHD accepts no responsibility for other use of the data.

Where reports, searches, any third party information and similar work have been performed 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.

For these investigations GHD has conducted desktop data searches and a field survey. The conclusions of this report were based on the information gathered during these investigations and thus reflect the environment of the Project Area at the time of survey. GHD accepts no responsibility for any variation in the flora present in the Project Area due to natural and seasonal variability.

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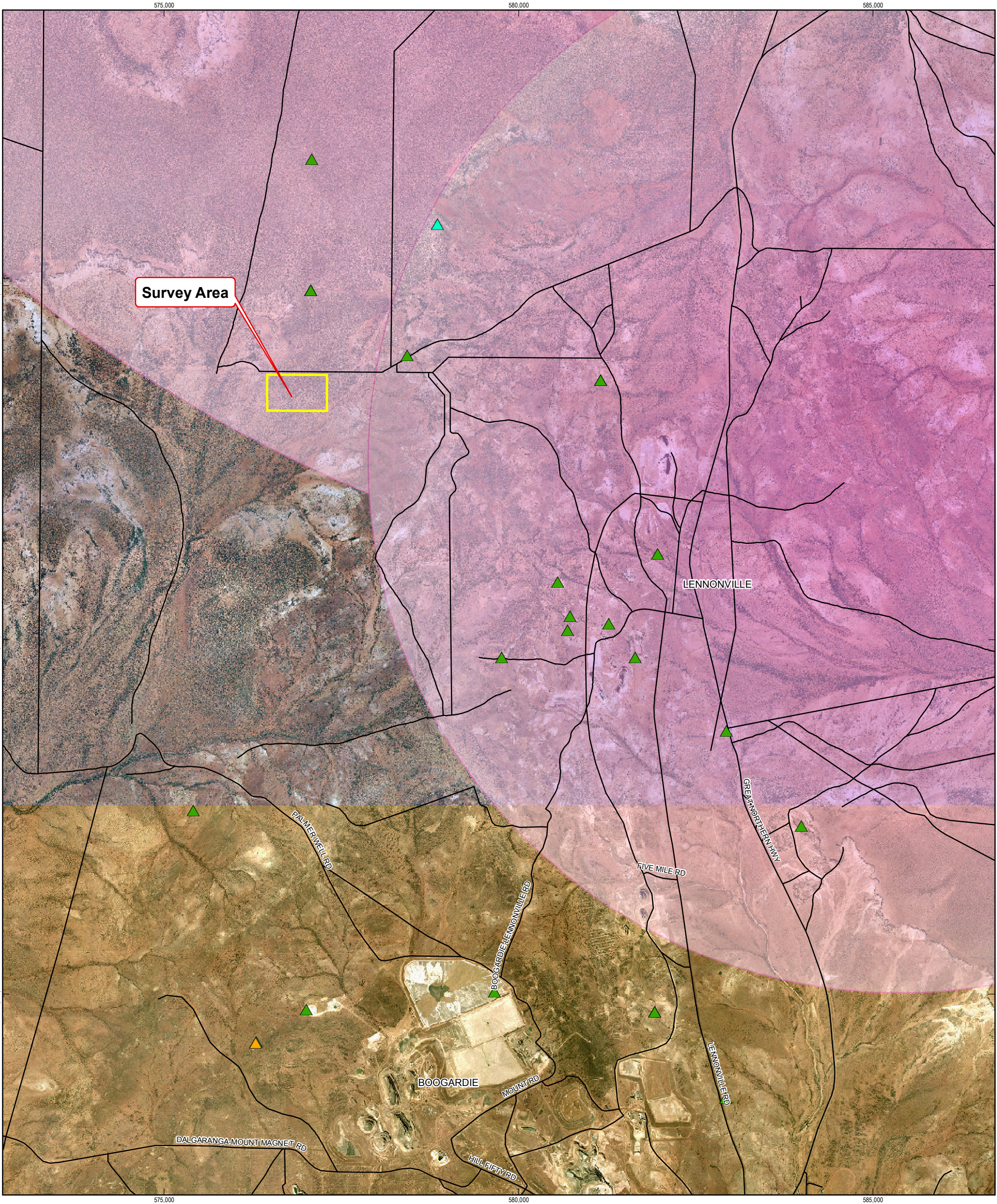
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Figures



LEGEND

Declared Rare & Priority Species

- X: Presumed Extinct Flora
- (T) Threatened Flora - Extant Taxa
- Priority 1 - Poorly Known Taxa
- Priority 2 - Poorly Known Taxa
- Priority 3 - Poorly Known Taxa
- Priority 4 - Rare, Near Threatened Taxa
- Priority 5 - Conservation Dependent Taxa

Threatened and Priority Ecological Communities

- Threatened Ecological Communities
- Priority Ecological Communities

— Roads

Survey Area



LEGEND

Priority Plants

- Stenanthemum mediale* (P1)
- Dicrastylis linearifolia* (P3)
- Euryomyrtus recurva* (P3)

Declared Rare & Priority Species

- X: Presumed Extinct Flora
- (T) Threatened Flora - Extant Taxa
- Priority 1 - Poorly Known Taxa

Priority 2 - Poorly Known Taxa

Priority 3 - Poorly Known Taxa

Priority 4 - Rare, Near Threatened Taxa

Priority 5 - Conservation Dependent Taxa

Roads

Threatened and Priority Ecological Communities

- Threatened Ecological Communities
- Priority Ecological Communities

Survey Area

1:15,000 (at A3)

0 75 150 300 450 600 750

Metres

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

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Date | 02 Mar 2012

Environmental Constraints Map

Figure 2

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Data Source: DEC: Declared Rare & Priority Species - 20100611, Threatened and Priority Ecological Communities - 20081010; Landgate: Roads - 20100617, Austin 2005 Mosaic - 20080326, Mt Magnet 2003 Mosaic - 20080326; GHD: Survey Area - 20080310, Priority Plants - 20100914. Created by: tgoad, jhchen, bflorczak



Appendix A

Flora

Table 3 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 immediate 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 Dependant	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 4 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.
X: Declared Rare Flora – Presumed Extinct Taxa	Taxa which have not been collected, or otherwise verified, over the past 50 years despite thorough searching, or of which all known wild populations have been destroyed more recently, 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 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 – 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 five to 10 years.



Table 5 Significant Flora Species Identified in the Threatened Flora Database Search Results

Taxa	Conservation Code	Description¹	Flowering Time¹	Preferred Habitat¹	Distribution¹	Data Source^{1, 2}	Likely Occurrence within Project Area
<i>Acacia burrowsonia</i>	Priority 3	Stout shrub or tree, to 5 m high, bark grey, fibrous fissured, smooth on upper branches; phyllodes sub-rigid, sub-glaucous, erect coarsely pungent.	-	Flats adjacent to watercourses, crests or low rises, breakaways. Red-brown loams with ironstone rubble on surface, calcrete soils, laterite, quartz.	Murchison	WAHERB	Unlikely – preferred habitat not present.
<i>Acacia speckii</i>	Priority 3	Bushy, rounded shrub or tree, 1.5 to 3 m high.	-	Rocky soils over granite, basalt or dolerite. Rocky hills or rises.	Gascoyne, Murchison, Yalgoo	WAHERB	Unlikely – preferred habitat not present.
<i>Alyxia tetanifolia</i>	Priority 3	Erect, rigid, pungent shrub, – 2 m high, to 2.5 m wide.	Flowers are white, cream, occurring between May to June and November.	Sandy clay, loam, concretionary gravel. Drainage lines, near lakes.	Coolgardie, Murchison.	WAHERB, DRPFL	Unlikely – preferred habitat not present.
<i>Calytrix erosipetala</i>	Priority 3	Shrub, 0.3 – 0.7 m high	Flowers white, pink, occurring between September and October.	Rocky sandstone or gravel breakaways.	Murchison, Yalgoo	WAHERB	Unlikely – preferred habitat not present.



Taxa	Conservation Code	Description ¹	Flowering Time ¹	Preferred Habitat ¹	Distribution ¹	Data Source ^{1, 2}	Likely Occurrence within Project Area
<i>Grevillea inconspicua</i>	Priority 4	Intricately branched, spreading shrub, 0.6–2 m high.	Flowers white, pink, between June and August.	Loam, gravel. Along drainage lines on rocky outcrops, creeklines.	Murchison	WAHERB	Unlikely – preferred habitat not present.
<i>Petrophile pauciflora</i>	Priority 3	Shrub, up to 1 m high.	Flowers are yellow, occurring in September.	Decaying and dissected granite breakaways.	Murchison, Yalgoo, Avon	WAHERB	Unlikely – preferred habitat not present.
<i>Ptilotus luteolus</i>	Priority 3	Shrub (with a yellow indumentum), 0.15 – 0.7 m high.	Flowers are yellow, red, purple, occurring between March and October.	Often on red sandy soils.	Gascoyne, Murchison	WAHERB	Possible, preferred habitat present
<i>Homalocalyx inerrabundus</i>	Priority 2	Shrub to 0.5 m high.	Flowers are violet, or pink, occurring between September and November.	Yellow sand, sandy loam.	Murchison, Geraldton sandplains	DRPFL	Unlikely – preferred habitat not present.

¹FloraBase accessed online at <http://florabase.calm.wa.gov.au/> on 25/06/2009 (DEC, 2009b).

²DEC Threatened and Priority Flora Database Search Request Ref No. 47-0609 (DEC, 2009a).

³EPBC Act 1999 Protected Matters Search Tool (DEWHA, 2009a)

WAHERB: Western Australian Herbarium Specimen Database.

DRPFL: Declared Rare and Priority Flora list.

DEWHA Protected Matters: Department of the Environment, Water, Heritage and the Arts Protected Matters Search.

Table 6 Vegetation Condition Scale

(Extract from Table 12 on page 48 of Bush Forever Volume 2 from Keighery (1994))

Assigned Number	Classification	Description
1	Pristine	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
4	Good	Vegetation structure significantly altered by very obvious signs of multiple disturbance. Retains basic vegetation structure or ability to generate it. For example, disturbance to vegetation structure caused by very frequent fires, the presence of some aggressive weeds at high density, partial clearing, dieback and grazing.
5	Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by very frequent fires, the presence of aggressive weeds, partial clearing, dieback and grazing.
6	Completely Degraded	The structure of the vegetation is no longer intact and the area is completely or almost without native species. These areas are often described as 'parkland clearing' with flora composing weed or crops species with isolated native trees or shrubs.



Table 7 Flora Species Recorded During the Field Survey

Family	Genus	Species	Common Name	Status
Amaranthaceae	<i>Ptilotus</i>	<i>chamaecladus</i>		
Amaranthaceae	<i>Ptilotus</i>	<i>drummondii</i>		
Amaranthaceae	<i>Ptilotus</i>	<i>obovatus</i>	Cotton Bush	
Apocynaceae	<i>Rhyncharhena</i>	<i>linearis</i>	Bush Bean	
Araliaceae	<i>Trachymene</i>	<i>ornata</i>	Spongefruit	
Asparagaceae	<i>Thysanotus</i>	sp. (insufficient material)		
Asteraceae	<i>Brachyscome</i>	<i>ibiderifolia</i>		
Asteraceae	<i>Calotis</i>	<i>hispidula</i>	Bindy Eye	
Asteraceae	<i>Chthonocephalus</i>	<i>pseudevax</i>	Woolly Groundheads	
Asteraceae	<i>Dielitzia</i>	<i>tysonii</i>		
Asteraceae	<i>Gnephosis</i>	<i>brevifolia</i>		
Asteraceae	<i>Gnephosis</i>	<i>tenuissima</i>		
Asteraceae	<i>Helipterum</i>	<i>craspedioides</i>	Yellow Billy Buttons	
Asteraceae	<i>Lemooria</i>	<i>burkittii</i>		
Asteraceae	<i>Olearia</i>	<i>stuartii</i>		
Asteraceae	<i>Rhodanthe</i>	<i>battii</i>		
Asteraceae	<i>Rhodanthe</i>	<i>manglesii</i>		
Asteraceae	<i>Schoenia</i>	<i>cassiniana</i>	Schoenia	
Asteraceae	<i>Waitzia</i>	<i>acuminata</i>	Orange Immortelle	
Chenopodiaceae	<i>Enchylaena</i>	<i>tomentosa</i>	Barrier Saltbush	
Chenopodiaceae	<i>Maireana</i>	<i>planifolia</i>	Low Bluebush	
Chenopodiaceae	<i>Rhagodia</i>	<i>eremaea</i>	Thorny Saltbush	
Colchicaceae	<i>Wurmbea</i>	sp. (insufficient material)		
Crassulaceae	<i>Crassula</i>	<i>colorata</i>	Dense Stonecrop	
Euphorbiaceae	<i>Euphorbia</i>	<i>Tannensis</i> subsp. <i>eremophila</i>	Desert Spurge	
Fabaceae	<i>Acacia</i>	<i>aneuravar. fuliginea</i>	Mulga	
Fabaceae	<i>Acacia</i>	<i>aneuravar. intermedia</i>	Mulga	
Fabaceae	<i>Acacia</i>	<i>aneuravar. microcarpa</i>	Mulga	
Fabaceae	<i>Acacia</i>	<i>craspedocarpa</i>	Hop Mulga	



Family	Genus	Species	Common Name	Status
Fabaceae	<i>Acacia</i>	<i>grasbyi</i>	Miniritchie	
Fabaceae	<i>Acacia</i>	<i>jamesiana</i>		
Fabaceae	<i>Acacia</i>	<i>murrayana</i>	Sandplain Wattle	
Fabaceae	<i>Acacia</i>	<i>ramulosavar. linophylla</i>	Horse Mulga	
Fabaceae	<i>Acacia</i>	<i>ramulosavar. ramulosa</i>	Horse Mulga	
Fabaceae	<i>Acacia</i>	<i>tetragonophylla</i>	Kurara	
Fabaceae	<i>Mirbelia</i>	<i>rhagodioides</i>		
Fabaceae	<i>Senna</i>	<i>charlesiana</i>		
Fabaceae	<i>Senna</i>	<i>glutinosasubsp. chatelainiana</i>		
Fabaceae	<i>Senna</i>	<i>artemisioidessubsp. filifolia</i>		
Geraniaceae	<i>Erodium</i>	<i>cygnorum</i>	Blue Heronsbill	
Goodeniaceae	<i>Goodenia</i>	<i>berardiana</i>		
Goodeniaceae	<i>Goodenia</i>	<i>pinnatifida</i>	Cut-leaf Goodenia	
Goodeniaceae	<i>Scaevola</i>	<i>spinescens</i>	Currant Bush	
Goodeniaceae	<i>Velleia</i>	<i>rosea</i>	Pink Velleia	
Haloragaceae	<i>Haloragis</i>	<i>gossei</i>		
Hemerocallidaceae	<i>Dianella</i>	<i>revoluta</i>	Blueberry Lily	
Lamiaceae	<i>Dicrastylis</i>	<i>linearifolia</i>		P3
Lamiaceae	<i>Hemigenia</i>	<i>macphersonii</i>		
Loranthaceae	<i>Lysiana</i>	<i>exocarpi</i>	Harlequin Mistletoe	
Malvaceae	<i>Brachychiton</i>	<i>gregorii</i>	Desert Kurrajong	
Malvaceae	<i>Keraudrenia</i>	<i>velutinasubsp. elliptica</i>	Firebush	
Myrtaceae	<i>Aluta</i>	<i>asperasubsp. hesperia</i>		
Myrtaceae	<i>Enekbatus</i>	<i>eremaeus</i>		
Myrtaceae	<i>Eucalyptus</i>	<i>kingsmillii</i>		
Myrtaceae	<i>Eucalyptus</i>	<i>oldfieldii</i>	Oldfield's Mallee	
Myrtaceae	<i>Euryomyrtus</i>	<i>recurva</i>		P3
Myrtaceae	<i>Melaleuca</i>	<i>leiocarpa</i>		
Family	Genus	Species	Common Name	Status
Myrtaceae	<i>Thryptomene</i>	<i>decussata</i>		



Family	Genus	Species	Common Name	Status
Pittosporaceae	<i>Bursaria</i>	<i>occidentalis</i>		
Poaceae	? <i>Eriachne</i>	<i>helmsii</i>	Buck Wanderrie Grass	
Poaceae	<i>Aristida</i>	? <i>contorta</i>	Bunched Kerosene Grass	
Poaceae	<i>Poaceae</i>	<i>sp. (insufficient material)</i>		
Portulacaceae	<i>Calandrinia</i>	<i>eremaea</i>	Twining Purslane	
Proteaceae	<i>Grevillea</i>	<i>obliquistigma</i>		
Proteaceae	<i>Grevillea</i>	<i>nematophylla</i>		
Rhamnaceae	<i>Stenanthemum</i>	<i>mediale</i>		P1
Rubiaceae	<i>Psydrax</i>	<i>rigidula</i>		
Rubiaceae	<i>Psydrax</i>	<i>suaveolens</i>		
Scrophulariaceae	<i>Eremophila</i>	<i>clarkei</i>	Turpentine Bush	
Scrophulariaceae	<i>Eremophila</i>	<i>ericalyx</i>	Desert Pride	
Scrophulariaceae	<i>Eremophila</i>	<i>forrestii</i> subsp. <i>forrestii</i>	Wilcox Bush	
Scrophulariaceae	<i>Eremophila</i>	<i>georgei</i>		
Scrophulariaceae	<i>Eremophila</i>	<i>glutinosa</i>		
Scrophulariaceae	<i>Eremophila</i>	<i>latrobei</i> subsp. <i>latrobei</i>	Warty Fuschia Bush	
Scrophulariaceae	<i>Eremophila</i>	<i>punicea</i>	Crimson Eremophila	
Scrophulariaceae	<i>Eremophila</i>	<i>spuria</i>		
Solanaceae	<i>Nicotiana</i>	<i>rosulata</i>	Rosetted Tobacco	
Solanaceae	<i>Solanum</i>	<i>orbiculatum</i>	Wild Tomato	
Stylidiaceae	<i>Stylidium</i>	<i>induratum</i>	Desert Triggerplant	

Notes:

*Introduced species.



Appendix B

Fauna



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.

See Table 3.

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
- ▶ 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
- ▶ 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
- ▶ 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:

1. 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
2. habitat utilised by a migratory species which is at the limit of the species range, or
3. 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.*

Table 8 Western Australia 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 9 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 identify able 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.



Table 10 Recorded and Observed Fauna Species for the Project Area

Genus	Species	Subspecies	Common Name	EPBC	WC	DEC	Exotic	Recorded	Observed
Birds									
<i>Acanthiza</i>	<i>uropygialis</i>		Chestnut-rumped Thornbill						X
<i>Ardea</i>	<i>alba</i>		Great Egret, White Egret	Mi, Ma				1	
<i>Ardeotis</i>	<i>australis</i>		Australian Bustard			P4		2,3	
<i>Apus</i>	<i>pacificus</i>		Fork-tailed Swift	Mi, Ma				1	
<i>Burhinus</i>	<i>grallarius</i>		Bush Stonecurlew			P4		2,3	
<i>Cacatua</i>	<i>roseicapilla</i>	<i>assimilis</i>	Galah					3	
<i>Calamanthus</i>	<i>campestris</i>	<i>montanellus</i>	Rufous Fieldwren			P4		1	
<i>Cinclosoma</i>	<i>castaneothorax</i>		Chestnut-breasted Quail Thrush						X
<i>Coracina</i>	<i>novaehollandiae</i>		Black-faced Cuckoo-shrike	Ma					X
<i>Corvus</i>	<i>orru</i>		Torresian Crow						X
<i>Cracticus</i>	<i>sp.</i>		Butcherbird species						X
<i>Dromaius</i>	<i>Novaehollandiae</i>		Emu						X
<i>Acanthiza</i>	<i>iredalei</i>	<i>iredalei</i>	Slender-billed Thornbill (Western)	V	S1			1	
<i>Leipoa</i>	<i>ocellata</i>		Malleefowl	V, Mi	S1			1	
<i>Merops</i>	<i>ornatus</i>		Rainbow Bee-eater	Mi, Ma				1	
<i>Rhipidura</i>	<i>leucophrys</i>		Willie Wagtail						X



Genus	Species	Subspecies	Common Name	EPBC	WC	DEC	Exotic	Recorded	Observed
Mammals									
<i>Capra</i>	<i>hircus</i>		Feral Goat				X		X
<i>Felis</i>	<i>catus</i>		Feral Cat				X		X
<i>Macropus</i>	<i>sp.</i>		Macropod species						X
<i>Oryctolagus</i>	<i>cuniculus</i>		European Rabbit				X		X
<i>Sminthopsis</i>	<i>dolichura</i>		Little long-tailed Dunnart					3	
Reptiles									
<i>Cyclodomorphus</i>	<i>branchialis</i>		Gilled Slender Bluetongue	S1	S1			2	
<i>Ctenophorus</i>	<i>caudicinctus</i>	<i>mensarum</i>	Ring-tailed Dragon					3	
<i>Ctenophorus</i>	<i>ornatus</i>		Ornate Crevice Dragon					3	
<i>Ctenotus</i>	<i>schomburgkii</i>		Barred Wedgesnout Ctenotus					3	
<i>Ctenotus</i>	<i>severus</i>		Striped Skink					3	
<i>Diplodactylus</i>	<i>granariensis</i>	<i>rex</i>	Western Stone Gecko					3	
<i>Diplodactylus</i>	<i>pulcher</i>		Fine-faced Gecko					3	
<i>Eremiascincus</i>	<i>richardsonii</i>		Broad-banded Sand Swimmer					3	
<i>Gehyra</i>	<i>variegata</i>		Tree Dtella					3	
<i>Heteronotia</i>	<i>binoei</i>		Bynoe's Gecko					3	
<i>Lerista</i>	<i>gerrardii</i>		Gerrard's Lerista					3	



Genus	Species	Subspecies	Common Name	EPBC	WC	DEC	Exotic	Recorded	Observed
<i>Lerista</i>	<i>eupoda</i>		Common Dwarf Skink					4	
<i>Menetia</i>	<i>grevii</i>		Marble Velvet Gecko					3	
<i>Oedura</i>	<i>marmorata</i>		Spotted Mulga Snake					3	
<i>Pseudechis</i>	<i>butleri</i>		Ringed Brown Snake					3	
<i>Psudonaja</i>	<i>modesta</i>		Gwardar					3	
<i>Psudonaja</i>	<i>nuchalis</i>		Bearded Gecko					3	
<i>Rhynchoedura</i>	<i>ornata</i>		Pebble Dragon					3	
<i>Tympanocryptis</i>	<i>cephalus</i>		Varanid species					3	
<i>Varanus</i>	<i>sp.</i>								X
Amphibians									
<i>Psudophryne</i>	<i>occidentalis</i>		Western Toadlet					3	
Invertebrates									
<i>Branchinella</i>	<i>simplex</i>		Brine Shrimp			P1		1	



KEY:

Conservation Codes

Mi Migratory
V Vulnerable
S Schedule
P Priority
E Endangered
Ma Marine

Recorded:

1. EPBC Act Protected Matters Search Tool
 2. DEC Threatened and Priority Fauna Database Search
 3. Nature Map
- X GHD Field survey August 11 to 13 2010



Appendix C

Department of Environment and Conservation 'Ten Clearing Principles'



(a) Native vegetation should not be cleared if it comprises a high level of biological diversity.

Methodology: Desktop assessment of available information and field survey results.

Survey Results: Plant Species

- ▶ Total Vascular Plant Taxa
 - A total of 79 flora taxa from 27 families were recorded from the Project Area, representing a moderate level of diversity. This total is considered to be similar to that found in the local area.
- ▶ Vascular Plant Taxa Diversity
 - Diversity in the Project Area is considered to be comparable to that found in the local area.
- ▶ Priority Flora, Significant Flora
 - Three Priority Flora species were recorded from the Project Area. The three Priority Flora species recorded have not been recorded from within the vicinity (10 km) of the Project Area previously.

Fauna Species

- ▶ Total Fauna Taxa
 - The reconnaissance fauna survey recorded seven bird species, four mammal species and one reptile species. No amphibian species were recorded from the Project Area. The survey result was considered to be a relatively good reflection of fauna species present, in a small survey area and relatively homogeneous habitat.

Ecosystem Diversity

- ▶ Number of Ecological Communities (Plant, Fauna)
 - One vegetation unit (plant community) and one fauna habitat were recorded from the Project Area. These communities are also present in the local area in similar condition.
- ▶ Habitat Diversity
 - Habitats (macro and microhabitats) found in the Project Area are also present in the local area in similar condition.
- ▶ Variety of Soil Types/Geological Formations
 - Soil types or geological formations in the Project Area are also present in the local regional area.

Assessment: Project may be at variance with the clearing principle due to the presence of Priority Flora in the Project Area. This will become “not at variance” if Priority Plant locations are avoided.



(b) Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia.

Methodology: Desktop assessment of available information and field survey results.

Survey Results: Significant Fauna

- ▶ Threatened Fauna
 - The desktop assessment indicated that threatened fauna may utilise the Project Area. Habitat for threatened fauna was recorded within the Project Area, however no threatened fauna was recorded during the survey. Habitat is considered to be common in the local and regional area.
- ▶ Priority Fauna
 - The desktop assessment indicated that Priority fauna may utilise the Project Area for foraging. No DEC listed Priority Fauna were recorded from the Project Area.
- ▶ Other Significant Fauna
 - The desktop assessment indicated that significant fauna may occur in the Project Area. One Marine Listed species was recorded from the Project Area.

Habitat

- ▶ Significant Habitat/Habitats of Significance
 - No habitat deemed to be significant occurs in the Project Area. Habitat in the Project Area also occurs in the local area in similar condition. The habitat in the Project Area occurs in a region relatively unaltered by physical disturbance.
- ▶ Habitat Extent and Retention
 - Habitats recorded in the Project Area are also found in the local area in similar condition. The proposed Project will not significantly diminish the extent of these habitats.
- ▶ Ecological Corridors
 - The habitat in the Project Area occurs in a region relatively unaltered by physical disturbance, and as such, ecological corridors are considered to be unlikely to be altered by the proposed project.

Assessment: The Project Area contains suitable habitat for Threatened and Priority fauna species. No conservation significant fauna were recorded from the Project Area. The Project is considered unlikely to be at variance with this clearing principle.



- (c) **Native vegetation should not be cleared if it includes, or is necessary for the continued existence of, rare flora.**

Methodology: Desktop assessment of available information and field survey results.

Survey Results: Rare Flora

- ▶ Presence
 - No Declared Rare Flora (DRF) taxa are known to occur within a 10 km buffer of the Project Area. No Declared Rare Flora taxa were recorded in the Project Area during the field survey.
- ▶ Habitat
 - No habitat considered to be required for the continued existence of DRF is considered to be present in the Project Area.

Assessment: The Project Area contains suitable habitat for Threatened and Priority fauna species. The Project is considered unlikely to be at variance with this clearing principle.

- (d) **Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of a threatened ecological community.**

Methodology: Desktop assessment of available information and field survey results.

Survey Results: Vegetation

- ▶ Extent and Status
 - Vegetation within and adjacent to the Project Area is considered to be of *Least Concern*, with approximately 100% remaining of the known Vegetation Associations in the Murchison IBRA region.
- ▶ Communities
 - No Threatened or Priority Ecological Communities were recorded from the Project Area. The Project Area occurs within the bugger of known PECs which are related to BIF ranges. These do not occur in the Project Areal, nor will they be impacted by the proposed project.
- ▶ Areas
 - No Environmentally Sensitive Areas occur within or adjacent to the Project Area.

Assessment: Not considered to be at variance with clearing principle.



- (e) **Native vegetation should not be cleared if it is significant as a remnant of native vegetation in an area that has been extensively cleared.**

Methodology: Desktop assessment of available information and field survey results.

Survey Results: Vegetation

- ▶ **Extent and Status**
 - Vegetation within and adjacent to the Project Area is considered to be of *Least Concern*, with approximately 100% remaining of the known Vegetation Associations in the Murchison IBRA region. The Project Area is not considered to contain fragmented vegetation.
- ▶ **Regionally Significant Areas**
 - Vegetation within the Project Area is not considered to contain communities required to maintain ecosystem services (e.g. hydrological processes).

Assessment: Not considered to be at variance with clearing principle.

- (f) **Native vegetation should not be cleared if it growing in, or in association with, an environment associated with a watercourse or wetland.**

Methodology: Desktop assessment of available information and field survey results.

Survey Results: Watercourses and Wetlands

- ▶ **Vegetation**
 - No defined wetlands or watercourses occur in the Project Area.
- ▶ **Groundwater Dependent Ecosystems**
 - No groundwater dependent ecosystems occur within or adjacent to the Project Area.

Assessment: Not considered to be at variance with clearing principle.



- (g) **Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.**

Methodology: Desktop assessment of available information and field survey results.

Survey Results: Land Degradation

- ▶ **Land Capability**
 - The Project proposes to clear vegetation to allow for the quarrying of material for road construction activities. Degradation will occur at the extraction site, but will not alter the land capability of the surrounding area.
- ▶ **Soil Erosion**
 - The Project proposes to clear vegetation to allow for the extraction of material for road construction activities. Erosion from wind or water is considered to be extremely low. The clearing of native vegetation is not expected to alter the quality or quantity of water run-off in or adjacent to the Project Area. Waterlogging and changes to nutrient levels are not expected to be altered by the clearing of vegetation in the Project Area.
- ▶ **Soil Acidity**
 - The clearing of vegetation is not considered to alter acidity in or adjacent to the Project Area.
- ▶ **Salinity**
 - The clearing of vegetation is not considered to significantly alter the hydrological balance and cause a change in the salinity either on or off site.

Assessment: Not considered to be at variance with clearing principle.



- (h) **Native vegetation should not be cleared if the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area.**

Methodology: Desktop assessment of available information and field survey results.

Survey Results: Conservation Areas

- ▶ Protected Areas
 - The Project Area is not adjacent to, or in the vicinity of, a conservation reserve or protected area.
- ▶ Fragmentation
 - The Project Area occurs in a region where the vegetation extent is of Least Concern. Little fragmentation of vegetation has occurred.
- ▶ Ecological Linkages
 - The Project Area occurs in a region where the vegetation has not been significantly altered. The Project Area does not provide a buffer or outlier to a conservation area. Ecological linkages and corridors are not considered to be significantly altered by any proposed clearing activities in the Project Area.

Assessment: Not considered to be at variance with clearing principle.

- (i) **Native vegetation should not be cleared if the clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water.**

Methodology: Desktop assessment of available information and field survey results.

Survey Results: Water Quality

- ▶ Catchment Areas
 - The Project Area does not occur within a proclaimed Public Drinking Water Supply Catchment.
- ▶ Groundwater
 - The clearing of vegetation is not considered to cause an alteration to the quality of groundwater in or adjacent to the Project Area.
 - No groundwater dependent ecosystems occur in or adjacent to the Project Area.
- ▶ Surface Water
 - The clearing of vegetation is not considered to cause an alteration to the quality of surface waters in or adjacent to the Project Area.

Assessment: Not considered to be at variance with clearing principle.



- (j) **Native vegetation should not be cleared if the clearing of the vegetation is likely to cause, or exacerbate, the incidence or intensity of flooding.**

Methodology: Desktop assessment of available information and field survey results.

Survey Results: Water Quantity

- ▶ Flooding
 - The clearing of vegetation in the Project Area is not considered to alter the frequency or intensity of flood events. Runoff coefficients in the Project Area are not likely to be significantly altered as the majority of the soil within and surrounding the Project Area is covered in continuous vegetation.

Assessment: Not considered to be at variance with clearing principle.



GHD

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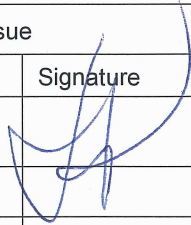
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