

**Main Roads Western
Australia**

Report for Brand Highway Upgrade
at 92.775 to 95.32 SLK

Environmental Impact
Assessment

February 2007

FINAL DRAFT



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Executive Summary

The Brand Highway links Bullsbrook (north of Perth) to Geraldton. Main Roads Western Australia (WA) proposes to install ten new passing lanes and extend an existing passing lane along a 115 km section of the Brand Highway from Gingin in the south to Eneabba in the north. The main objective is to improve road user safety, particularly with the interaction of smaller vehicles and the large road trains that use the route to cart mineral sands and oil from the Dongara, Eneabba and Cataby areas.

This report covers the upgrades from 92.775 to 95.32 Standard Length Kilometres (SLK), which consists of a 1675 m northbound passing lane from 92.775 to 94.45 SLK and a 1920 m southbound passing lane from 93.40 to 95.32 SLK. The report refers to this area as the Site and the roadworks and associated activities as the Project.

The construction works for this upgrade will require the clearing of approximately 3.6 ha of native vegetation along the existing road edge and as such Main Roads WA, as specified under their existing clearing permit (CPS 818/1), must undertake a PEIA. Where the outcome of the PEIA indicates that the proposed clearing “may be at variance or seriously at variance with one or more of the clearing principles”, Main Roads WA must undertake an Environmental Impact Assessment (EIA) (DEC, 2005 - MRWA Purpose Permit CPS 818/1, Condition 7d). Condition 7n of the purpose permit then states “where the results of the EIA indicate that clearing for the Site may be seriously at variance with the clearing principles, the permit holder must apply to the CEO for a clearing permit in respect of that clearing”.

GHD developed a series of Preliminary Environmental Impact Assessments (PEIAs) for the ten proposed passing lanes, each requiring clearing of native vegetation in good or better condition, for Main Roads WA in April 2006. These PEIA’s identified that all of the proposed passing lanes may potentially be at variance with one or more of the “Ten Clearing Principles”, therefore, the formal EIA process was triggered (GHD, 2006).

GHD Pty Ltd (GHD) was commissioned by Main Roads Western Australia (WA) to prepare an Environmental Impact Assessment and Environmental Management Plan (EIA and EMP), including field surveys to assess the vegetation and habitat values, for the proposed road upgrades.

The field survey for the Site located 92.775 to 95.32 SLK at was conducted on the 19th September 2006, by an experienced and qualified botanist/zoologist and an experienced field ecologist. The results of the assessment concluded that:

- » The main vegetation types across the Site were Banksia low woodland and scrub-heath. In the southern section of the Site there was a small patch of Marri woodland. Most of the vegetation across the Site was considered to be a mosaic, that is, transitional between the various vegetation types.
- » The vegetation at the Site was largely intact with few disturbance factors and was rated between Condition 1 (‘Pristine’) to Condition 3 (‘Very Good’). The vegetation adjacent to the highway was in a worse condition than the rest of the road reserve vegetation, with substantial weed infestation adjacent to the highway. One species, *Moraea* sp. (Cape Tulip),



identified during the survey is declared under the *Agriculture and Related Resources Protection Act 1976*.

- » The vegetation types recorded during the survey were compared with those of Shepherd (*pers. comm.*, 2005). This comparison indicated that the main vegetation types at the Site, 'Low woodland; Banksia' and 'Mosaic; Hakea scrub-heath and Dryandra heath shrublands' have more than 30% of their original distribution remaining indicating they are above a 'threshold level', below which a vegetation type is considered to be 'underrepresented'. The vegetation type 'Medium woodland; Marri' is below the 30% 'threshold level' and clearing of this vegetation type should be avoided where possible. The Marri woodland at the Site is described as a transitional vegetation community.
- » The originally proposed site, as described in the Preliminary Environmental Impact Assessment (PEIA) was located from 92.60 to 95.90 SLK. The survey found some clearing of an under-represented Marri woodland community was required for the northbound passing lane (approximately 0.17 ha). Although this clearing was considered minor Main Roads WA have elected to relocate the northbound passing lane 175m to the north of the original proposal (with the southern most extent of the upgrade starting at 92.775 SLK) to avoid clearing in the area classified as Marri woodland.
- » No evidence of plant diseases was observed during the survey. Based on patterns of health of susceptible plants there was no indication of the occurrence of dieback (*Phytophthora cinnamomi*) within the Site.
- » The middle section of the Site has been recently burnt and so it was not possible to comprehensively assess the vegetation type or condition of this section; however it is assumed that this area was similar to the surrounding areas.
- » The Site has moderately high species diversity and a total of 112 taxa (90 native taxa) from 38 families and 114 taxa (90 native taxa) from 46 families were recorded for the northbound and southbound passing lane respectively.
- » No DRF or Priority Flora species were identified during the survey.
- » The Site would be expected to support a number of bird species, and eight species were observed during the survey. The Site would be expected to support a number of reptile species, particularly lizard species, and two skink species were observed during the survey. Signs of fox and kangaroo use of the Site were recorded during the field survey.
- » A number of significant species have been recorded in the general area but the main species that would be likely to use the Site is Carnaby's Cockatoo, which could use the Site for foraging. The extent of clearing required for this project would not significantly impact on the habitat of this species and no significant impacts on other significant fauna species would be expected from the project.
- » The Site contains two main habitat types, woodland and scrub-heath. The vegetation of these habitats was in good condition and, in a landscape that has been largely cleared for agriculture (particularly in the north of the Site), this vegetation would offer a habitat refuge. This Site offers high value as a habitat linkage and fauna corridor. The vegetation of the road reserve at this Site is in excellent condition and the reserve is of substantial size and could be used by a variety of fauna species.



- » The clearing of vegetation that is required for this project will reduce the amount of habitat available to fauna, but the extent of clearing is minor and the majority of the road reserve vegetation will be retained and can continue to be utilised by fauna.
- » The amount of clearing required for this project is minimal and the project has been assessed as not being at variance with any of the “Ten Clearing Principles”.

No environmental impacts identified during the preparation of this EIA and EMP are considered to warrant the referral of the Project to the Commonwealth Minister for the Environment under the provisions of the *Environmental Protection and Biodiversity Conservation Act, 1999*, or the West Australian *Environmental Protection Act 1986*.



1. Introduction

1.1 Background

GHD Pty Ltd (GHD) was commissioned by Main Roads WA to prepare an Environmental Impact Assessment and Environmental Management Plan (EIA and EMP) for a proposed road upgrade of sections of the Brand Highway.

Main Roads WA proposes to improve road user safety by constructing ten new passing lanes and extend an existing lane along southern sections of the Brand Highway. This report covers the proposed upgrades at 92.775 to 95.32 SLK, which consists of a northern and southern passing lane upgrade, intersected by Salt Lake Road, Regans Ford. The passing lanes are located together along a 2.5 km section of the Brand Highway (overlapping for a length of 1.05 km), so have been considered together in this EIA report.

In April 2006, a Preliminary Environmental Impact Assessment (PEIA) report for ten proposed passing lanes was completed by GHD for Main Roads WA (GHD, 2006). The location of each of the ten passing lanes is identified in Figure 1.

The PEIA involved a desktop study to assess each of the proposed clearing areas to determine the likelihood that the clearing may be at variance with the "Ten Clearing Principles" defined in Schedule 5 of the *Environmental Protection Amendment Act 2003*, as required by Main Roads WA clearing permit CPS 818/1.

Where the outcome of the PEIA indicated that the proposed clearing "may be at variance or seriously at variance with one or more of the clearing principles", Main Roads WA must undertake an EIA (DEC, 2005).

This EIA and EMP has been prepared as a result of the PEIA findings for the Site, which indicated that the proposed clearing may be at variance with one or more of the "Ten Clearing Principles" outlined in Schedule 5 of the *Environmental Protection Amendment Act 2003*.

1.2 Study Area

The Site consists of a 1.675 km northbound passing lane from 92.775 SLK to 94.45 SLK and a 1.92 km southbound passing land from 93.40 to 95.32 SLK. This Site is located approximately 14 km south of Cataby and intersected by Salt Lake Road, to the north of Nammegarra Rd. The survey location is shown at Figure 1, identified as MRWA Site 3.

It should be noted that the originally proposed site, as described in the PEIA, was located from 92.60 to 95.90 SLK. The biological survey undertaken as part of the EIA process covered this larger area and found some clearing of an under-represented Marri woodland community was required. Main Roads WA have elected to slightly relocate the Site as identified above, within the original assessment area, in order to avoid any clearing impacts on this community.

The field surveys considered the whole area of vegetated road reserve along the entire length of the survey area; however, with effort concentrated on the area of road widening required. Additional to the survey of the road reserve, any significant biological aspects outside of the Site were considered for any potential indirect impacts from the proposed works.



1.3 Field Survey Scope

The field survey was conducted to verify the desktop study and to provide a detailed assessment of the existing environment at the Site and its relationship to adjoining areas. The field survey considered the following aspects:

- » Assessment of plant species located at the Site, including consideration of rare and protected species and introduced species;
- » An assessment of the vegetation type and condition of the Site and a review of the significance of the vegetation communities at the Site;
- » An assessment of the potential presence of any plant pests and diseases at the Site;
- » An assessment of the clearing against the “Ten Clearing Principles”;
- » An inventory and review of the vertebrate fauna species in the survey area, particularly protected fauna species. A review of presence and abundance of introduced fauna species;
- » Identification of any habitats of significance; and
- » Assessment of habitat linkages.

The survey for both passing lanes (north and south) was conducted at the same time and the broadscale information in the report (such as vegetation and fauna) applies across the Site area from 92.775 to 95.32 SLK (note, the survey actually included the greater area of the original proposal being 92.60 to 95.90 SLK). However, the collection of plant species was conducted separately for the two passing lanes, with separate flora species lists collated for 92.775 SLK to 94.45 SLK and 93.40 to 95.32 SLK.

1.4 Purpose of this Document

This document has been prepared in accordance with the Main Roads WA Clearing Permit CPS 818/1 and the Supplementary Guidance on Environmental Impact Assessment (Main Roads WA, 2006) and describes the significant aspects of the existing natural and social environment at the Site and examines the environmental and social impacts of the proposed works.

Actions to manage and minimise the identified impacts have been proposed and incorporated as part of this document with the objective to develop an effective EMP that can be utilised during all phases of the Project.

The EIA and EMP has been prepared based on:

- » A field based flora and fauna survey, as described in Section 1.3;
- » A review of relevant design documents prepared for the Project;
- » Discussions with the Main Roads WA Project Manager;
- » Discussions with officers from the Department of Environment and Conservation (DEC);
- » A search of CALM's Declared Rare and Priority Flora, Threatened Ecological Communities and Threatened Fauna databases; and
- » A relevant literature and database review.



2. Project Details

2.1 Proposal in a Regional Context

The proposal to upgrade the Brand Highway is a State Government initiative implemented through Main Roads WA.

The proposal includes the construction of ten new passing lanes and the extension of an existing lane along southern sections of the Brand Highway. The works are located within the Shires of Gingin and Dandaragan, from approximately 18 km north of the Gingin turn-off to 55 km south of Eneabba, as shown in Figure 1.

2.2 Description of this Upgrade

This report covers the proposed passing lane upgrades at Regans Ford, which consists of a 1.675 km northbound passing lane from 92.775 to 94.45 SLK and a 1.92 km southbound passing lane from 93.40 to 95.32 SLK. The Site is located approximately 10 to 14 km south of Cataby, intersecting with Salt Lake Road, to the north of Nammegarra Road. Key characteristics are summarised in Table 1.

Table 1 Key Characteristics of the Upgrades

Issue	Description
Lane Lengths	Southbound – 1.92 km (93.40 to 95.32 SLK) Northbound – 1.675 km (92.775 to 94.45 SLK)
Lane Width	3.5 m
Sealed Shoulder	1.0 m
Unsealed Shoulder	1.0 m
Tapered Shoulder	2.1 m
Table Drain	1:6
Fill Slope or Batter	1:6
Fill details	Fill material required for construction of the road will be sourced by the Contractor in accordance with criteria set in the Contract, for approval by the Superintendent. The volume of fill material required will depend on whether the construction works are on the basis of widening in fill or in cut.
Side Road Intersections	Salt Lake Road
Clearing	3.6 ha
Revegetation Area	N/A
Land Acquisition	N/A



2.3 Need for the Proposal

The objective of the passing lanes at this Site, and the other proposed upgrades in the region (discussed in Section 2.1), is to improve road user safety particularly with the interaction of smaller vehicles and the large road trains that use the route to cart mineral sands and oil from the Dongara, Eneabba and Cataby areas.

2.4 Proposal Schedule

It is anticipated that clearing for the Project will commence in January 2007 and will be completed under contract by a private contractor, on the behalf of Main Roads WA within approximately 12 weeks.



3. Existing Environment

3.1 Climate

The climate of the Site is best described as Mediterranean with warm dry summers and cool wet winters. The Bureau of Meteorology (BOM) weather-recording stations located closest to the Site are Lancelin, approximately 30 km west of the Site, Moora approximately 45 km to the north-east and Badgingarra approximately 50 km to the north. The recorded climate data at Lancelin, Moora and Badgingarra are summarised in Table 2.

Table 2 Climate Readings at Closest Weather Stations (BOM, 2006)

Climate Statistic	Lancelin	Moora	Badgingarra
Mean Annual Maximum Daily Temperature Range (°C)	29.7 (February) to 19.1 (July/Aug)	34.3 (January) to 17.3 (July)	34.8 (February) to 17.5 (July)
Mean Annual Minimum Daily Temperature Range (°C)	17.9 (February) to 9.8 (August)	17.7 (January) to 6.8 (July/Aug)	17.7 (February) to 6.9 (August)
Mean Annual Rainfall (mm)	619.9	460	587.4
Mean Annual Rain days per year (days)	108.3	92.2	103.4
Highest Recorded Daily Rainfall (mm)	85.8 (January)	143.0 (February)	98.4 (November)
Highest Monthly Rainfall (mm)	219.2 (June)	244.9 (July)	292.3 (May)

3.2 Geology and Soils

The Site forms part of the Perth Sedimentary Basin. The main geological unit of the area is the Bassendean Sands that consist of deflated low ridges of siliceous sand with intervening swampy depressions and soils characterised by leached dunes of quartz sand. This system overlies the Yarragadee Formation of sandstone and conglomerate with a ferruginous lateritic layer.

3.2.1 Acid Sulphate Soils

The Site has not been mapped for potential acid sulphate soils as part of the Western Australian Planning Commission's (2003) Planning Bulletin No. 64, although areas 50 km to the south of the Site have been mapped.



Those areas mapped identify inundated areas as posing a high risk of actual or potential acid sulphate soils less than 3 m from the surface, with surrounding higher areas considered as having a moderate to low risk of having actual or potential acid sulphate soils generally at depths of greater than 3 m from the surface.

It is considered that the Site would fall into the latter category, with it likely that the Site would contain Acid Sulphate Soils at depth owing to the close proximity of the Site to various wetlands. As the roadworks associated with the Project are not expected to require deep excavation, it is considered unlikely that Acid Sulphate Soils will be encountered during the roadworks.

3.3 Rivers and Wetlands

The Site lies within the northern extent of the Moore River catchment area, a proclaimed surface water area under the *Rights in Water and Irrigation Act 1914*. The Moore River has been defined as saline, having recorded a mean salinity level of 7200 mg/L Total Dissolved Solids between 1993 and 2002 (Department of Environment, 2005b).

Several permanently and seasonally inundated wetlands occur approximately 1 km to the west of the Site. No wetlands described in the *Environmental Protection (South West Agricultural Zone Wetlands) Policy 1998* or listed under the Ramsar Convention (1971) occur within the vicinity of the Site.

3.4 Groundwater

The Project is located within a proclaimed Gingin Groundwater Area. The Department of Water (DoW, 2006) identifies the area as having on average groundwater salinity levels of between 1000 and 3000 mg/L total dissolved solids (TDS).

The area is not located within any gazetted Public Drinking Water Supply Area.

3.5 Reserve and Conservation Areas

No conservation areas are located in the near vicinity of the Site (Department of Land Information, 2006).

The Shire of Dandaragan Town Planning Scheme No. 6 zoning maps do not identify any local Parks and Recreation reserves in the vicinity of the Site.

3.6 Contaminated Sites

A search for Potentially Contaminated Sites through the DEC Water Information (WIN) database was conducted. This search concluded that no previously recorded contaminated sites occur in close vicinity to the Site, which is consistent with the pattern of historical land use in the Site.

The presence of unexploded ordnance contamination (UXO) was identified as possible in the Site area. MRWA commissioned BACTEC to undertake a survey of the area. The reader is referred to MRWA for the results of this survey.



3.7 Flora and Vegetation

3.7.1 Background

The PEIA undertaken for this Site in April 2006, identified a potential variance with one or more of the “Ten Clearing Principles” outlined in Schedule 5 of the *Environmental Protection Act 1986*. As a result of these findings, a vegetation, rare flora and opportunistic fauna survey of the Site was required for inclusion in an EIA document.

3.7.2 Field Survey Methods

The field survey for the Site was conducted on the 19th September 2006, by an experienced and qualified botanist and an experienced field ecologist. The Site was surveyed by traversing the area on foot and by conducting extensive searching of 10 by 10 m quadrats.

The surveys were conducted with regard to the Environmental Protection Authority Guidance Statement No. 51 – *Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia (2004)*

The survey recorded and mapped vegetation types present at the Site. Aerial photography was used to assist in the delineation of vegetation types. Dominant species in each vegetation type was noted and a full list of species was generated for the Site. Targeted searches for Declared Rare or Priority Flora were conducted, with reference to Declared Rare and Priority Flora species lists for the area, generated from the DEC and the West Australian Herbarium. The condition and weed status of the vegetation were noted and the significance of the vegetation type in a regional context was assessed. Where identification of species was uncertain, confirmation was made at the Western Australian State Herbarium, using published keys and with reference to experts, where required.

A section of the Site had been recently burnt so the number of plants recorded in this area was limited to those that rapidly germinate and sprout post-fire. It was not possible to comprehensively assess the vegetation of this section; however, it was assumed that this area was similar to the surrounding unburnt areas.

Nomenclature of the species follows that of *Florabase (2006)* for plant species and *Faunabase (2006)* for fauna species.

3.7.3 Vegetation Description

Beard (1979) has mapped the vegetation of the general area at a scale of 1:250,000. The Site vegetation is within the Darling Botanical District, in the Drummond sub-district of the South Western Botanical Province as recognised by Beard (1979). The vegetation of the area around the Site has been mapped as Banksia low woodland and heath & scrub-heath.

The vegetation type was mapped during the field survey and is shown in Figure 2. A full description of the vegetation types, with photographs, is provided in **Appendix A**. There were a number of different vegetation types across the Site, including Marri woodland, Banksia low woodland and scrub-heath. Very little of the Site contained discrete vegetation types; rather, the vegetation across the Site was transitional between the various vegetation types.



The southern section of the Site contained a small section of Marri woodland; which was composed of Marri (*Corymbia calophylla*) over Grass trees (*Xanthorrhoea preissii*), Zamia (*Macrozamia fraseri*), *Mesomelaena pseudostygia*, *Desmocladius flexuosus*, Yellow Buttercups (*Hibbertia hypericoides*) and various scrub-heath species.

The majority of the Site contained mixed scrub-heath, which was dominated by Myrtaceous and Proteaceous plants, particularly Dryandra and Hakea species. However, much of the vegetation was transitional and species such as Grass trees (*Xanthorrhoea preissii*) and Buttercups (*Hibbertia hypericoides*) were also dominant.

There were patches of Banksia low open woodland with scattered *Eucalyptus tottiana* in the northern section of the Site. This vegetation type was transitional with mixed scrub-heath, and the understorey was dominated by scrub species, such as *Hakea trifurcata*, *Allocasuarina humilis*, *Calothamnus sanguineus* and *Eremaea pauciflora*. The Site contained some patches where *Banksia prionotes* was dominant in the upper-storey, with this species lining the roadside in some areas.

3.7.4 Vegetation Condition

The vegetation at the Site was given a condition rating based on the Bush Forever (Government of Western Australia, 2000) vegetation condition ratings scale. This scale recognises a level of 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;
- » The potential for natural or assisted regeneration.

The ratings in this scale are described in Table 3.

There is some evidence that sections of the Site have been cleared in the past, and there has been disturbance from old roadworks close to the highway. However, in general the majority of the vegetation is Condition 1 ('Pristine') to Condition 2 ('Excellent'). The Marri woodland in the southern section has been subject to greater disturbance, including weed invasion, but the vegetation structure was still intact. This area was rated Condition 2 ('Excellent') to Condition 3 ('Very Good').

There is substantial weed invasion, particularly of grass species, along the edge of the highway, adjacent to the shoulder and there is also evidence of other disturbances from the highway, such as rubbish disposal. The vegetation adjacent to the highway was rated between Condition 3 ('Very Good') and Condition 4 ('Good'). In general, disturbance is restricted to the edge of the shoulder and after a few metres in from the shoulder there is little indication of disturbance factors. There is a parking bay in the north of the Site and the vegetation adjacent to this has had its structure altered somewhat. The parking bay contains planted Eucalypts and other species not native to the area.



Table 3 Government of Western Australia (2000) Vegetation Condition Scale

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

The middle section of the Site has been recently burnt and so it was not possible to assess the condition of this section, it is assumed that this area was similar to the surrounding unburnt areas.

3.7.5 Significance of Vegetation

A vegetation type is considered to be under-represented 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 (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



Native vegetation types represented in the study, their regional extent and reservation status are generally drawn from Shepherd (*pers. comm.*, 2005) to give an indication of the regional impact of the proposed clearing. Vegetation types known to occur within the vicinity of the Site are outlined in Table 4.

Table 4 Regional Assessment of Vegetation Extent (Source: Shepherd, 2005) within the vicinity of the Site

Vegetation Association	Vegetation Community	Pre-European Extent (ha)	Current Extent (ha)	% Remaining	Status
949	Low woodland; Banksia	218,205	124,461	57.0	Least Concern
999	Medium woodland; Marri	115,712	15,161	13.1	Vulnerable
1031	Mosaic: Hakea scrub-heath and Dryandra heath shrublands	269,505	93,975	34.9	Depleted

It can be seen from the above vegetation classifications that the vegetation, ‘Low woodland; Banksia’ and ‘Mosaic; Hakea scrub-heath and Dryandra heath shrublands’ at the Site are above 30% which means they are above the ‘threshold level’, whereas the current extent of the vegetation type ‘Medium woodland; Marri’ is below the 30% ‘threshold level’ and is classified as *Vulnerable*.

Of note, the Vegetation Association 999 is not mapped by Beard (1979) to occur within the Site (including that Site originally proposed). The closest extent of Vegetation Association 999: Medium woodland; Marri is indicated to occur 2 km east of Brand Highway.

MRWA have advised that a maximum of 13 m is required from the edge of the existing seal to accommodate the proposed road works. The Site currently has a gravel shoulder of approximately 3 m in width, indicating an extra 10 m clearing will be required. The existing width of road reserve vegetation ranges from around 35 m (on the western side of the highway, south of Salt Lake Rd) to around 100 m (on both sides of the highway, north of Salt Lake Rd). The clearing width is minimal in relation to the extent of vegetation that will be retained in the road reserve.

Clearing of 10 m width over the 1.675 km for the northbound passing lane and 1.92 km for the southbound passing lane equates to 3.6 hectares of good quality remnant vegetation that will be required to be cleared.

It can be difficult to assign the vegetation types described by Shepherd (*pers. comm.*, 2005) to the vegetation within the Site as the Shepherd mapping is based on the broad-scale (1:250,000) vegetation mapping produced by Beard (1979). As a result, boundaries of vegetation types may be considered to be somewhat obscure, particularly where pre-European vegetation has been inferred “on the evidence of relics on roadsides and paddocks with reference to topography and soil as seen in photo patterns” (Beard, 1979).

The vegetation types classified during the field surveys were extrapolated to and found matched with the vegetation classifications as indicated in Table 4.



Despite the fact that the Marri woodland is not mapped to occur within the Site by Beard (1979), an area at the southern section of the original Site was deemed to match the vegetation association (999) description, as is therefore considered *Vulnerable*.

The area of Marri woodland that would have been required to be cleared for the originally proposed 92.60 to 95.90 SLK site, was approximately 0.17 ha to the southern extent of the north bound passing lane (based on the vegetation mapping in **Figure 2**, indicating 170m of this community in the southernmost section of the original site, and a clearing width of 10m). This represents approximately 0.0012% of the current remaining extent of Marri woodland, which is not considered significant. In addition, the majority of the Marri woodland recorded from the Site occurs on the eastern side of the Brand Highway, which will not be impacted by the proposed works. Furthermore, within the vicinity of the Site, the Marri woodland is considered not to occur as a discrete community, but rather in transition to the more widespread mixed scrub-heath, present on the western side of the Site.

However, Main Roads WA have elected to relocate the proposed northbound passing lane 175m to the north in order to avoid clearing in this vegetation community, in line with the EMP recommendations. The currently proposed Site is located from 92.775 to 95.32 SLK.

3.7.6 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, that is, Presumed Totally Destroyed, Critically Endangered, Endangered, and Vulnerable. Some TECs are protected under the Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act)*. Although TECs are not formally protected under the WA *Wildlife Conservation Act 1950*, the loss of, or disturbance to, some TECs triggers 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.

A search of the CALM Threatened Ecological Communities (TEC) database indicated that there are no TEC's within the vicinity of the Site. However, a Priority Ecological Community is known to occur 20 km to the west of the Site. This is **JB28** – Claypans with mid dense shrublands of *Melaleuca lateritia* over herbs. This Priority Ecological Community was not recorded during the field survey and no Threatened Ecological Communities were identified during the field survey.

3.7.7 Environmentally Sensitive Areas

Environmentally Sensitive Area's (ESA's) are subject to definition under Section 51B of the *Environmental Protection Act 1986* and may include areas such those requiring special management attention to protect important scenic values, fish and wildlife resources, historical and cultural values, and other natural systems or processes.

No ESA's have been identified within the Site (DEC, 2006a).



3.7.8 Flora Species

Northbound Passing Lane: 92.775 to 94.45 SLK

The area of the northbound passing lane, from 92.775 to 94.45 SLK, has good species diversity with a total of 112 taxa (90 native taxa) from 38 families recorded within the surveyed area.

The dominant families recorded from the area were:

- » Myrtaceae 14 taxa
- » Proteaceae 12 taxa
- » Poaceae 9 taxa
- » Papilionaceae 7 taxa
- » Asteraceae 7 taxa

Additionally, the dominant genera recorded were:

- » *Styloidium* 5 taxa
- » *Acacia* 4 taxa
- » *Banksia* 3 taxa
- » *Petrophile* 3 taxa

See Table 9, **Appendix B** for a full list of flora species recorded in the Site.

Nine species were identified to genus only, due to lack of distinctive features, such as flowers. Additionally there were a number of plants that were tentatively identified to species; however, this identification could not be completely certain due to lack of distinctive features. These species are indicated in **Appendix B**. Field surveys at different times of year would allow the identification of a greater number of plant species.

Southbound Passing Lane: 93.40 to 95.32 SLK

The area of the southbound passing lane, from 93.40 to 95.32 SLK, has relatively high species diversity with a total of 114 taxa (90 native taxa) from 46 families recorded within the surveyed area.

The dominant families recorded from the area were:

- » Proteaceae 14 taxa
- » Myrtaceae 10 taxa
- » Papilionaceae 9 taxa
- » Poaceae 7 taxa

Additionally, the dominant genera recorded were:

- » *Banksia* 4 taxa
- » *Acacia* 3 taxa
- » *Dryandra* 3 taxa
- » *Conostylis* 3 taxa



See Table 10, **Appendix B** for a full list of flora species recorded in the Site.

Fourteen species were identified to genus only, due to lack of distinctive features, such as flowers. Additionally there were a number of plants that were tentatively identified to species; however, this identification could not be completely certain due to lack of distinctive features. These species are indicated in **Appendix B**. Field surveys at different times of year would allow the identification of a greater number of plant species.

3.7.9 Significant Flora Species

Flora species that are considered to be significant are listed under the Western Australian *Wildlife Conservation Act 1950* and the *EPBC Act 1999*. Additionally, the DEC keeps a list of Priority species, that are not listed under legislation but for which the DEC feels there is cause for concern, or for which not enough information is known. A description of the DEC's conservation codes is provided in Table 7, **Appendix B**.

A search of the rare flora databases of the DEC and the Western Australian Herbarium was requested for the Site. This search indicated that a Priority 3 species (*Haemodorum loratum*) is known to occur approximately 250 m to the north of the Site (Figure 2). Additionally, a number of significant species have been recorded in the general vicinity of the Site (Table 8, **Appendix B**).

The Moora District Office of CALM also advised that two declared rare species *Ptychosema pusillum* and *Drakaea elastica* may also exist at the Site as nearby areas of remnant vegetation are known to host the species, which are known to co-occur.

During the field survey a thorough search for the DRF and Priority species known to occur in the vicinity, particularly *Haemodorum loratum*, *Ptychosema pusillum* and *Drakaea elastica*, was conducted.

No DRF or Priority species were identified during the survey. One *Haemodorum* species was identified in the burnt section of the Site; however, this plant could not be identified to species-level as it had only recently germinated.

3.7.10 Weeds

The majority of the road reserve vegetation at the Site has minimal weed infestation. Weed species were mostly evident along the edge of the highway and other areas of disturbance, such as access tracks and the parking bay in the north of the Site.

A total of 22 weed species were recorded within the Northbound passing lane search area, which represents about 20% of the total species recorded. A total of 24 weed species were recorded within the Southbound passing lane search area, which represents about 21% of the total species recorded. These were mainly pasture grasses (Poaceae) and Daisies (Asteraceae). The majority of the weeds were agricultural weeds, rather than environmental weeds that invade intact bushland. However, the bushland did contain *Gladiolus*, an invasive environmental weed.

One species, *Moraea* sp. (Cape Tulip), identified during the survey on the north of the parking bay, is declared under the *Agriculture and Related Resources Protection Act 1976*. This species is a "P1" species for the whole of State, which "prohibits movement of plants or their



seeds within the State. This prohibits the movement of contaminated machinery and produce including livestock and fodder”.

3.7.11 Plant Pests and Diseases

Phytophthora cinnamomi (dieback) disease is generally restricted to areas in the south west of the State receiving at least 600 mm of average annual rainfall, although it is most active in areas receiving more than 800 mm of annual rainfall. It can occur in water-gaining areas in the 400 – 600 mm annual rainfall areas.

The closest Bureau of Meteorology weather-recording stations to the Site are located at Lancelin, Moora and Badgingarra, which recorded 619.9, 460 and 587.4 mm annual rainfall respectively (Bureau of Meteorology, 2004). Thus, dieback is unlikely to occur in the majority of the area around the Site, but low-lying wet areas may be at risk.

No evidence of plant diseases was observed during the survey. Dieback-susceptible plant species occur in the survey area; however, there was no indication of the occurrence of dieback within the Site based on patterns of health of susceptible plants.

No other plant pests or diseases were identified during the survey.



3.8 Fauna

3.8.1 Field Survey Methods

The reconnaissance survey for the presence of fauna was conducted on the 19th September 2006, by an experienced and qualified botanist/zoologist and an experienced field ecologist, concurrently with the flora and vegetation survey. A consideration of fauna habitat was undertaken within the Site.

The fauna survey was limited to terrestrial and vertebrate species.

3.8.2 Fauna Species

Eight species of birds were observed during the survey. The Site would be expected to support a number of bird species, not all of which were observed during the field survey. Two skink species were observed, the South-western Bobtail and a small skink species that was sighted only briefly and thus could not be identified. The Site would be expected to support a number of reptile species, particularly lizard species. Signs of fox and kangaroo use of the Site were recorded during the field survey. The number of mammal species that use the Site would be limited by the size of the Site and an absence of freshwater. Kangaroos may travel through the Site from the bushland in the southwest, to the agricultural land in the east.

The number of species determined during the reconnaissance survey was limited by the short period of the survey and the fact that it was purely opportunistic and did not provide the opportunity to survey those species that are cryptic or nocturnal.

A search of the WA Museum database (Faunabase, 2006) for fauna records within a 5 km radius of the Site was conducted. The results of this search are shown in Table 15, **Appendix C**.

3.8.3 Significant Species

The conservation status of fauna species is assessed under State and Commonwealth Acts; in particular the Western Australian *Wildlife Conservation Act 1950*; *Wildlife Conservation (Specially Protected Fauna) Notice 2006*, and the Commonwealth *EPBC Act*.

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). These levels are described in Table 11, **Appendix C**.

The EPBC Act also has lists of migratory species that are recognised under international treaties such as the China Australia Migratory Bird Agreement (CAMBA), the Japan Australia Migratory Bird Agreement (JAMBA) and the Bonn Convention (The Convention on the Conservation of Migratory Species of Wild Animals).

Listed migratory species also include any native species identified in an international agreement approved by the Commonwealth Environment Minister. The Minister may approve an international agreement for this purpose if satisfied that it is an agreement relevant to the conservation of migratory species.



In Western Australia, the *Wildlife Conservation (Specially Protected Fauna) Notice 2006* has classified Threatened Fauna in a series of Schedules (Table 12, **Appendix C**). The DEC also produces a supplementary list of Priority Fauna, 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 protection, but their presence would normally be considered to determine any potential impacts on these species. Levels of Priority are described in Table 13, **Appendix C**.

A listing of Significant Fauna from the *EPBC Act Protected Matters Search Tool (2006)* and Rare and Priority species from the DEC rare fauna database for the general Site are presented in, Table 14 **Appendix C**.

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 out-dated and often misrepresent the current range of threatened species.

3.8.4 Introduced Species

Signs of foxes, an old burrow and a skeleton, were located during the field survey. This species may use the woodland areas of the Site to shelter and may forage in adjacent more open land during the night.

3.8.5 Habitat Value

The habitat value of the Site was assessed during the survey. The Site contains two main habitat types, woodland and scrub-heath. The vegetation of these habitats was in Good, or better, condition and in a landscape that has been largely cleared for agriculture (particularly in the north of the Site) this vegetation would offer a habitat refuge. The Site is close to a number of lakes and species that utilise the lakes may be occasional visitors to the Site.

The clearing of vegetation that is required for this project will reduce the amount of habitat available to fauna, but the extent of clearing is minor and the majority of the road reserve vegetation will be retained and can continue to be utilised by fauna.

3.8.6 Habitat Linkages

Fauna corridors and habitat linkage are important to allow animals to move between areas of resource availability. Such corridors are important for ground and aerial fauna, providing cover, resources, and linking areas suitable for rest and reproduction.

This Site offers high value as a habitat linkage and fauna corridor. The vegetation of the road reserve at this Site is in Good, or better, condition and the reserve is of substantial size (around 100 m on either side of the road, north of Salt Lake Rd) and could be used by a variety of fauna species. While there are large areas of bushland to the west of Brand Highway, to the east of Brand Highway the land has been largely cleared for agriculture, and native vegetation occurs only as small remnants. The vegetation of the road reserve of Brand Highway provides a significant and contiguous habitat linkage in a north-south direction. Fauna travelling east-west



could also use the vegetation in the road reserve as refuge while moving between vegetation patches from the east of the highway to the lakes and bushland to the west of Brand Highway.



4. Social Environment

4.1 Surrounding Land Use

The Site is surrounded by general farming land and remnant vegetation, and is zoned as "Rural", under the Shire of Dandaragan Town Planning Scheme No. 6. The surrounding rural land use is described as 'dry land agriculture' or 'livestock grazing' (Australian Government, 2006).

4.2 Aboriginal Heritage

A search of the Department of Indigenous Affairs (DIA) Register of Aboriginal Sites was conducted as part of the PEIA, to determine the likelihood of the Project impacting on an Aboriginal site listed under the *Aboriginal Heritage Act 1972*. The search indicated that no known Aboriginal Heritage sites occur within the vicinity of the Site.

It was considered possible that there are unregistered sites located in the vicinity of the Site and it was recommended that the Main Roads WA Project Officer liaise with the Main Roads WA Heritage Liaison Officer and appropriate representatives of the local Aboriginal community to determine the presence of unregistered sites.

Main Roads WA have since commissioned further works and received advice following preliminary archaeological and ethnographic surveys in the area. Further information regarding this work should be sought through the Quartermaine (2006) and O'Connor (2006) reports.

Main Roads WA and their contractors need to be aware of their obligations under the *Aboriginal Heritage Act 1972* during road construction works.

4.3 European Heritage

The assessment of European Heritage issues for the Project included an inspection of the Site and a review of the Australian Heritage Commission on-line database, Australian Heritage Places Inventory on-line database, and the Western Australian Heritage Council on-line register.

No recorded European heritage sites were identified as occurring within 1 km of the Site.



5. Environmental Aspects

The PEIA identified the primary environmental and social aspects for consideration for the proposed project. The PEIA identified aspects that required further investigation as part of this EIA and EMP and those that were considered to be irrelevant to the Project. Those considered irrelevant would unlikely be impacted upon, or otherwise be of concern during the proposed works, and have not been discussed in any detail in the EIA or EMP. A justification for not including these factors is outlined in Table 5.

Environmental aspects considered relevant for this EIA are examined in more detailed in Section 6.

Table 5 Environmental Aspects Considered for the Project

Environmental Aspect	Yes	No	Comments
Air Quality		√	Lack of emission sources therefore no impact on regional air quality.
Dust	√		Addressed in Section 6.5.
Fauna	√		Addressed in Section 6.2.
Vegetation – threatened species and communities	√		Addressed in Section 6.1.
Vegetation – clearing	√		Addressed in Section 6.1.1.
Vegetation – dieback and other diseases or pathogens	√		Addressed in Section 6.1.2.
Vegetation – weeds	√		Addressed in Section 6.1.3.
Vegetation – weeds	√		Addressed in Section 6.8.
European Heritage		√	No sites of European Heritage identified within the Site.
Aboriginal Heritage	√		Survey details are not provided in this report, rather, the reader is directed to Quartermaine (2006) and O'Connor (2006). However, management measures will be implemented for potential impact on unregistered sites - addressed in Section 6.6.
Surface Waters / Drainage (watercourses, erosion, stormwater, disposal, water quality, salinity)	√		Addressed in Section 6.3.
Public Drinking Water Source Areas (PDWSA)		√	Site not located within a PDWSA.



Environmental Aspect	Yes	No	Comments
Groundwater	√		Addressed in Section 6.4.
Wetlands	√		No actual wetlands occur on site, however, wetlands do occur within the vicinity. These are not expected to be impacted by the Project, but management measures have been addressed in Section 6.3.
Noise and Vibration		√	Lack of sensitive receptors within the area.
Visual Impacts		√	Minimal impact due to the remote location of the Site and the fact that a road already exists at the location.
Dust	√		Addressed in Section 6.5.
Public Safety and Risk	√		Addressed in Section 6.7.
Contaminated Sites		√	No contaminated sites identified within the Site. UXO addressed in BACTEC report (2006).
Acid Sulphate Soil		√	As the roadworks associated with the Project are not expected to require deep excavation, it is considered unlikely that Acid Sulphate Soils will be encountered during the Project.
Hydrocarbon and Chemical Storage	√		No large quantities are to be stored onsite, but management measures have been addressed in Section 6.9.
Reserves and Conservation Areas		√	No reserves or conservation areas are within or adjacent to the Site.



6. Environmental Impacts and Management

Those issues considered relevant for further assessment as identified in Section 5 are discussed below, with a summary of the environmental and social impacts and management measures also detailed in the EMP in **Appendix E**.

6.1 Flora and Vegetation

6.1.1 Assessment Against the “Ten Clearing Principles”

The clearing of any native vegetation is regulated by the Environmental Protection Authority (EPA) and requires a permit under Part V of the *Environmental Protection Act (1998)*, except where exemptions apply under Schedule 6 of the Act or when the clearing is for exempt purposes, as prescribed in the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*, and not in an Environmentally Sensitive Area (ESA).

Applications to clear native vegetation are assessed against the “Ten Clearing Principles” outlined in Schedule 5 of the *Environmental Protection Amendment Act 2003*.

The principles address three main environmental areas:

- » Biodiversity significance;
- » Land degradation; and
- » Ground and surface water quality.

Main Roads WA was issued with a statewide vegetation clearing permit (Purpose Permit CPS 818/2), granted under section 51E of the *Environmental Protection Act (1986)*, on the 1st February 2006 by the Department of Environment and Conservation. The Purpose Permit allows Main Roads WA to clear of native vegetation for road realignment projects and associated construction activities. Any clearing of native vegetation must be assessed against the “Ten Clearing Principles” outlined in the permit. The Permit does not authorise the clearance of native vegetation for project activities where:

- » The clearing may be seriously at variance with the clearing principles;
- » Those project activities are incorporated in any proposal that is referred to and assessed under Part IV of the *Environmental Protection Act 1986* by the EPA; or
- » Clearing occurs in an Environmentally Sensitive Area.

The Permit holder should engage in activities that minimise the amount of vegetation to be cleared and where clearing is assessed as being at variance with one or more of the “Ten Clearing Principles”, then the permit holder must implement an offset in accordance with Part V of the Permit with respect to that native vegetation.

The Purpose Permit requires that Main Roads WA adhere to internal environmental processes of Environmental Assessment and Approval to ensure that they comply with the requirements of the Permit.



The clearing required at the Site for the upgrade project has been assessed against the “Ten Clearing Principles” below in **Table 6**.

Table 6 Assessment against the “Ten Clearing Principles”.

Principle Number	Principle	Assessment	Outcome
(a)	Native vegetation should not be cleared if it comprises a high level of biological diversity.	The remnant native vegetation is considered to contain a moderately high level of biological diversity but it is of a comparable (or lower) level of diversity to the remaining native vegetation in the area.	Vegetation may be considered for clearing.
(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.	The vegetation comprises habitat for a number of fauna species, but this habitat is not considered significant habitat for fauna indigenous to Western Australia	Vegetation may be considered for clearing. Mitigation measures should be implemented to minimise the impacts on fauna from the clearing of this vegetation.
(c)	Native vegetation should not be cleared if it includes, or is necessary for the continued existence of, rare flora.	No Declared Rare Flora were recorded during this survey.	Vegetation may be considered for clearing.
(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.	No Threatened Ecological Communities were recorded during this survey, and there are none recorded within 20 km of this Site.	Vegetation may be considered for clearing.



Principle Number	Principle	Assessment	Outcome
(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.	<p>The amount of clearing required for this project is minimal. A large area of remnant vegetation will be retained within the rest of the road reserve. Additionally, there are large areas of remnant vegetation to the west of the Site.</p> <p>To the south of the Site there is a small section of transitional vegetation - between Marri woodland (the majority of which is to the east of the Site) and the scrub-heath of the majority of the Site. Marri woodland is considered 'under-represented' and clearing of this vegetation type should be avoided where possible. However, the Marri woodland in the Site vicinity is considered not be a discrete community and this area is also not mapped (Beard, 1979) as part of the open Marri Woodland located 2 km east of the Site. The original northbound passing lane proposal required approximately 0.17 ha (or 0.0012% of the extent remaining) of this vegetation type to be cleared.</p> <p>Main Roads WA have elected to relocate the northbound passing lane 175m to the north to avoid clearing in the Marri woodland transitional community.</p>	<p>Vegetation may be considered for clearing.</p> <p>Where possible, the amount of vegetation clearing should be minimised and the disturbed area adjacent to the existing highway shoulder should be used.</p> <p>Main Roads WA have avoided clearing in the Marri woodland transitional community by relocating the northbound passing lane 175m to the north of that originally proposed.</p>
(f)	Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland.	There are no watercourses or wetlands within the Site.	Vegetation may be considered for clearing.
(g)	Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.	Partial clearing within the Site is likely to cause some, but not considerable, land degradation to adjacent bushland areas. Impacts are already present due to the existing highway and impacts are not expected to increase significantly.	<p>Vegetation may be considered for clearing.</p> <p>Appropriate management plans should mitigate potential impacts</p>
(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.	There are no adjacent or nearby conservation areas that are likely to be impacted by this project.	Vegetation may be considered for clearing.



Principle Number	Principle	Assessment	Outcome
(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	Vegetation clearing is not likely to cause increased deterioration in the quality of surface or underground water. Any impacts from run-off etc would already be present due to the existing highway.	Vegetation may be considered for clearing. Appropriate management plans should mitigate potential impacts.
(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.	The clearing of native vegetation is not expected to cause, or exacerbate the incidence or intensity of flooding. The increased road surface from the additional lane may increase run-off immediately adjacent to the highway but this will not be significant.	Vegetation may be considered for clearing. Appropriate management plans should mitigate potential impacts.

The amount of clearing required for this project is minimal and the project has been assessed as not being at variance with any of the “Ten Clearing Principles”.

The Main Roads WA Purpose Permit does not authorise the permit holder to clear native vegetation for project activities where the clearing may be seriously at variance with the clearing principles and does not permit Main Roads WA to clear within an Environmentally Sensitive Area (ESA).

This EIA has determined that the proposed clearing is not at variance with any of the “Ten Clearing Principles” and not within an ESA, therefore, the Site may be considered for clearing. However, clearing at the Site will be minimised and managed in accordance with the project EMP provided in **Appendix E**.

6.1.2 Disease Management

The field flora survey at the north and southbound passing lanes at the Site indicated no evidence of plant diseases. There was no indication of the occurrence of dieback within the Site normally shown by patterns of death of susceptible plants.

Condition 15a of the Main Roads WA Clearing Permit relating to dieback and pathogen control, requires actions to be taken in regions that have an average annual rainfall of greater than 400 mm and are south of the 26th parallel of latitude, therefore are relevant to the Site. The following control measures are required for the Project to minimise the risk of introduction and spread of dieback:

- » Clean earth-moving machinery of soil and vegetation prior to entering and leaving the area to be cleared;
- » Avoid the movement of soil in wet conditions;
- » If movement of soil in wet conditions is necessary, the permit holder must prepare, implement and adhere to a dieback management plan, developed in consultation with CALM;



- » Ensure that no dieback affected road building materials, mulches or fill are brought into an area that is not affected by dieback; and
- » Restrict the movement of machines and other vehicles to the limits of the areas to be cleared.

Management measures are included in the Environmental Management Plan provided as **Appendix E**.

6.1.3 Weed Management

Machinery and vehicle hygiene measures detailed in Section 6.1.2 will avoid the inadvertent spread of weeds throughout the Site, and from the Site to other sites. Management for this project will be also undertaken in accordance with the MRWA clearing permit.

6.2 Fauna

The habitat requirements of the protected species listed under the *EPBC Act*, the *Wildlife Conservation Act 1950* and listed as Priority species by the DEC, and the likelihood of their occurrence at the Site (after consideration of the habitat during the opportunistic fauna survey) is considered below, based on the findings of the field survey.

***Calyptrorhynchus latirostris* – Carnaby’s Cockatoo:** Carnaby’s Cockatoo, also known as the Short-billed Black-Cockatoo, is distributed across the south-west of Western Australia in uncleared or remnant areas of eucalypt woodland and shrubland or kwongan heath. Breeding usually occurs in the Wheatbelt region of Western Australia, with flocks moving to the higher rainfall coastal areas to forage after the breeding season. These black cockatoos feed on the seeds of a variety of native plants, including *Allocasuarina*, *Banksia*, *Dryandra*, *Eucalyptus*, *Grevillea* and *Hakea*, and some introduced plants, including *Pinus*. They will also feed on the nectar from flowers of a number of species, and on insect larvae.

Habitat Assessment The Site contains plant species that are feed species of Carnaby’s Cockatoo and this species may utilise the Site for foraging. There is some suitable breeding habitat for Carnaby’s Cockatoo in the general region but the Site does not contain suitable breeding trees for this species. The species may occasionally utilise the Site, however the minimal nature of clearing and the presence of surrounding habitat would not impact on their survival in the area.

***Dasyurus geoffroii* – Chuditch:** The Chuditch is the largest carnivorous marsupial in Western Australia. This species occupies a wide range of habitats including woodlands, riparian vegetation, beaches and deserts. The densest populations of Chuditch have often been found in riparian vegetation (Orell and Morris, 1992). The Chuditch formerly ranged over nearly 70% of Australia but now retains only a patchy distribution through the Jarrah forest and mixed Karri/Marri/Jarrah forest of south-western WA (CALM, 2005a).

Habitat Assessment This Site is at the northern extent of the known range of the Chuditch and this species is unlikely to occur on this Site.

***Botaurus poiciloptilus* – Australasian Bittern:** The Australasian Bittern occurs from southern Queensland to Tasmania and also occurs in the south-west of Western Australia; however it is rare in WA. This species occurs in terrestrial and estuarine wetlands with permanent water,



particularly wetlands with heavy fringing vegetation (NSW National Parks & Wildlife Service, 1999).

Habitat Assessment There are no permanent wetlands within the Site and this species would be very unlikely to occur at the Site.

***Leipoa ocellata* – Malleefowl:** Malleefowl are large ground-dwelling birds that build nests from a large mound of soil over leaf litter. Malleefowl were originally distributed in the mallee regions of southern Australia but its range has now been reduced and highly fragmented (CALM, 2006). In WA they are found in a number of national parks and in reserves in the Wheatbelt. The habitat of Malleefowl includes arid and semi-arid woodlands dominated by mallee eucalyptus on sandy soils, Mulga and other sclerophyllous associations (CALM, 2006). In WA they can also be found in some coastal heaths (CALM, 2006).

Habitat Assessment The Site occurs within the historical distribution of this species but it is no longer known to occur in the area. This species is highly unlikely to occur at the Site.

***Platycercus icterotis xanthogenys* – Western Rosella (inland subspecies):** The Western Rosella is only found in the south-west of Western Australia. The habitat of this species is generally open eucalypt forests but can also include cultivated land and orchards. The subspecies *P. icterotis xanthogenys* is generally found in semi-arid woodland with a heath understorey, from the western edge of wheatbelt out through salmon gum country.

Habitat Assessment This sub-species generally occurs in the wheatbelt (east of Brand Highway), and would be very unlikely to occur at the Site.

***Morelia spilota imbricata* – Carpet Python:** The Southern Carpet Python occurs in south-west Western Australia and has been recorded in a number of habitats including semi-arid coastal areas, Banksia woodlands, eucalypt woodlands and grasslands. This species is often rock-dwelling, or will use burrows, hollow tree limbs and hollow logs. It is listed as Specially Protected Fauna (Schedule 4) under the Western Australian *Wildlife Conservation Act 1950* and is protected because, while it has a broad distribution across south-west Western Australia, it is not common within its range.

Habitat Assessment This species occurs in low numbers in the general area of the Site and there is the potential for it to occur on the Site, however the minimal nature of clearing and the presence of surrounding habitat would not impact on their survival in the area.

***Falco peregrinus* – Peregrine Falcon:** Peregrine falcons occur throughout Australia, and are widespread across all continents except for Antarctica. The Peregrine Falcon is uncommon but not endangered in Australia, however it is considered endangered on a global scale. This species is a Schedule 4 species under the *Wildlife Conservation Act 1950*, which classifies it as “Other Specially Protected Fauna”.

Habitat Assessment While this species could potentially utilise the Site for foraging, it prefers areas with rocky ledges, cliffs and watercourses for breeding habitat.

***Macropus irma* – Western Brush Wallaby:** The Western Brush Wallaby, a medium sized macropod, is a grazer found primarily in open forest and woodland. This species was once very common in the south-west of Western Australia but has undergone a reduction in range and a significant decline in abundance in its current habitat. The decline in populations of this species



has resulted from extensive clearing within its original distribution, and from predation of juvenile Western Brush Wallabies by foxes (CALM, 2005b).

Habitat Assessment The Site is at the northern extent of the Western Brush Wallaby's known range. This species also requires large patches of vegetation to sustain its populations, and would be unlikely to occur at the Site.

Based upon the nominal clearing area associated with the Project, it is considered unlikely that the Project will significantly impact upon the long-term survival of any species of threatened fauna that may occur in the area. The Site contains vegetation that is in Good (and better) condition, and which would provide high value as fauna habitat. However, the extent of clearing required for this project is minor and the majority of the vegetation in the road reserve will be retained.

Impacts on the remaining vegetation and on significant and other indigenous fauna species at the Site can be managed through appropriate mitigation measures, as outlined in the EMP. Clearing of vegetation, however should be minimised to that which is practicable for the safe construction and operation of the road.

6.3 Drainage

No wetlands listed under the *Environmental Protection (South West Agricultural Zone Wetlands) Policy 1998* or the Ramsar Convention (1971) occur within the Site, however, several permanently and seasonally inundated wetlands occur approximately 1 km to the west of the Site. These should not be impacted by the roadworks.

Roadside drainage will replicate the existing drainage by the use of table drains, off-shoot drains and culverts. Existing surface water flows will be maintained by replacing and / or extending existing crossroad culverts.

6.4 Groundwater

Construction of bores and abstraction of groundwater or surface water will require a 26D Licence under the *Rights in Water and Irrigation Act 1914*.

The Construction Contractor is responsible for the supply and delivery of water required for the Project. The Construction Contractor (subject to the approval of the Superintendent) is also responsible for ensuring that all water abstraction and use is licensed and all approvals have been obtained.

6.5 Dust

There is likely to be some dust lift generated during the construction works and from passing traffic, which has the potential to settle on and cause impacts to adjacent vegetation. During construction, regular watering of the road will be undertaken to ensure the base material is at or near the Optimum Moisture Content to achieve sufficient compaction levels. This will assist in reducing dust generation. The Construction Contractor will provide for the management of dust such as by watering of the works area and of roads, streets and other areas immediately adjacent to the works as required.



Where it is found that vehicles leaving the Site have dropped excessive soil material onto adjacent sections of Brand Highway these sections will be swept to reduce the potential for dust generation and maintain traffic safety.

6.6 Aboriginal Heritage

Main Roads WA and their contractors need to be aware of their obligations under the *Aboriginal Heritage Act 1972* during the road construction.

If during roadworks, the Construction Contractor uncovers any materials that could be considered significant to Aboriginal people, works will immediately cease within 50 m of the material and the DIA will be notified immediately.

6.7 Public Safety

To ensure the safe access of traffic through the Site during construction the Construction Contractor will develop and implement a Traffic Management Plan (TMP) congruent with the current *Australian Standard Manual 1742.3: Uniform Traffic Control Devices: Part 3 Traffic Control Devices for Works On-Road (Standards Australia)* and the current Main Roads *Traffic Management Requirements for Works on Roads (2002)*.

The TMP should be submitted to the Construction Manager for approval within twenty-eight days of Award of Contract or within ten days of Possession of Site being granted or prior to the commencement of works, whichever is earlier.

The Construction Contractor must submit with the TMP a Certificate of Compliance certifying that the TMP has been prepared and/or reviewed by an appropriately qualified person as defined in the current Main Roads WA publication *Traffic Management Requirements for Works on Roads*.

All traffic control measures will be in place and fully operational before the Construction Contractor commences any work activity that affects existing roadways.

6.8 Fire Management

The risk of igniting a fire during construction activities will be minimised to reduce the potential impacts on public safety, buildings and equipment, and the environment. The Construction Contractor will conform to any specific requirements for fire prevention requested by Main Roads WA, Shire of Gingin, DEC and/or the Fire and Emergency Services Authority (FESA).

During road construction activities, the following fire management requirements will be complied with:

- » Machines and vehicles will be restricted to designated cleared areas;
- » All plant and vehicles operating over vegetation will have exhaust systems in good working order;
- » All machinery will be shut down during periods of extreme fire hazard as advised by the DEC or the Shire of Gingin;
- » All machinery will be fitted with fire extinguishers;



- » Smoking on site will be controlled and all cigarettes will be disposed of in an appropriate vessel; and
- » All glass (and other wastes) will be collected and removed off site on a daily basis.

6.9 Hydrocarbon and Chemical Storage

No on-site storage of fuel, oils and other contaminant materials will be permitted during road construction. Equipment required for the cleanup of any accidental spillages will be maintained on-site.

Major vehicle and plant servicing will not be conducted at the Site.

6.10 Waste Management

All domestic rubbish and other rubbish will be disposed of on a daily basis, offsite for final disposal to an authorised waste disposal site, or a site agreed with the Shire of Dandaragan.



7. Environmental Management Plan

The Environmental Management Plan (EMP) for this Project is presented in **Appendix E**. The EMP presents commitments and management measures that Main Roads WA will implement to ensure the project is environmentally acceptable.

The EMP outlines management strategies under each environmental aspect identified in the EIA. The EMP further outlines who is responsible for each commitment and the applicable design, construction or operational stage for which management is required. The commitments outlined in the EMP aim to provide a basis for which performance and compliance can be measured throughout the Project.

7.1 Environmental Monitoring and Compliance

Environmental management commitments detailed in this EMP will be included in relevant contract documents and the Technical Specification prepared for the Project. All Main Roads WA employees, contractors and other personnel employed on the Project will be made aware of the EMP through the site induction process.

During the Project construction phase, compliance with environmental management measures will be regularly monitored. Any non-conformances should be addressed at the first opportunity, while the non-conformance and any improvement actions implemented should be detailed in appropriate construction superintendent's documentation.

7.1.1 Environmental Management and Quality Plan

The Construction Contractor will prepare a Quality Plan for the Project, which will address the Construction Contractor's management responsibility, authority and communication requirements and clearly detail the Contractor's 'Quality Management Representative' (QMR) role with respect to the Contract in accordance with AS/NZS ISO 9001.

The Quality Plan will be submitted to the Construction Manager for approval within twenty-eight days of award of the Contract or ten days of Possession of Site being granted whichever is the earlier.



8. Consultation

Consultation was undertaken with the following parties, as part of the PEIA process:

- » Ms Annaleisha Sullivan – Natural Resource Management Officer – Department of Water, Geraldton Regional Office.
- » Ms Natalie Lauritsen – Natural Resource Management Officer – Department of Environment and Conservation, Geraldton Regional Office.
- » Ms Gina Broun – Conservation Officer – Department of Environment and Conservation, Moora District Office.
- » Mr Frank Rickwood – Department of Agriculture, Moora District Office.
- » Mr David Seinor – Corporate Services Manager, Shire of Dandaragan.
- » Mr Andrew Arnold – UXO Liaison Officer, Fire and Emergency Services Authority.
- » Mr Gerard Connell – Lands Officer, Agility Management Pty Ltd (Operator of the Parmelia Gas Pipeline).

Comments received during this consultation are provided in **Appendix F**.

Further consultation was not considered warranted as the proposal was not considered to be at variance with the “Ten Clearing Principles”.



9. Conclusions

A field biological assessment of the Brand Highway Upgrade at 92.775 to 95.32 SLK was conducted in mid-September 2006 and the results of the assessment concluded that:

- » The main vegetation types across the Site were Banksia low woodland and scrub-heath. In the southern section of the Site there was a small patch of Marri woodland. Most of the vegetation across the Site was considered to be a mosaic, that is, transitional between the various vegetation types.
- » The vegetation at the Site was largely intact with few disturbance factors and was rated between Condition 1 ('Pristine') to Condition 3 ('Very Good'). The vegetation adjacent to the highway was in a worse condition than the rest of the road reserve vegetation, with substantial weed infestation adjacent to the highway. One species, *Moraea* sp. (Cape Tulip), identified during the survey is declared under the *Agriculture and Related Resources Protection Act 1976*.
- » The vegetation types recorded during the survey were compared with those of Shepherd (*pers. comm.*, 2005). This comparison indicated that the main vegetation types at the Site, 'Low woodland; Banksia' and 'Mosaic; Hakea scrub-heath and Dryandra heath shrublands' have more than 30% of their original distribution remaining indicating they are above a 'threshold level', below which a vegetation type is considered to be 'underrepresented'. The vegetation type 'Medium woodland; Marri' is below the 30% 'threshold level' and clearing of this vegetation type should be avoided where possible. Main Roads WA have avoided clearing of this vegetation type (although it was considered transitional) by relocating the originally proposed passing lane 175m to the north.
- » No evidence of plant diseases was observed during the survey. Based on patterns of health of susceptible plants there was no indication of the occurrence of dieback (*Phytophthora cinnamomi*) within the Site.
- » The middle section of the Site has been recently burnt and so it was not possible to comprehensively assess the vegetation type or condition of this section; however it is assumed that this area was similar to the surrounding areas.
- » The Site has moderately high species diversity and a total of 112 taxa (90 native taxa) from 38 families and 114 taxa (90 native taxa) from 46 families were recorded for the northbound and southbound passing lane respectively.
- » No DRF or Priority Flora species were identified during the survey.
- » The Site would be expected to support a number of bird species, and eight species were observed during the survey. The Site would be expected to support a number of reptile species, particularly lizard species, and two skink species were observed during the survey. Signs of fox and kangaroo use of the Site were recorded during the field survey.
- » A number of significant species have been recorded in the general area but the main species that would be likely to use the Site is Carnaby's Cockatoo, which could use the Site for foraging. The extent of clearing required for this project would not significantly impact on the



habitat of this species and no significant impacts on other significant fauna species would be expected from the project.

The Site contains vegetation that is in very good condition, and which would provide high value as fauna habitat. However, the extent of clearing required for this project is minor and the majority of the vegetation in the road reserve will be retained. Impacts on the remaining vegetation and on fauna species at the Site can be managed through appropriate mitigation measures, as outlined in the EMP.

The amount and type of clearing required for this Project has been assessed as not being at significant variance with any of the "Ten Clearing Principles".



10. Limitations

10.1 Survey Limitations

This survey was carried out during only one season, and in one year. Complete surveys require multiple surveys, at different times of year, and over a period of a number of years, to enable full survey 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 in Western Australia on these species is limited, and requires specialist attention.

A section of the Site had been recently burnt so the number of plants recorded in this area was limited to those that rapidly germinate and sprout post-fire. The survey assumed that this area was floristically similar to the surrounding area.

Some fauna species are cryptic or only active at certain times (such as during the night), or may occur at the Site only as occasional visitors. The fauna survey was restricted to an opportunistic survey only, which means that some fauna species that may utilise the Site may have been overlooked.

The fauna survey was limited to terrestrial and vertebrate species.

10.2 Report Limitations

This report presents the results of a flora and fauna investigation 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 Pty Ltd 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 field surveys. The conclusions of this report were based on the information gathered during these investigations and thus reflect the environment of the Site at the time of survey. GHD accepts no responsibility for any variation in the flora and fauna present at the Site due to natural and seasonal variability.



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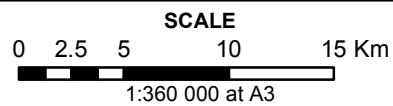
Figures



LEGEND

- Site Boundaries
- Major Roads
- Minor Roads
- Towns
- National Park

NOTE THAT POSITIONAL ERRORS CAN BE > 5M IN SOME AREAS



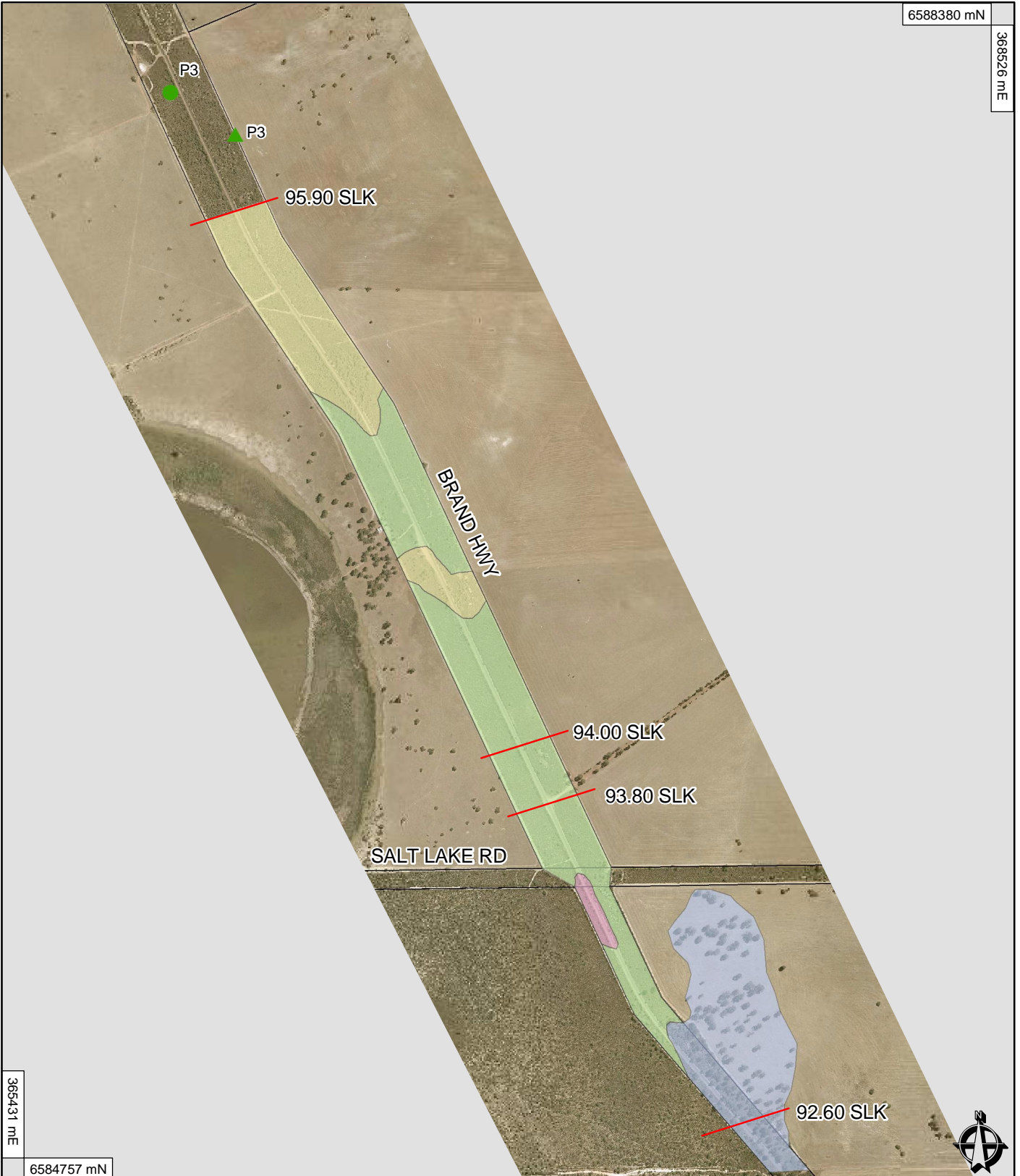
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**Proposed Passing Lanes,
Brand Highway Gingin to Eneabba**



LEGEND

- Project Area Start and Finish
 - Cadastral Boundaries
 - Threatened flora data (DEC 12.04.06)
 - ▲ WA Herbarium Flora data (CALM 12.04.06)
- Vegetation Types
- Banksia prionotes* dominant in upper storey
 - Mixed Scrub-Heath
 - Banksia* low woodland with scattered *Eucalyptus tottiana*; transitional to Mixed Scrub-Heath
 - Marri (*Corymbia calophylla*) open woodland; transitional to Mixed Scrub-Heath

NOTE THAT POSITIONAL ERRORS CAN BE > 5M IN SOME AREAS

SCALE

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LOCALITY MAP



WESTERN AUSTRALIA

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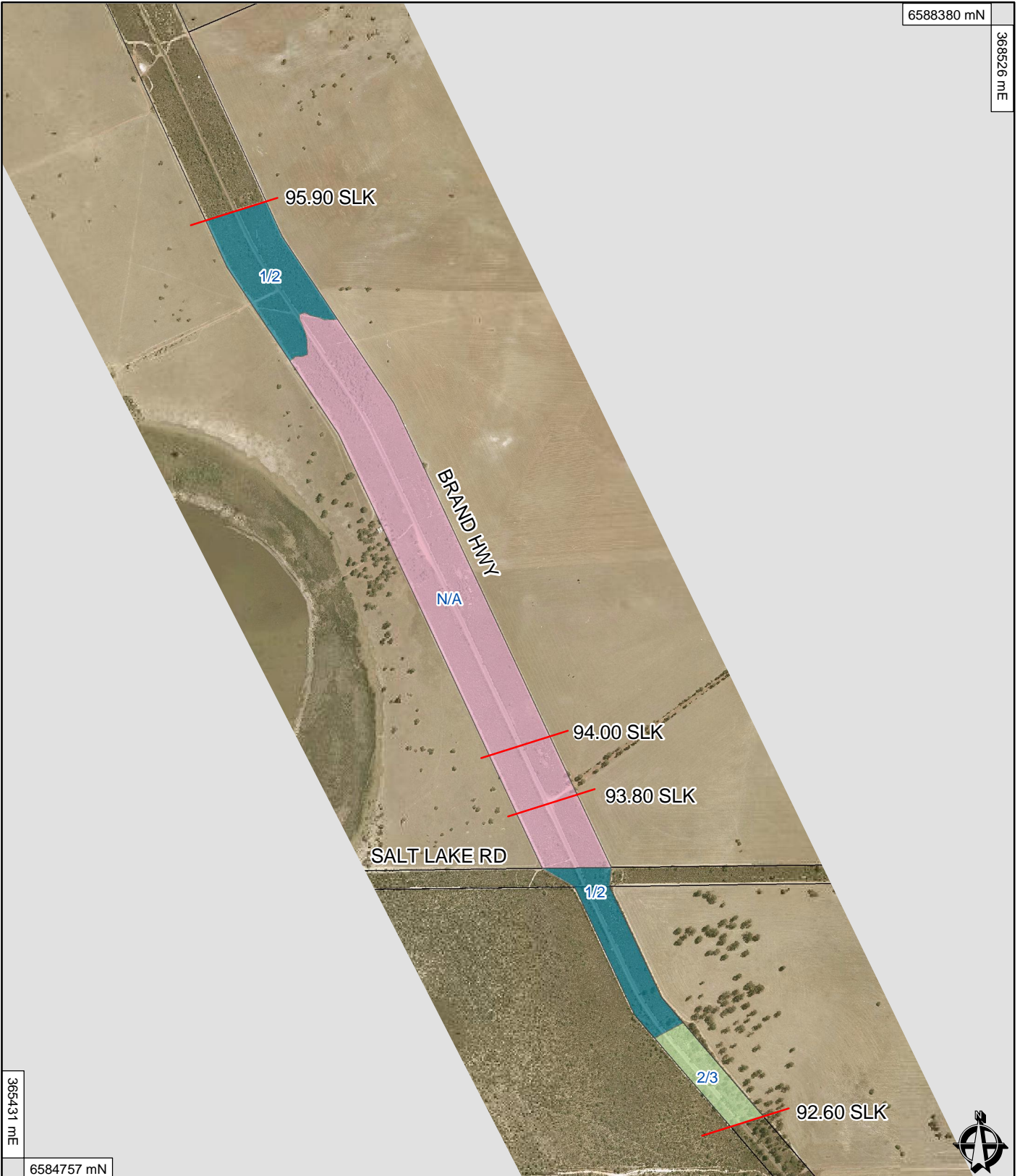
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BIOLOGICAL ASSESSMENT

Figure 2: Vegetation Type and Declared rare and Priority Flora, (CALM Database)

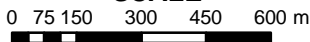


LEGEND

- Project Area Start and Finish
 - Cadastral Boundaries
- Vegetation Conditions**
- | | |
|--|---|
| 1 Pristine or nearly so | 4 Good |
| 1/2 | 4/5 |
| 2 Excellent | 5 Degraded |
| 2/3 | 5/6 |
| 3 Very Good | 6 Completely degraded |
| 3/4 | N/A Burnt Sections Condition: "Not Assessable" |

NOTE THAT POSITIONAL ERRORS CAN BE > 5M IN SOME AREAS
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SCALE



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BIOLOGICAL ASSESSMENT

**Figure 3: Site 3
Vegetation Condition**



Appendix A

Vegetation Descriptions and Photos

Vegetation Community Descriptions

JOB: Brand Highway Upgrade, Main Roads Western Australia

SITE: Site 3: 92.6 to 95.9 SLK

DATE OF SURVEY: 19th September 2006

SURVEYED BY: J. Foster, M. Dilly

Marri Open Woodland



Plate 1: Southern extent of Site 3: 92.6 - 95.9, looking north. Shows area of Marri open woodland,

Vegetation Type:

Corymbia calophylla over *Xanthorrhoea preissii*, *Macrozamia fraseri*, *Hakea trifurcata*, *Calothamnus sanguineus*, *Dianella revoluta*, *Lepidosperma leptostachyum*, *Mesomelaena pseudostygia*, *Desmocladius flexuosus*, *Hibbertia hypericoides* and *Burchardia bairdiae*.

Banksia Low Woodland



Plate 2: *Banksia prionotes* along the edge of Brand Highway



Plate 3: Recently burnt section of Banksia low woodland

Vegetation Type:

Banksia low open woodland: *Banksia attenuata*, *Banksia menziesii* and *Banksia prionotes* with scattered *Eucalyptus tottiana* over *Hakea trifurcata*, *Allocasuarina humilis*, *Calothamnus sanguineus*, *Acacia pulchella*, *Burchardia bairdiae*, *Eremaea pauciflora* and other scrub-heath species.

Scrub-heath



Plate 4: Scrub-heath in the centre of the site (looking east from Brand Highway)



Plate 5: Scrub-heath in the centre of the site

Vegetation Type:

Scrub-heath: *Xanthorrhoea preissii*, *Allocasuarina humilis*, *Hakea trifurcata*, *Dryandra hewardiana*, *Hakea prostrata*, *Hakea ruscifolia*, *Hibbertia hypericoides*, *Eremaea pauciflora*, *Calothamnus*

sanguineus, *Hypocalymma angustifolium*, *Mesomelaena pseudostygia*, *Petrophile macrostachya*, *Bossia eriocarpa*, *Caustis dioica*, *Neurachne alopecuroidea* and other scrub- heath species.



Appendix B

Flora and Vegetation

Table 7 - Conservation Codes and Descriptions for the DEC Declared Rare and Priority Flora Species

Table 8 - Significant Flora Species Previously Recorded within the General Vicinity of the Site (Source: The DEC and the WA Herbarium)

Table 9 - Flora List for Northbound Passing Lane: 92.775 SLK to 94.45 SLK

Table 10 - Flora List for Southbound Passing Lane: 93.40 to 95.32 SLK



Table 7 Conservation Codes and Descriptions for the 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 8 Significant Flora Species Previously Recorded within the General Vicinity of the Site
(Source: The DEC and the WA Herbarium)**

Species	Common Name	Conservation Code
<i>Acacia plicata</i>		P3
<i>Baekkea</i> sp. Moora (R. Bone 1993/1)		P3
<i>Beaufortia eriocephala</i>	Woolly Bottlebrush	P3
<i>Drosera marchantii</i> subsp. <i>prophylla</i>		P1
<i>Eucalyptus macrocarpa</i> subsp. <i>elachantha</i>	Small-leaved Mottlecah	P4
<i>Grevillea florida</i>		P3
<i>Grevillea saccata</i>	Pouched Grevillea	P4
<i>Grevillea synapheae</i> subsp. <i>minyulo</i>		P1
<i>Grevillea thyrsoides</i> subsp. <i>thyrsoides</i>		P3
<i>Haemodorum loratum</i>		P3
<i>Hypocalymma tetrapterum</i>		P3
<i>Jacksonia carduacea</i>		P3
<i>Melaleuca clavifolia</i>		P1
<i>Spirogardnera rubescens</i>	Spiral Bush	DRF
<i>Stenanthemum reissekii</i>		P3
<i>Stylidium aeonioides</i>		P2
<i>Thelymitra apiculata</i>		P4
<i>Thysanotus glaucus</i>		P4
<i>Tricoryne</i> sp. Eneabba (E.A. Griffin 1200)		P2



Table 9 Flora List for the Northbound Passing Lane: 92.775 SLK to 94.45 SLK (Results from field survey conducted 19th September 2006)

Family	Genus	Species	Common Name	Status
Anthericaceae	<i>Chamaescilla</i>	<i>corymbosa</i>	Blue Squill	
Anthericaceae	<i>Sowerbaea</i>	<i>laxiflora</i>	Purple Tassels	
Anthericaceae	<i>Thysanotus</i>	<i>manglesianus</i>	Fringed Lily	
Apiaceae	<i>Trachymene</i>	<i>pilosa</i>	Native Parsnip	
Asphodelaceae	<i>Asphodelus</i>	<i>fistulosus</i>	Onion Weed	*
Asteraceae	<i>Brachyscome</i>	<i>?iberidifolia</i>		
Asteraceae	<i>Calendula</i>	<i>arctotheca</i>	Cape Weed	*
Asteraceae	<i>Hypochaeris</i>	<i>glabra</i>	Smooth Catsear	*
Asteraceae	<i>Monoculus</i>	<i>monstrosus</i>	Stinking Roger	*
Asteraceae	<i>Podotheca</i>	<i>gnaphalioides</i>	Golden Long-heads	
Asteraceae	<i>Ursinia</i>	<i>anthemoides</i>	Ursinia	*
Asteraceae	<i>Waitzia</i>	<i>suaveolens</i>	Fragrant Waitzia	
Brassicaceae	<i>Raphanus</i>	<i>raphanistrum</i>	Wild Radish	*
Casuarinaceae	<i>Allocasuarina</i>	<i>humilis</i>	Dwarf Sheoak	
Colchicaceae	<i>Burchardia</i>	<i>bairdiae</i>		
Crassulaceae	<i>Crassula</i>	<i>colorata</i>	Dense Stonecrop	
Cucurbitaceae	<i>Citrullus</i>	<i>lanatus</i>	Pie Melon	*
Cucurbitaceae	<i>Cucumis</i>	<i>myriocarpus</i>	Prickly Paddy Melon	*
Cyperaceae	<i>Caustis</i>	<i>dioica</i>		
Cyperaceae	<i>Lepidosperma</i>	<i>leptostachyum</i>		
Cyperaceae	<i>Mesomelaena</i>	<i>pseudostygia</i>		
Cyperaceae	<i>Mesomelaena</i>	<i>tetragonia</i>	Semaphore Sedge	
Cyperaceae	<i>Tetaria</i>	<i>octandra</i>		
Dilleniaceae	<i>Hibbertia</i>	<i>huegelii</i>		
Droseraceae	<i>Drosera</i>	<i>erythrorhiza</i>	Red Ink Sundew	
Droseraceae	<i>Drosera</i>	<i>pallida</i>	Pale Rainbow	
Epacridaceae	<i>Conostephium</i>	<i>pendulum</i>	Pearl Flower	
Epacridaceae	<i>Leucopogon</i>	<i>?pulchellus</i>	Beard-heath	
Euphorbiaceae	<i>Phyllanthus</i>	<i>calycinus</i>	False Boronia	



Family	Genus	Species	Common Name	Status
Euphorbiaceae	<i>Ricinus</i>	<i>communis</i>	Castor Oil Plant	*
Geraniaceae	<i>Erodium</i>	<i>cygnorum</i>	Blue Heronsbill	
Goodeniaceae	<i>Goodenia</i>	<i>convexa</i>		
Goodeniaceae	<i>Goodenia</i>	sp.		
Goodeniaceae	<i>Scaevola</i>	<i>canescens</i>	Grey Scaevola	
Gyrostemonaceae	<i>Gyrostemon</i>	<i>subnudus</i>		
Haemodoraceae	<i>Anigozanthos</i>	<i>humilis</i>	Catspaw	
Haemodoraceae	<i>Conostylis</i>	<i>?setigera</i>	?Bristly Cottonhead	
Haemodoraceae	<i>Conostylis</i>	<i>teretiuscula</i>		
Haemodoraceae	<i>Haemodorum</i>	sp.		
Haemodoraceae	<i>Haemodorum</i>	<i>?paniculatum</i>	?Mardja	
Iridaceae	<i>Gladiolus</i>	<i>caryophyllaceus</i>	Wild Gladiolus	*
Iridaceae	<i>Orthrosanthus</i>	<i>laxus var. laxus</i>	Morning Iris	
Iridaceae	<i>Romulea</i>	<i>rosea</i>	Guildford Grass	*
Lauraceae	<i>Cassytha</i>	<i>aurea var. hirta</i>		
Mimosaceae	<i>Acacia</i>	<i>anthochaera</i>		
Mimosaceae	<i>Acacia</i>	<i>lasiocarpa var. lasiocarpa</i>	Panjang	
Mimosaceae	<i>Acacia</i>	<i>stenoptera</i>	Narrow Winged Wattle	
Mimosaceae	<i>Acacia</i>	sp.		
Myrtaceae	<i>Baeckea</i>	<i>robusta</i>		
Myrtaceae	<i>?Beaufortia</i>	sp.		
Myrtaceae	<i>Calothamnus</i>	<i>sanguineus</i>	Silky-leaved Blood Flower	
Myrtaceae	<i>Calytrix</i>	<i>oldfieldii</i>		
Myrtaceae	<i>Corymbia</i>	<i>calophylla</i>	Marri	
Myrtaceae	<i>Darwinia</i>	<i>neildiana</i>	Fringed Bell	
Myrtaceae	<i>Eremaea</i>	<i>pauciflora</i>		
Myrtaceae	<i>Eucalyptus</i>	<i>todtiana</i>	Coastal Blackbutt	
Myrtaceae	<i>Hypocalymma</i>	<i>angustifolium</i>	White Myrtle	
Myrtaceae	<i>Hypocalymma</i>	<i>xanthopetalum</i>		
Myrtaceae	<i>Leptospermum</i>	<i>erubescens</i>	Roadside Teatree	
Myrtaceae	<i>Leptospermum</i>	<i>spinescens</i>		
Myrtaceae	<i>Melaleuca</i>	sp.		NF



Family	Genus	Species	Common Name	Status
Myrtaceae	<i>?Verticordia</i>	sp.		NF
Orchidaceae	<i>Caladenia</i>	<i>flava</i>	Cowslip Orchid	
Orchidaceae	<i>Diuris</i>	<i>?corymbosa</i>		
Orchidaceae	<i>Pterostylis</i>	sp.		NF
Orchidaceae	<i>Pyrorchis</i>	<i>nigricans</i>	Red Beaks	
Papilionaceae	<i>Daviesia</i>	<i>angulata</i>		
Papilionaceae	<i>Daviesia</i>	<i>nudiflora</i>		
Papilionaceae	<i>Gompholobium</i>	<i>knightianum</i>		
Papilionaceae	<i>Gompholobium</i>	<i>tomentosum</i>	Hairy Yellow Pea	
Papilionaceae	<i>Jacksonia</i>	<i>?sternbergiana</i>	Stinkwood	
Papilionaceae	<i>Kennedia</i>	<i>prostrata</i>	Scarlet Runner	
Papilionaceae	<i>Lupinus</i>	<i>cosentinii</i>		*
Phormiaceae	<i>Dianella</i>	<i>revoluta</i>	Blueberry Lily	
Poaceae	<i>Aira</i>	<i>cupaniana</i>	Silvery Hairgrass	*
Poaceae	<i>Austrostipa</i>	<i>elegantissima</i>		
Poaceae	<i>Avena</i>	<i>fatua</i>	Wild Oats	*
Poaceae	<i>Briza</i>	<i>maxima</i>	Blowfly Grass	*
Poaceae	<i>Ehrharta</i>	<i>calycina</i>	Perennial Veldt Grass	*
Poaceae	<i>Ehrharta</i>	<i>longiflora</i>	Annual Veldt Grass	*
Poaceae	<i>Eragrostis</i>	<i>curvula</i>	African Lovegrass	*
Poaceae	<i>Lolium</i>	<i>rigidum</i>	Wimmera Ryegrass	*
Poaceae	<i>Neurachne</i>	<i>alopeкуроidea</i>	Foxtail Mulga Grass	
Primulaceae	<i>Anagallis</i>	<i>arvensis</i>	Pimpernel	*
Proteaceae	<i>Banksia</i>	<i>candolleana</i>	Propeller Banksia	
Proteaceae	<i>Banksia</i>	<i>menziesii</i>	Firewood Banksia	
Proteaceae	<i>Banksia</i>	<i>prionotes</i>	Acorn Banksia	
Proteaceae	<i>Dryandra</i>	<i>hewardiana</i>		
Proteaceae	<i>Dryandra</i>	sp.		
Proteaceae	<i>Hakea</i>	<i>prostrata</i>	Harsh Hakea	
Proteaceae	<i>Hakea</i>	<i>trifurcata</i>	Two-leaf Hakea	
Proteaceae	<i>Persoonia</i>	<i>stricta</i>		
Proteaceae	<i>Petrophile</i>	<i>brevifolia</i>		



Family	Genus	Species	Common Name	Status
Proteaceae	<i>Petrophile</i>	<i>macrostachya</i>		
Proteaceae	<i>Petrophile</i>	<i>recurva</i>		
Proteaceae	<i>Synaphea</i>	<i>spinulosa</i> subsp. <i>spinulosa</i>		
Restionaceae	<i>Desmocladius</i>	<i>flexuosus</i>		
Restionaceae	<i>Lepidobolus</i>	<i>preissianus</i>		
Rhamnaceae	<i>Stenanthemum</i>	sp.		
Rubiaceae	<i>Opercularia</i>	<i>vaginata</i>	Dogweed	
Rutaceae	<i>Philothea</i>	<i>spicata</i>	Pepper and Salt	
Scrophulariaceae	<i>Zaluzianskya</i>	<i>divaricata</i>	Spreading Night Phlox	*
Solanaceae	<i>Solanum</i>	<i>lasiophyllum</i>	Flannel Bush	
Solanaceae	<i>Solanum</i>	<i>nigrum</i>	Black Berry Nightshade	*
Stylidaceae	<i>Stylidium</i>	<i>calcaratum</i>	Book Triggerplant	
Stylidaceae	<i>Stylidium</i>	? <i>diuroides</i>		
Stylidaceae	<i>Stylidium</i>	? <i>piliferum</i>	?Common Butterfly Triggerplant	
Stylidaceae	<i>Stylidium</i>	<i>repens</i>	Matted Triggerplant	
Stylidaceae	<i>Stylidium</i>	<i>schoenoides</i>	Cow Kicks	
Thymelaceae	<i>Pimelea</i>	<i>floribunda</i>		
Xanthorrhoeaceae	<i>Xanthorrhoea</i>	<i>preissii</i>	Grass Tree	
Zamiaceae	<i>Macrozamia</i>	<i>fraseri</i>		

* Introduced species

NF No flowers (so identification to species was not possible)

? Identification to species was not completely certain due to lack of distinctive features



Table 10 Flora List for the Southbound Passing Lane: 93.40 to 95.32 SLK (Results from field survey conducted 19th September 2006)

Family	Genus	Species	Common Name	Status
Amaranthaceae	<i>Ptilotus</i>	<i>polystachyus</i>	Prince of Wales Feather	
Anthericaceae	<i>Corynotheca</i>	<i>micrantha</i>	Sand Lily	
Anthericaceae	<i>Johnsonia</i>	<i>pubescens</i> subsp. <i>pubescens</i>		
Anthericaceae	<i>Sowerbaea</i>	<i>laxiflora</i>	Purple Tassels	
Anthericaceae	<i>Thysanotus</i>	<i>manglesianus</i>	Fringed Lily	
Apiaceae	<i>Trachymene</i>	<i>pilosa</i>	Native Parsnip	
Asteraceae	<i>Brachyscome</i>	<i>?iberidifolia</i>		
Asteraceae	<i>Calendula</i>	<i>arctotheca</i>	Cape Weed	*
Asteraceae	<i>Hypochaeris</i>	<i>glabra</i>	Smooth Catsear	*
Asteraceae	<i>Ursinia</i>	<i>anthemoides</i>	Ursinia	*
Asteraceae	<i>Waitzia</i>	<i>suaveolens</i>	Fragrant Waitzia	
Brassicaceae	<i>Brassica</i>	<i>tournefortii</i>	Mediterranean Turnip	*
Brassicaceae	<i>Raphanus</i>	<i>raphanistrum</i>	Wild Radish	*
Caryophyllaceae	<i>Polycarpon</i>	<i>tetraphyllum</i>	Fourleaf Allseed	*
Colchicaceae	<i>Burchardia</i>	<i>bairdiae</i>		
Crassulaceae	<i>Crassula</i>	<i>colorata</i>	Dense Stonecrop	
Cucurbitaceae	<i>Citrullus</i>	<i>lanatus</i>	Pie Melon	*
Cyperaceae	<i>Caustis</i>	<i>dioica</i>		
Cyperaceae	<i>Lepidosperma</i>	<i>leptostachyum</i>		
Cyperaceae	<i>Mesomelaena</i>	<i>pseudostygia</i>		
Cyperaceae	<i>Tetaria</i>	<i>octandra</i>		
Dasypogonaceae	<i>Calectasia</i>	<i>narragara</i>		
Dilleniaceae	<i>Hibbertia</i>	<i>huegelii</i>		
Dilleniaceae	<i>Hibbertia</i>	<i>hypericoides</i>	Yellow Buttercups	
Droseraceae	<i>Drosera</i>	<i>erythrorhiza</i>	Red Ink Sundew	
Droseraceae	<i>Drosera</i>	<i>porrecta</i>		
Epacridaceae	<i>Andersonia</i>	<i>heterophylla</i>		
Epacridaceae	<i>Astroloma</i>	<i>pallidum</i>	Kick Bush	
Epacridaceae	<i>Conostephium</i>	<i>pendulum</i>	Pearl Flower	



Family	Genus	Species	Common Name	Status
Epacridaceae	<i>Leucopogon</i>	<i>sprengelioides</i>		
Fumariaceae	<i>Fumaria</i>	<i>capreolata</i>	Whiteflower Fumitory	*
Geraniaceae	<i>Pelargonium</i>	<i>capitatum</i>	Rose Pelargonium	*
Goodeniaceae	<i>Lechenaultia</i>	<i>linarioides</i>	Yellow Leschenaultia	
Goodeniaceae	<i>Scaevola</i>	<i>anchusifolia</i>	Silky Scaevola	
Goodeniaceae	<i>Scaevola</i>	<i>canescens</i>	Grey Scaevola	
Goodeniaceae	<i>Verreauxia</i>	<i>reinwardtii</i>	Common Verreauxia	
Gyrostemonaceae	<i>Gyrostemon</i>	<i>ramulosus</i>	Corkybark	
Gyrostemonaceae	<i>Tersonia</i>	<i>?cyathiflora</i>	?Button Creeper	
Haemodoraceae	<i>Anigozanthos</i>	<i>humilis</i>	Catspaw	
Haemodoraceae	<i>Conostylis</i>	<i>?setigera</i>	?Bristly Cottonhead	
Haemodoraceae	<i>Conostylis</i>	<i>setigera</i>	Bristly Cottonhead	
Haemodoraceae	<i>Conostylis</i>	<i>teretifolia</i> subsp. <i>planescens</i>		
Haemodoraceae	<i>Haemodorum</i>	sp.		NF
Haemodoraceae	<i>Haemodorum</i>	<i>spicatum</i>		
Iridaceae	<i>Gladiolus</i>	<i>caryophyllaceus</i>	Wild Gladiolus	*
Iridaceae	<i>Moraea</i>	sp	Cape Tulip	* DP
Iridaceae	<i>Romulea</i>	<i>rosea</i>	Guildford Grass	*
Lauraceae	<i>Cassytha</i>	sp.		NF
Laxmanniaceae	<i>Laxmannia</i>	sp.		NF
Loranthaceae	<i>Nuytsia</i>	<i>floribunda</i>	Christmas Tree	
Malvaceae	<i>Malva</i>	sp	Mallow	*
Mimosaceae	<i>Acacia</i>	<i>pulchella</i> var. <i>pulchella</i>	Prickly Moses	
Mimosaceae	<i>Acacia</i>	sp.		planted
Mimosaceae	<i>Acacia</i>	<i>stenoptera</i>	Narrow Winged Wattle	
Myrtaceae	<i>Baeckea</i>	<i>robusta</i>		
Myrtaceae	<i>Calothamnus</i>	<i>sanguineus</i>	Silky-leaved Blood Flower	
Myrtaceae	<i>Calytrix</i>	<i>oldfieldii</i>		
Myrtaceae	<i>Darwinia</i>	<i>neildiana</i>	Fringed Bell	
Myrtaceae	<i>Eremaea</i>	<i>pauciflora</i>		
Myrtaceae	<i>Eucalyptus</i>	spp.	Various	planted
Myrtaceae	<i>Eucalyptus</i>	<i>totdiana</i>	Coastal Blackbutt	



Family	Genus	Species	Common Name	Status
Myrtaceae	<i>Hypocalymma</i>	<i>angustifolium</i>	White Myrtle	
Myrtaceae	<i>Kunzea</i>	?		
Myrtaceae	<i>Leptospermum</i>	<i>spinescens</i>		
Onagraceae	<i>Oenothera</i>	<i>glazioviana</i>	Evening Primrose	*
Orchidaceae	<i>Diuris</i>	<i>?corymbosa</i>		
Papilionaceae	<i>?Bossiaea</i>	<i>eriocarpa</i>	Common Brown Pea	NF
Papilionaceae	<i>Daviesia</i>	<i>divaricata</i>		
Papilionaceae	<i>Daviesia</i>	<i>nudiflora</i>		
Papilionaceae	<i>Gompholobium</i>	<i>tomentosum</i>	Hairy Yellow Pea	
Papilionaceae	<i>Jacksonia</i>	<i>sternbergiana</i>	Stinkwood	
Papilionaceae	<i>Jacksonia</i>	<i>floribunda</i>	Holly Pea	
Papilionaceae	<i>Lupinus</i>	<i>cosentinii</i>		*
Papilionaceae	<i>Mirbelia</i>	<i>sp.</i>		NF
Papilionaceae	<i>Trifolium</i>	<i>sp.</i>	Clover	NF
Phormiaceae	<i>Dianella</i>	<i>revoluta</i>	Blueberry Lily	
Poaceae	<i>Agrostis</i>	<i>sp.</i>		*
Poaceae	<i>Austrostipa</i>	<i>elegantissima</i>		
Poaceae	<i>Avena</i>	<i>fatua</i>	Wild Oats	*
Poaceae	<i>Briza</i>	<i>maxima</i>	Blowfly Grass	*
Poaceae	<i>Ehrharta</i>	<i>calycina</i>	Perennial Veldt Grass	*
Poaceae	<i>Eragrostis</i>	<i>curvula</i>	African Lovegrass	*
Poaceae	<i>Neurachne</i>	<i>alopecuroidea</i>	Foxtail Mulga Grass	
Polygalaceae	<i>Comesperma</i>	<i>calymega</i>	Blue-spike Milkwort	
Primulaceae	<i>Anagallis</i>	<i>arvensis</i>	Pimpernel	*
Proteaceae	<i>Adenanthos</i>	<i>cygnorum</i>	Common Woollybush	
Proteaceae	<i>Banksia</i>	<i>attenuata</i>	Slender Banksia	
Proteaceae	<i>Banksia</i>	<i>candolleana</i>	Propeller Banksia	
Proteaceae	<i>Banksia</i>	<i>menziesii</i>	Firewood Banksia	
Proteaceae	<i>Banksia</i>	<i>prionotes</i>	Acorn Banksia	
Proteaceae	<i>Conospermum</i>	<i>stoechadis</i>	Common Smokebush	
Proteaceae	<i>Dryandra</i>	<i>hewardiana</i>		
Proteaceae	<i>Dryandra</i>	<i>shuttleworthiana</i>	Bearded Dryandra	



Family	Genus	Species	Common Name	Status
Proteaceae	<i>Dryandra</i>	sp.		
Proteaceae	<i>Hakea</i>	<i>ruscifolia</i>	Candle Hakea	
Proteaceae	<i>Hakea</i>	<i>trifurcata</i>	Two-leaf Hakea	
Proteaceae	<i>Petrophile</i>	<i>macrostachya</i>		
Proteaceae	<i>Petrophile</i>	sp.		
Proteaceae	<i>Stirlingia</i>	<i>latifolia</i>	Blueboy	
Restionaceae	<i>Desmocladus</i>	<i>flexuosus</i>		
Restionaceae	<i>Lepidobolus</i>	<i>preissianus</i>		
Rhamnaceae	<i>Stenanthemum</i>	sp.		
Rubiaceae	<i>Galium</i>	<i>murale</i>	Small Goosegrass	*
Rubiaceae	<i>Opercularia</i>	<i>vaginata</i>	Dogweed	
Rutaceae	<i>Boronia</i>	<i>scabra</i> subsp. <i>scabra</i>		
Scrophulariaceae	? <i>Misopates</i>	<i>orontium</i>	?Lesser Snapdragon	*
Solanaceae	<i>Solanum</i>	<i>nigrum</i>	Black Berry Nightshade	*
Stackhousiaceae	<i>Stackhousia</i>	<i>monogyna</i>		
Sterculiaceae	<i>Keraudrenia</i>	sp.		
Stylidaceae	<i>Stylidium</i>	<i>diuroides</i> subsp. <i>diuroides</i>		
Stylidaceae	<i>Stylidium</i>	<i>schoenoides</i>	Cow Kicks	
Violaceae	<i>Hybanthus</i>	<i>calycinus</i>	Wild Violet	
Xanthorrhoeaceae	<i>Xanthorrhoea</i>	<i>preissii</i>	Grass Tree	
Zamiaceae	<i>Macrozamia</i>	<i>fraseri</i>		

* Introduced species

NF No flowers (so identification to species was not possible)

? Identification to species was not completely certain due to lack of distinctive features

DP Declared Plant (a weed declared under the *Agriculture and Related Resources Protection Act 1976*)



Appendix C

Fauna

Table 11 - *Environment Protection And Biodiversity Conservation Act 1999* Fauna Conservation Categories

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

Table 13 – The DEC Priority Fauna Conservation Codes

Table 14 - Listing of Potentially Occurring Rare and Priority Fauna Species (Source: EPBC Act Protected Matters Search, the DEC Threatened and Priority Fauna Database search results and WA Museum Faunabase search in a 5 km radius of the Site)

Table 15 - Fauna species that may occur in 92.60 to 95.9 SLK (Source: Western Australian Museum *Faunabase* search of 5km radius of the Site); and those recorded during the opportunistic fauna surveys



Table 11 Environment Protection and Biodiversity Conservation Act 1999 Fauna Conservation Categories

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

EPBC Act Categories

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
- » 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.



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.*



Table 12 *Western Australian Wildlife Conservation Act 1950 Fauna 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 The DEC Priority Fauna Conservation 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.



Table 14 Listing of Potentially Occurring Rare and Priority Fauna Species (Source: EPBC Act Protected Matters Search, the DEC Threatened and Priority Fauna Database search results and WA Museum Faunabase search in a 5 km radius of the Site)

Genus	Species	Common Name	DEC / Wildlife Conservation Act 1950 Rating	EPBC Act Rating	CALM Database	EPBC Act Protected Matters search	Faunabase search
<i>Calyptorhynchus</i>	<i>latirostris</i>	Carnaby's Cockatoo	Endangered / Schedule 1	Endangered	x	x	x
<i>Calyptorhynchus</i>	<i>sp.</i>	These records pertain to either Baudin's Cockatoo or Carnaby's Cockatoo	Endangered / Schedule 1	Endangered / Vulnerable	x		
<i>Dasyurus</i>	<i>geoffroii</i>	Chuditch	Vulnerable / Schedule 1	Vulnerable	x		
<i>Botaurus</i>	<i>poiciloptilus</i>	Australasian Bittern	Vulnerable / Schedule 1		x		
<i>Leipoa</i>	<i>ocellata</i>	Malleefowl	Vulnerable / Schedule 1	Vulnerable	x	x	x
<i>Platyercus</i>	<i>icterotis xanthogenys</i>	Western Rosella (inland subspecies)	Vulnerable / Schedule 1		x		
<i>Morelia</i>	<i>spilota imbricata</i>	Carpet Python	Other Specially Protected Fauna / Schedule 4		x		
<i>Falco</i>	<i>peregrinus</i>	Peregrine Falcon	Other Specially Protected Fauna / Schedule 4		x		
<i>Macropus</i>	<i>irma</i>	Western Brush Wallaby	Priority 4		x		
<i>Haliaeetus</i>	<i>leucogaster</i>	White-bellied Sea-eagle		Migratory / Marine		x	
<i>Apus</i>	<i>pacificus</i>			Migratory / Marine		x	
<i>Ardea</i>	<i>alba</i>			Marine		x	



Genus	Species	Common Name	DEC / Wildlife Conservation Act 1950 Rating	EPBC Act Rating	CALM Database	EPBC Act Protected Matters search	Faunabase search
<i>Ardea</i>	<i>ibis</i>			Marine		x	
<i>Merops</i>	<i>ornatus</i>	Rainbow Bee-eater		Marine		x	



Table 15 Fauna species that may occur at 92.60 to 95.9 SLK (Source: Western Australian Museum *Faunabase* search of 5km radius of the Site); and those recorded during the opportunistic fauna surveys.

Family	Genus	Species	Common Name	Status	Faunabase Search	Field Survey
Birds						
Accipitridae	<i>Haliastur</i>	<i>sphenurus</i>	Whistling Kite			x
Campephagidae	<i>Coracina</i>	<i>novaehollandiae</i>	Black-faced Cuckoo-shrike			x
Halcyonidae	<i>Dacelo</i>	<i>novaeguineae</i>	Laughing Kookaburra	*	x	x
Megapodiidae	<i>Leipoa</i>	<i>ocellata</i>	Malleefowl	Vulnerable / Schedule 1	x	
Meliphagidae	<i>Anthochaera</i>	<i>carunculata</i>	Red Wattlebird			x
Meliphagidae	<i>Phylidonyris</i>	<i>nigra</i>	White-cheeked Honeyeater			x
Pachycephalidae	<i>Pachycephala</i>	<i>pectoralis</i>	Golden Whistler			x
Pardalotidae	<i>Pardalotus</i>	<i>striatus</i>	Striated Pardalote		x	
Psittacidae	<i>Cacatua</i>	<i>pastinator butleri</i>	Western Long-billed Corella		x	
Psittacidae	<i>Cacatua</i>	<i>roseicapilla</i>	Galah			x
Psittacidae	<i>Cacatua</i>	<i>?sanguinea</i>	? Corella			x
Psittacidae	<i>Calyptorhynchus</i>	<i>latirostris</i>	Carnaby's Cockatoo	Endangered / Schedule 1	x	
Psittacidae	<i>Platycercus</i>	<i>zonarius</i>	Australian Ringneck (Ring-necked Parrot)		x	
Reptiles						
Elapidae	<i>Parasuta</i>	<i>gouldii</i>	Gould's Snake		x	
Scincidae	<i>Menetia</i>	<i>greyii</i>	Common Dwarf Skink		x	
Scincidae	<i>Tiliqua</i>	<i>rugosa rugosa</i>	South-western Bobtail			x
Scincidae	Unknown					x
Mammals						
Canidae	<i>Vulpes</i>	<i>vulpes</i>	Red Fox			x
Macropodidae	<i>Macropus</i>	<i>fuliginosus</i>	Western Grey Kangaroo			x

* Introduced



Appendix D

Summary of Environmental Impacts and Management



Table 16 Environmental Impacts Summary

Environmental Aspect	Potential Impact	Management Measure (EMP Reference)	Timing
Native Vegetation Clearing	<p>Clearing 3.6 ha of native vegetation.</p> <p>Minimal clearing of the Marri Woodland transitional community will be required, this community is considered to be regionally poorly represented.</p> <p>No DRF or Priority species were identified.</p> <p>The proposed clearing is not considered to be at variance with any of the ten clearing principles.</p>	EMP Commitments – 5	Design and Construction
Dieback Disease	<p>The Project area shows no indicating of being infected with dieback.</p> <p>The Project area is however, at risk from the introduction of dieback disease due to its location and annual average rainfall.</p>	EMP Commitments – 6	Design and Construction
Weeds	Existing Project area contains weed species, one of which is declared under the <i>Agriculture and Related Resources Protection Act 1976</i> .	EMP Commitments – 7	Construction
Fire Management	Fire caused by ignition sources has the potential to impact on public safety, buildings and equipment and the environment in the immediate area and near the Project area.	EMP Commitments – 8	Construction
Fauna	Due to the minimal clearing it is unlikely that there will be a significant impact on the long-term survival of any species of threatened fauna that may occur within the Project area.	EMP Commitments – 5 and 9	Design and Construction
Drainage	Disturbance to existing surface water flows.	EMP Commitments – 4	Design and Construction
Groundwater	Non-sustainable use of local groundwater.	EMP Commitments – 2	Construction
Dust	Impacts to surrounding vegetation from dust generated during road construction.	EMP Commitments – 10	Construction



Environmental Aspect	Potential Impact	Management Measure (EMP Reference)	Timing
Hydrocarbon and Chemical Storage	Accidental spillages of hydrocarbons and/ or other chemicals that may cause contamination.	EMP Commitments – 11	Construction
Waste Management	Incorrect disposal or containment of waste may contaminate the environment.	EMP Commitments – 12	Construction
Aboriginal Heritage	The potential for unregistered sites to be encountered during the Project.	EMP Commitments – 13	Construction
Public Safety	Accident / incidents involved with altered traffic flow during road construction	EMP Commitments – 14	Prior to Construction



Appendix E

Environmental Management Plan



Table 17 Environmental Impacts and Management Commitments

	Commitment	Expected Outcome	Responsibility	Timing Of Project
Project Environmental Management				
1.1	Main Roads WA will implement the upgrade of Brand Highway (92.775 to 95.32 SLK) in line with the environmental management measures detailed in this EIA and EMP.	All issues will be identified and managed to ensure minimal environmental impact.	Project Manager	All
1.2	Environmental management measures detailed in this EMP will be included in relevant contract documents and the Technical Specification prepared for the Project.	The contractor undertaking the construction will be aware of environmental concerns and their obligations, to ensure minimal environmental impact.	Project Manager	Pre-Construction
1.3	Environmental issues and management measures will be included in site inductions for Main Roads WA and contract staff.	The staff involved with the Project will be aware of environmental concerns and their obligations, to ensure minimal environmental impact.	Project Manager	All of Project
Approvals				
2.1	Main Roads WA to undertake an EIA to determine the significance of clearing.	Compliance with the <i>Environmental Protection (Clearing of Native Vegetation) Regulations 2004</i> , Main Roads WA clearing permit and internal standards.	Project Manager	Pre-Construction
2.2	Approvals will be sought, and conditions complied with, should groundwater bore construction and abstraction be required. Should MRWA utilise an existing bore, they will do so in accordance with the existing abstraction licence.	Compliance with the <i>Rights in the Water and Irrigation Act 1914</i> .	Project Manager	Pre-Construction



Commitment	Expected Outcome	Responsibility	Timing Of Project	
Environmental Management and Quality Plan				
3.1	The Construction Contractor will prepare an Environmental Management and Quality Plan for the Project, which will address the Construction Contractor's management responsibility, authority and communication requirements and clearly detail the Contractor's 'Quality Management Representative' (QMR) role with respect to the Contract in accordance with AS/NZS ISO 9001.	Environmental issues are adequately understood and managed throughout the project and environmental impacts are minimised.	Construction Contractor	Pre-Construction
3.2	The Environmental Management and Quality Plan will be submitted to the Construction Manager for approval within twenty-eight days of award of the Contract or ten days of Possession of Site being granted whichever is the earlier.	Environmental issues are adequately understood and managed throughout the project and environmental impacts are minimised.	Construction Contractor	Pre-Construction
Rivers, Wetlands and Drainage				
4.1	No rivers or wetlands exist on site, but existing surface water flows will be maintained by replacing and/or extending existing crossroad culverts and will enable <i>in-situ</i> infiltration.	Maintain existing surface water movements.	Project Manager / Construction Contractor	Design and Construction
Vegetation and Clearing				
5.1	During roadworks, clearing of existing remnant vegetation will be avoided as far as is practicable with clearing restricted to 13 m from the edge of the existing seal.	Minimise clearing impacts.	Construction Contractor	Construction
5.2	Prior to the start of clearing operations the Construction Contractor will mark out the clearing line and this will be checked by the Project Manager to ensure that it is correctly defined – with particular regard to the Marri Woodland transitional community. Trees of particular habitat significance to be conserved will be clearly marked prior to the commencement of clearing.	Minimise clearing impacts.	Construction Contractor	Pre-Construction
5.3	No vegetation is to be disturbed for temporary works such as access tracks, spoil areas or site offices. Vehicles and equipment will not be parked or driven over tree roots.	Minimise clearing impacts.	Construction Contractor	All
5.4	Trees to be removed will be felled in a manner that ensures they fall within the approved clearing area.	Minimise clearing impacts.	Construction Contractor	Construction



Commitment	Expected Outcome	Responsibility	Timing Of Project
5.5 Cleared vegetation suitable for rehabilitation of any degraded locations on/ or adjacent to the Site will be re-used or otherwise appropriately disposed of.	Minimise clearing impacts.	Construction Contractor	Construction/ Post- Construction
5.6 Any damage caused by the Construction Contractor to vegetation, landforms or fauna habitat outside of the works area will be rehabilitated at the Contractor's cost. If environmental damage beyond the works area is identified, the Project Manager may withhold the payment of monies due to the Contractor, where the extent of damage exceeds \$5,000, determined at the following rates: <ul style="list-style-type: none"> » For damaged trees greater than 3m in height - \$1,000 each. » For damaged trees and shrubs up to 3m in height - \$500 each. » For damaged grassland, open soil areas, rock faces and landforms, and habitats in general - \$10 per square metre. 	Minimise clearing impacts.	Construction Contractor	Post- Construction
Dieback Disease			
6.1 The following management measures will be implemented during the design and construction of works. <ul style="list-style-type: none"> » Clean earth-moving machinery of soil and vegetation prior to entering and leaving the area to be cleared; » Avoid the movement of soil in wet conditions; » If movement of soil in wet conditions is necessary, the MRWA must prepare, implement and adhere to a dieback management plan, developed in consultation with the DEC; » Ensure that no dieback affected road building materials, mulches or fill are brought into an area that is not affected by dieback; and » Restrict the movement of machines and other vehicles to the limits of the areas to be cleared. 	The risk of introducing Dieback disease into uninfected areas will be minimised.	Project Manager Construction Contractor	Design/ Construction
6.2 Existing drainage lines to be used over the length of the Site.	The risk of introducing Dieback disease into uninfected areas will be minimised.	Project Manager Construction Contractor	Design/ Construction



Commitment	Expected Outcome	Responsibility	Timing Of Project
Weed Management			
7.1	Machinery and vehicle hygiene measures (outlined at 6.1) will avoid the inadvertent spread of weeds throughout the Site, and from the Site to other sites.	Project Manager Construction Contractor	Pre-construction/ Construction
7.2	Any declared weeds on Site will be managed as required by the Agriculture and Related Resources Protection Act 1976.	Project Manager / Construction Contractor	Pre-construction/ Construction
Fire			
8.1	No burning will be permitted within the Project area.	Construction Contractor	All
8.2	Machines and vehicles will be restricted to designated cleared areas.	Construction Contractor	All
8.3	The Construction Contractor will conform to any specific requirements for fire prevention requested by Main Roads WA, Shire of Gingin, Department of Conservation and Land Management and/or the Fire and Emergency Services Authority.	Construction Contractor	All
8.4	<p>During road construction activities, the following fire management requirements will be complied with:</p> <ul style="list-style-type: none"> » All plant and vehicles operating over vegetation will have exhaust systems in good working order » All machinery will be shut down during periods of extreme fire hazard as advised by the DEC or Main Roads WA or the Shire of Gingin; and » All machinery to be fitted with fire extinguishers. » Smoking on site will be controlled and all cigarettes will be disposed of in an appropriate vessel. » All glass (and other wastes) will be collected and removed off site on a daily basis. 	Construction Contractor	Construction



Commitment	Expected Outcome	Responsibility	Timing Of Project
Fauna			
9.1	Clearing of vegetation will be minimised to that which is practicable for the safe construction and operation of the road as discussed in detailed in Commitments 5.1 to 5.6.	Project Manager Construction Contractor	Design/ Construction
9.2	Works will cease on sighting an animal in the construction site. Works will commence once the animal has moved on.	Construction Contractor	Construction
9.3	The work site will be left in a safe condition at the end of each working day to ensure animals are not subject to harm from the site works.	Construction Contractor	Construction
Dust			
10.1	The Construction Contractor will employ construction methods that will keep dust lift to a minimum, and as required provide for the management of dust such as by watering of the works area and of roads, streets and other areas immediately adjacent to the works.	Construction Contractor	Construction
10.2	Where it is found that vehicles leaving the site have dropped excessive soil material onto adjacent sections of Brand Highway these sections will be swept to reduce the potential for dust generation and maintain traffic safety.	Construction Contractor	Construction
Hydrocarbon and Chemical Storage			
11.1	No storage of large quantities of fuel, oils or chemicals within the Project area. Spill containment equipment will available in the event of a spill of minor fuels stored in vehicles and equipment.	Construction Contractor	All
11.2	Major vehicle and plant servicing will not be conducted within the Site.	Construction Contractor	All



Commitment	Expected Outcome	Responsibility	Timing Of Project
Waste			
12.1 Domestic site rubbish other rubbish will be disposed of on a daily basis offsite for final disposal to an authorised waste disposal site.	Waste is disposed and contained of appropriately in order to avoid contamination of the environment.	Construction Contractor	All
Aboriginal Heritage			
13.1 If during roadworks, any materials of significance to Aboriginal people are uncovered by the Construction Contractor, works will immediately cease within 50 m of the material and the DIA will be notified as soon as practicable.	Aboriginal Heritage sites are not disturbed without appropriate approvals.	Project Manager Construction Contractor	Construction
13.2 If skeletal material is uncovered during works then the WA Police Service will also be advised immediately.	Aboriginal Heritage sites are not disturbed without appropriate approvals.	Project Manager Construction Contractor	Pre- Construction/ Construction
13.3 Recommendations made by O'Connor (2006) and Quartermaine (2006) are addressed.	Aboriginal Heritage sites are not disturbed without appropriate approvals.	Project Manager Construction Contractor	Pre- Construction/ Construction
Public Safety			
14.1 To ensure the safe access of traffic through the construction site the Construction Contractor will be required to develop and implement a Traffic Management Plan congruent with the current Australian Standard <i>Manual 1742.3 of Uniform Traffic Control Devices: Part 3 Traffic Control Devices for Works On-Road</i> (Standards Australia) and the current Main Roads WA <i>Traffic Management Requirements for Works on Roads</i> .	Maintain safe access for through traffic movements.	Construction Contractor	All
14.2 The Traffic Management Plan (TMP) will conform to the current Main Roads WA <i>Traffic Management Requirements for Works on Roads</i> and the current Australian Standard <i>Manual 1742.3 of Uniform Traffic Control Devices: Part 3 Traffic Control Devices for Works On-Road</i> (Standards Australia). The TMP will be submitted to the Construction Manager for approval within twenty-eight days of Award of Contract or within ten days of Possession of Site being granted or prior to the commencement of works, whichever is earlier.	Maintain safe access for through traffic movements.	Construction Contractor	All



Commitment	Expected Outcome	Responsibility	Timing Of Project
14.3 The Construction Contractor must submit with the TMP a Certificate of Compliance certifying that the TMP has been prepared and/or reviewed by an appropriately qualified person as defined in the current Main Roads WA publication <i>Traffic Management Requirements for Works on Roads</i> .	Maintain safe access for through traffic movements.	Construction Contractor	All
14.4 All traffic control measures will be in place and fully operational before the Construction Contractor commences any work activity that affects existing roadways.	Maintain safe access for through traffic movements.	Construction Contractor	All
Monitoring			
15.1 During the project compliance with environmental management measures will be regularly monitored. Any non-conformances will be addressed at the first opportunity, while the non-conformance and any improvement actions implemented will be detailed in appropriate construction superintendent's documentation.	Compliance with this EMP and relevant legislation.	Project Manager Construction Contractor	All



Appendix F

PEIA Consultation Results



During the preparation of this PEIA GHD contacted the following stakeholders. The responses to our request for comments are detailed below.

Ms Annaleisha Sullivan, Geraldton Regional Office - Department of Environment.

Ms Sullivan advised that the highway doesn't cross any gazetted Public Drinking Water Supply Areas, however, the proposal is within the proclaimed Gingin Groundwater Area. Construction of bores in this area require a 26D licence under the *Rights in Water and Irrigation Act (1914)*. Taking water (eg for dust suppression) will also require a licence. The project site is within the northern most proclaimed section of the Moore River Catchment.

Ms Natalie Lauritsen, Geraldton Regional Office - Department of Environment.

Ms Lauritsen provided information on a basic check as for any clearing permit, consisting of a review of Environmentally Sensitive Areas, Threatened Ecological Communities and proximity to reserves. Ms Lauritsen advised that their records identified a priority species possibly located at or close to the site. No Environmentally Sensitive Area was identified at this site. Ms Lauritsen advised that it will be necessary for MRWA to apply for a clearing permit as the previous exemption that applied to this activity has now expired, however, GHD advised of MRWA's new purpose clearing permit.

Ms Gina Broun, Conservation Officer - Moora District Office - Department of Conservation and Land Management.

Ms Broun strongly recommended that the proponent undertake a flora survey of the Sites at an appropriate time of the year to determine the extent of both known and unrecorded populations of DRF and Priority Flora species as well as TEC occurrences. This site requires particular attention as nearby areas of remnant vegetation house the DRF species *Ptychosema pusillum* and *Drakea elastica*. The habitat of this site should be assessed for suitability and if deemed suitable for these species (which co-occur), they should be included in the flora survey at an appropriate time of year (October - early November would suit both). Ms Broun stated the outcome of the surveys may influence the locality of the passing lanes and will be necessary information in the event of the proponent applying for any Permits to Take DRF. The flora survey should include any area that will be impacted by works including the site itself, temporary access tracks, machinery parking areas and the new maintenance zones resulting from changes in road surface widths.

Ms Broun also advised that the Site falls within the known range of the rare Carnaby's Cockatoo which both feeds and nests in the local area. As part of the preliminary work, CALM recommend a survey to identify any of their nesting sites that may be impacted (including where loud machinery noises would disturb nesting birds) as this may have implications on the timing of works.

Ms Broun suggested other considerations may also impact on the preferred timing of works. Examples provided included, where DRF species or TECs occur within or immediately adjacent to the areas of proposed works, requiring the area to be surveyed at a particular time of year to identify their presence, and where remedial actions such as seed harvesting/propagule collection may be recommended for particular species at an appropriate time of year.

Ms Broun emphasised that all staff involved in the works must be made aware of their duty of care in regards to Environmentally Sensitive Areas (as defined in the new clearing legislation attached to the *Environmental Protection and Biodiversity Conservation Act (1999)*- this includes both TECs and rare plants) and the *Wildlife Conservation Act (1950)* which specifically protects DRF as well as provides protection to native flora species.



Mr Frank Rickwood, Moora District Office, Department of Agriculture.

Mr Rickwood recommended the adoption of a biosecurity protocol to ensure weeds are not spread to other locations from the sites and, new weeds are not introduced to the sites through road materials and machinery. He indicated the site has remnant vegetation and MRWA would need to seek clearances through DoE and CALM. He further stated the road works were not expected to interfere with any waterways.

Mr David Seinor, Corporate Services Manager, Shire of Dandaragan.

No comment was received prior to the completion of this report.

Mr Andrew Arnold – UXO Liaison Officer, Fire and Emergency Services Authority.

Mr Arnold advised that this site lies outside known unexploded ordinance (UXO) contamination sites, although other MRWA upgrade sites to the south and north do lie within contamination sites and will need to be surveyed (refer to Appendix D). Mr Arnold advised that numerous UXO have been found over the past 50 years, some in very close proximity to Brand Highway by former elements of UXO Services during the construction of the gas pipeline in the early 1980s.

Mr Gerard Connell – Lands Officer, Agility Management Pty Ltd (Operator of the Parmelia Gas Pipeline).

Mr Connell provided details of the gas pipeline infrastructure crossing in the vicinity of the Site. A gas crossing has been identified as crossing within the boundary of these two passing lanes. Mr Connell has advised that prior to any works commencing, Agility would be pleased to receive plans and work methodology. Each crossing will require a letter of conditions to be sent out to the main proponent for agreement and signing of on the site specific conditions.



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Document Status

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
	M. Dilly / F. Tibbett	J. Foster / C. Miller		M. Goldstone		