Main Roads Western Australia

Report for Brand Highway Upgrade at 54.20 to 56.00 SLK

SIte 3 Environmental Impact Assessment

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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 southern-most upgrade from 54.20 to 56.00 Standard Length Kilometres (SLK), which consists of a northbound passing lane of 1.8 km in length, adjacent to and south of Douglas Road, Beermullah. 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 1.8ha of native vegetation along the existing road edge and as such Main Roads WA, as specified under their existing clearing permit (CPS 818/1), was required to undertake a Preliminary Environmental Impact Assessment (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 - Main Roads WA 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 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 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 at 54.20 to 56.00 SLK was conducted on the 18th September 2006, by an experienced and qualified botanist/zoologist and an experienced field ecologist. The results of the assessment concluded that:

» The main vegetation at the site was a mosaic of low open woodland of *Banksia* spp. and *Eucalyptus todtiana,* and Scrub-heath. In the south of the site the vegetation is primarily low open woodland with occasional weedy grasses. In the uplands of the site scattered Marri (*Corymbia calophylla*) and Grass Trees (*Xanthorrhoea preissii*) occur.

» The vegetation at the site has been impacted in the past by disturbances such as road works. There is substantial weed invasion, particularly of grass species, along both sides of the highway adjacent to the shoulder. The vegetation adjacent to the highway was rated between Condition 4 ('Good') and Condition 6 ('Completely Degraded'). In general, the 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. The vegetation off the shoulder ranges from Condition 2 ('Excellent') to Condition 3 ('Very Good'). A 300m section to the north on the western side of the Brand Highway was classified as ranging from

Condition 4 ('Good') to Condition 6 ('Completely Degraded'). One of the weed species, *Moraea* sp. (Cape Tulip), identified during the survey is declared under the *Agriculture and Related Resources Protection Act 1976*.

- The extent and status of Heddle *et al*. (1980) vegetation complexes are described in the EPA's *Guidance for the Assessment of Environmental Factors: Level of assessment for proposals affecting natural areas within the System 6 region and Swan Coastal Plain portion of the System 1* (EPA, 2006). It can be seen from this data that the vegetation complex at the study site has more than 30% of its original distribution remaining indicating is above the 'threshold level'. The vegetation types recorded during the survey were also 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' are above 30 % which means they are above the 'threshold level'.
- 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. However, based on patterns of death of susceptible plants, there appears to be dieback present a few kilometres to the south of the site. As there is potential for dieback to occur within the site it is recommended that dieback hygiene measures are adhered to during roadworks at the site.
- The site has good species diversity with a total of 139 taxa (98 native taxa) from 43 families recorded within the surveyed area.
- No DRF or Priority Flora species were identified during the survey.
- The Site would be expected to support a number of bird species, and seven species were observed during the survey. The Site would be expected to support a number of reptile species, particularly lizard species. Signs of fox, rabbit and kangaroo use at 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.
- A number of significant species have been recorded in the general area but the main species that would be likely to use the Site are the 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 habitat type is a mosaic of low woodland and scrub-heath. The vegetation in the road reserve was generally in good condition and in a landscape that has been largely cleared for agriculture this vegetation would offer a local habitat refuge. This site offers value as a habitat linkage and fauna corridor.
- 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 *Environment 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 southern-most upgrade from 54.20 to 56.00 SLK, which consists of a northbound passing lane upgrade, adjacent to and south of Douglas Road, Beermullah.

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 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 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 1.8 km northbound passing lane from 54.20 SLK to 56.00 SLK. This Site is located approximately 18 km north of Gingin turn-off and 50km south of Cataby. The survey location is shown at **Figure 1,** identified as Main Roads WA Site 1.

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.

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 upgrade at Beermullah, which consists of a 1.8 km northbound passing lane. The Site is located approximately 18 km north of the Gingin turn-off, intersecting with Douglas Road. Key characteristics are summarised in **Table 1** below.

Table 1 Key Characteristics of the Upgrades

Issue	Description
Lane Length	Northbound – 1.8 km (54.20 to 56.00 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	Douglas Road
Clearing	1.8 ha
Revegetation Area	N/A
Land Acquisition	N/A

2.3 Need for the Proposal

The objective of the passing lane 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 2007/2008 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 Project area is best described as Mediterranean with warm dry summers and cool wet winters. The Bureau of Meteorology weather-recording station located closest to the Project area is Lancelin, approximately 50 km northwest of the Project area. The recorded climate data at Lancelin is summarised in **Table 2.**

Table 2 Climate Readings at Closest Weather Stations

Climate Statistic	Lancelin
Mean Annual Maximum Daily Temperature Range (°C)	29.7 (February) to 19.1 (July/Aug)
Mean Annual Minimum Daily Temperature Range (°C)	17.9 (February) to 9.8 (August)
Mean Annual Rainfall (mm)	619.9
Mean Annual Rain days per year (days)	108.3
Highest Recorded Daily Rainfall (mm)	85.8 (January)
Highest Monthly Rainfall (mm)	219.2 (June)

(Source: Bureau of Meteorology – Climatic Averages for Australian Sites, 2004)

3.2 Geology and Soils

The Site forms part of the Perth Sedimentary Basin. The Geological Survey of Western Australia (GSWA, 1978) identifies the main geological unit in the area as colluvium, soil and undifferentiated sand over laterite of Coastal Plain includes minor alleviated areas.

To the west of the site are 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. Massive laterite also exists in areas to the east of the Brand Highway (GSWA, 1978).

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 10 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 project area would contain Acid Sulphate Soils at depth owing to the proximity of the project area to various wetlands, including Six Mile Swamp, Red Gully Creek and Whitfield Brook. As the roadworks associated with the

project are not expected to require deep excavation, it is considered unlikely that Acid Sulphate Soils will require be encountered during the project.

3.3 Rivers and Wetlands

The Site lies within the Moore River surface water 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).

This upgrade is within the Moore River surface water catchment area, of which some tributaries are proclaimed. The DEC has advised that the Project area does not fall within the proclaimed portion of the catchment.

No *Environmental Protection (Swan Coastal Plain Wetlands) Policy 2004* wetlands or wetlands listed under the Ramsar Convention (1971) occur within the Project area. Several permanently and seasonally inundated wetlands occur approximately 2 km to the west of the Project area. These wetlands have been identified by the *Environmental Protection (Swan Coastal Plain Wetlands) Policy 2004*.

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

The Project area is approximately 1 km northwest of a small conservation area, 5 km to the northwest of the Boonanarring Nature Reserve and 7 km to the east of the Moore River National Park (Department of Land Information, 2006).

The Shire of Gingin Town Planning Scheme No. 8 does not recognise any local Parks and Recreation reserves in the vicinity of the Project area.

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. Main Roads WA commissioned BACTEC to undertake a survey of the area. The reader is referred to Main Roads WA 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 18th 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 were 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.

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 south-west section has been mapped as Banksia low woodland on low sandhills. To the north and east of the site the vegetation has been mapped as a mosaic of Mixed Scrub-heath and Heath with *Dryandra* species dominant.

Mapping by Heddle *et al.* (1980) indicates the site to be within the Regan Complex on the Gingin Scarp. Vegetation ranges from low open woodland of *Banksia* species and *Eucalyptus todtiana* to closed heath, depending on the soil.

The vegetation type was mapped during the field survey and is shown in **Figure 2.** A full description of the vegetation type, with photographs, is provided in **Appendix A**. The site was a mosaic of low open woodland of *Banksia* spp. and *Eucalyptus todtiana,* and Scrub-heath.

In the south of the site the vegetation is primarily a low open woodland of *Banksia attenuata, Banksia menziesii* and *Banksia ilicifolia* over *Calothamnus sanguineus, Eremaea pauciflora, Hibbertia hypericoides, Phyllanthus calycinus, Mesomelaena pseudostygia, Neurachne alopecuroidea,* with occasional weedy grasses, such as *Ehrharta calycina.*

In the uplands of the site scattered Marri (*Corymbia calophylla*) and Grass Trees (*Xanthorrhoea preissii*) occur.

The east side of the highway has similar vegetation type in better condition, with less weed invasion and a denser overstorey. *Daviesia* species are dominant in the midstorey.

The northern section of the site has been previously cleared and there is little of the original vegetation intact. Some scattered scrub-heath species still occur but the majority of the species are introduced, including planted *Eucalyptus* species along the road edge.

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.

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

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

The vegetation has been impacted in the past by disturbances such as road works. There is substantial weed invasion, particularly of grass species, along both sides of the highway adjacent to the shoulder. There is also evidence of other disturbances from the highway, such as rubbish disposal. The vegetation adjacent to the highway was rated between Condition 4 ('Good') and Condition 6 ('Completely Degraded').

In general, on the east side of the highway and on the west side of the highway in the southern section, the 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. The vegetation off the shoulder ranges from Condition 2 ('Excellent') to Condition 3 ('Very Good').

In the northern section of the site the road reserve vegetation is very degraded with substantial weed invasion. The majority of this vegetation is between Condition 4 ('Good') and Condition 5 ('Degraded'). The road reserve is 'Very Degraded' (Condition 6) in areas of disturbance, such as around the spoon drain and near the entrance to a farm (on the eastern side of the road).

3.7.5 Significance of Vegetation

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

» The "threshold level" below which species loss appears to accelerate exponentially at an ecosystem level is regarded as being at a level of 30% of the pre-European extent of the vegetation type. Vegetation communities where less than 30% of the original vegetation extent remain are referred to as "vulnerable"; and

» A level of 10% of the original vegetation extent is regarded as being a level representing an "endangered" vegetation community. Clearing which would put a vegetation type into this category should be avoided.

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

- Presumed extinct: Probably no longer present in the bioregion
- Endangered*: <10% of pre-European extent remains
- Vulnerable*: 10-30% of pre-European extent exists
- Depleted*: >30% and up to 50% of pre-European extent exists
- Least concern: >50% pre-European extent exists and subject to little or no degradation over a majority of this area.
    - or a combination of depletion, loss of quality, current threats and rarity gives a comparable status

The extent and status of Heddle's (1980) vegetation complexes are described in the EPA's *Guidance for the Assessment of Environmental Factors: Level of assessment for proposals affecting natural areas within the System 6 region and Swan Coastal Plain portion of the System 1* (EPA, 2006). The extent of vegetation remaining is described in the publication as both the percent remaining in this region and the percentage remaining in this area in secure tenure. Protection in 'secure tenure' includes National Parks, Nature Reserves, and 5(g) Reserves from DEC Managed Lands 2002 GIS Database. This database was examined to determine the extent of the vegetation remaining in the study area (Table 4).

Table 4 Vegetation extent and status for Heddle, *et al*. (1980) Vegetation Complexes within the Study site (EPA, 2006).

Vegetation Complex	Total pre-1750 extent (ha)	Present extent (1997/98) in the System 6/part System 1 area (ha)	% Remaining (1997/98) in the System 6/part System 1 area	Area in secure tenure (2002) (ha)	% remaining of pre-1750 extent in secure tenure (2002)
Regan Complex on the Gingin Scarp.	9097	3455	38	168	1.9

It can be seen from this data that the vegetation in the study site are above the 30% 'threshold' level. However, it should be noted that the percent remaining in secure tenure is very low, 1.9%.

Native vegetation types represented in the study, their regional extent and reservation status are generally drawn from Shepherd (2002; *pers. comm.,* 2005*)* to give an indication of the regional impact of the proposed clearing. This information is presented in Table 5.

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 5.

Table 5 Regional Assessment of Vegetation Extent (Source: Shepherd, pers. comm., 2005)

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
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'.

Shepherd mapping also identifies the Vegetation Association 1015, 'Mosaic: Shrublands, scrub-heath on the Swan Coastal Plain / Shrublands; Dryandra Heath, in the vicinity of the Site. The regional assessment indicates that 33.3% of this vegetation remains Shepherd (2002; *pers. comm.,* 2005*).* There was no discrete community of Vegetation Association 1015 observed within this Site, rather the site is a mosaic of Banksia Low woodland and Scrub-Heath (which may be equivalent to Vegetation Association 1015). Some areas have been disturbed (through previous roadworks) and so the original vegetation is no longer intact, which makes assigning it to vegetation communities difficult. The presence of these

communities in the Shepherd data may also be due to the high scale at which this (Shepherd) mapping is conducted and can tend to be inaccurate.

Main Roads WA 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, along a 1.8 km section. This equates to a clearing area of approximately 18,000m^2 or 1.8 ha. The existing width of road reserve vegetation is around 25m; therefore, over half of the existing native vegetation in the road reserve will be retained.

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 *Environment 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 DEC's TEC database indicated that there are no TECs within the vicinity of the Site. The closest community is approximately 5 km to the south-west of the site, which is SCP07 (Plot MRNP03) 'Herb rich saline shrublands in clay pans' (Morley, M. *pers comm*., 2007). This TEC was not recorded during the field survey and no TECs 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, 2007).

3.7.8 Flora Species

The site has good species diversity with a total of 139 taxa (98 native taxa) from 43 families recorded within the surveyed area.

The dominant families recorded from the area were:

- Myrtaceae 13 taxa
- Proteaceae 21 taxa
- Poaceae 17 taxa
- Papilionaceae 14 taxa
- Asteraceae 9 taxa

Additionally, the dominant genera recorded were:

- *Hakea* 5 taxa
- *Banksia* 4 taxa
- *Avena* 3 taxa
- *Petrophile* 3 taxa
- *Gompholobium* 3 taxa
- *Daviesia* 3 taxa

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

Eight 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 **Table 8, 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 there are no recorded Rare or Priority Flora species within 100 m of the project areas. However, a number of significant species have been recorded in the general region of the Site (**Table 9**, **Appendix B**).

During the field survey a thorough search for the DRF and Priority species known to occur in the region was conducted.

No DRF or Priority species were identified during the survey.

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. In some places along the shoulder there were substantial infestations of African Love Grass (*Eragrostis curvula*).

A total of 41 weed species were recorded within the Site search area, which represents about 29% of the total species recorded. These were mainly Grasses (Poaceae), Daisies (Asteraceae), Peas (Papilionaceae), Irises (Iridaceae) and members of the Carnation family (Caryophyllaceae). The majority of the weeds were agricultural weeds and weeds of disturbed areas, rather than environmental weeds that can invade intact bushland. However, the bushland did contain *Gladiolus*, an invasive environmental weed.

One of the weed species, *Moraea* sp. (Cape Tulip), identified during the survey 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". This weed was found in two locations on the west side of the road, in the northern section of the site (385229mE, 6552571mN and 385202mE, 6552799mN).

Biosecurity protocols should be adopted to ensure that this Declared Plant, and other weeds are not spread to other locations from the site and new weeds are not introduced to the site through road materials and machinery.

3.7.11 Plant Pests and Diseases

The project area can be considered as susceptible to the development of the dieback pathogen, *Phytophthora cinnamomi* (Dieback Consultative Council, 2001).

There are many dieback susceptible species within the site, including *Banksia* and *Dryandra* species. On the site there are some dead *Banksia* trees but in general, the vegetation on site is in good condition and does not show the typical pattern of deaths of susceptible species that occurs in dieback-infected areas.

There appears to be dieback present a few kilometres to the south of the site, based on patterns of death of susceptible plants. As there is potential for dieback to occur within the site it is recommended that dieback hygiene measures are adhered to during roadworks at the site.

3.8 Fauna

3.8.1 Field Survey Methods

The reconnaissance survey for the presence of fauna was conducted on the 18th 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

Seven species of birds were observed during the survey. The Site would be expected to support a number of bird species, particularly a number of bushland birds, not all of which were observed during the field survey.

The Site would be expected to support a number of reptile species, particularly lizard species. Signs of fox, rabbit 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 agricultural land and bushland in the east to wetlands in the west.

The general region is rich in bird species, and there would be a number of species that would be expected to utilise the site, though many of these would be vagrants. Additionally, the herpetofauna of the general area is relatively rich and a number of reptiles, particularly small lizard species, would be expected at the site. The clearing of the area for farming has had a major impact on the richness of the mammalian fauna and many of the species that originally occurred in the region are locally extinct.

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 and from the reconnaissance survey conducted at the site are shown in **Table 14**, **Appendix C**. The species recorded from the opportunistic survey include species observed (obs.), either visually or through distinctive calls (particularly birds and amphibians), and species identified from signs, such as scats or tracks.

3.8.3 Significant Fauna 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 and rabbits were observed during the survey. Foxes 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 habitat type is a mosaic of low woodland and scrub-heath. The vegetation in the southern section of the site was generally in Good, or better, condition and in a landscape that has been largely cleared for agriculture this vegetation would offer a local habitat refuge. The vegetation in the northern section of the site was generally more degraded and the habitat value of this area would be low.

The Site is not large enough to support permanent populations of large fauna species, particularly large mammals, but may be occupied by some of the smaller mammals and by a number of reptile species. The site would provide habitat for a number of bird species, for both sedentary species and for vagrants that may use the site only occasionally. 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 value as a habitat linkage and fauna corridor. Much of the vegetation of the road reserve at this Site is in Good, or better, condition and could be used by a variety of fauna species. There are a number of bushland areas in the general region of the study site including a number of reserves: Boonanarring Nature Reserve, Moore River National Park and Namming Nature Reserve. However directly adjacent to Brand Highway much of the land has been cleared for agriculture and the road reserve vegetation 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 bushland remnants 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 Project area is surrounded by general farming uses, including a Pauwlonia plantation to the west, and is zoned as “Rural”, under the Shire of Gingin Town Planning Scheme No. 8. The Australian Government (2006) describes the surrounding rural land uses as ‘dry land agriculture’ or ‘livestock grazing’.

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*.

One Aboriginal Heritage artefacts / scatter site is listed under on the Register of Aboriginal Sites under the *Aboriginal Heritage Act 1972* as being known to occur within the vicinity of the Project area. The Aboriginal Heritage Site is referred as Site No. 4098 and referred to as ‘Natgas 131’.

Site No. 4098 is listed on the “interim register” which means a claim has been submitted to the Aboriginal Cultural and Materials Committee, but not considered at this stage. Sites on the interim register are still provided with protection under the *Aboriginal Heritage Act 1972*.

Given the location of the interim site within the road reserve, to the southern extent of the passing lane, there may be some impact upon this site and potentially the need to apply for a Section 18, conditional approval to disturb an Aboriginal Heritage Site.

It was also considered possible that there are unregistered sites located in the vicinity of the Site.

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 4**.

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

Table 4 Environmental Aspects Considered for the Project

Environmental Aspect	Yes	No	Comments
Air Quality		√	Lack of emissions 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- fire			Addressed in Section 6.8
European Heritage		√	No sites of European Heritage within Project Area.
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)		√	Project area not located within a PDWSA.
Groundwater	√		Addressed in Section 6.4.

Environmental Aspect	Yes	No	Comments
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 remote Project location.
Public Safety and Risk	√		Addressed in Section 6.7.
Contaminated Sites	√		No contaminated sites identified within the Project area. 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.
Use of Hazardous Substances	√		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 within the Project area.

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 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 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 5.**

Table 5 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 medium level of biological diversity but it is of a comparable (or lower) level of diversity to the remaining native vegetation in the area.	The proposal is not at variance with the Principle.
(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.	The proposal is not at variance with the Principle. However, 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.	The proposal is not at variance with the Principle.
(d)	Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a threatened ecological community.	No Threatened Ecological Communities were recorded during this survey, and there are none recorded within 5 km of this Site.	The proposal is not at variance with the Principle.
(e)	Native vegetation should not be cleared if it is significant as a remnant of native vegetation in an area that has been extensively cleared.	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 substantial areas of remnant vegetation in the general region of the site, including vegetation protected in reserves.	The proposal is not at variance with the Principle. Where possible, the amount of vegetation clearing should be minimised and the disturbed area adjacent to the existing highway shoulder should be used.
(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.	The proposal is not at variance with the Principle.
(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.	The proposal is not at variance with the Principle. Appropriate management plans should mitigate potential impacts

Principle Number	Principle	Assessment	Outcome
(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.	The Project area is approximately 1 km northwest of a small conservation area, 5 km to the northwest of the Boonanarring Nature Reserve and 7 km to the east of the Moore River National Park (Department of Land Information, 2006). Conservation areas are unlikely to be impacted by this project.	The proposal is not at variance with the Principle.
(i)	Native vegetation should not be cleared if the clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water	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.	The proposal is not at variance with the Principle. 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.	The proposal is not at variance with the Principle. 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 Road 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 Road 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 Site indicated some dead *Banksia* trees but in general, the vegetation on site is in good condition and did not show the typical pattern of deaths of susceptible species that occurs in dieback-infected areas. However, based on patterns of death of susceptible plants a few kilometres to the south of the site it is likely that dieback is present in the area. As there is potential for dieback to occur within the site it is recommended that dieback hygiene measures are adhered to during roadworks at the site.

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 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.

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 Main Roads WA clearing permit.

One of the weed species, *Moraea* sp. (Cape Tulip), identified during the survey is declared under the *Agriculture and Related Resources Protection Act 1976*. This species is classified as a P1 plant in the Shire of Gingin, which prohibits movement of plants or their seeds, and the movement of contaminated machinery and produce including livestock and fodder, within the State. Machinery and vehicle hygiene measures detailed in Section 6.1.2 will also avoid the inadvertent spread of Cape Tulip.

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.

***Calyptorhynchus 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 for foraging, however the minimal nature of clearing and the presence of surrounding habitat would not impact on their survival in the area.

***Calyptorhynchus baudinii* - Baudin's Cockatoo**

Baudin's Cockatoo, also known as the Long-billed Black-Cockatoo, is found in the south-west of Western Australia in the forest and woodlands of Jarrah (*Eucalyptus marginata)*, Karri *(E. diversicolor)* and Marri *(Corymbia calophylla).* The primary food source of this cockatoo is the seeds of the Marri (Garnett and Crowley, 2000). This species has been impacted by the removal of large Marri throughout its range as

this species is its principal food source. Baudin's Cockatoo has been listed as Endangered under the Federal *EPBC Act.*

Habitat Assessment The site occurs at the very northern extent of Baudin's Cockatoo range and this species would be highly unlikely to occur at the site.

***Pseudocheirus occidentalis* - Western Ringtail Possum**

The Western Ringtail Possum (*Pseudocheirus occidentalis)* is found in the south-west of Western Australia, with a patchy occurrence from the Collie River to Two Peoples Bay (Jones, *et al.,* 1994). Urban populations of this species are located in Busselton, as well as East Augusta and Albany.

Habitat Assessment This species is not known from the Brand Highway region, and the record of this species is from subfossil material. It would be highly unlikely to occur at the site.

***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 It is unlikely that the Chuditch would occur in the study site, though there is a very low likelihood that this species may occur as a vagrant in the area.

***Pseudomys shortridgei* - Heath Mouse (Dayang)**

This small native mouse inhabits long unburnt heath and mallee scrub on sandy soil and was once found in coastal heath and mallee in the south west of Western Australia, from Jurien Bay to Bremer Bay. However, this species is now only known to occur in two populations, one in south-west Victoria and the other in south-western Western Australia.

Habitat Assessment This species no longer occurs in the Brand Highway region, and the record of this species is from subfossil material. It would be highly 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 its range has been significantly reduced and it is now highly unlikely to occur at the Site.

***Hylaeus globuliferus* – (native bee)**

This native bee feeds on the flowers of *Adenanthos cygnorum* in particular but also has been collected from *Grevillea cagiana, Banksia grossa* and *Banksia attenuata.*

Habitat Assessment This species is known from the Moore River National Park and species on which it feeds were identified in the flora and vegetation survey. This species may occur in the study site.

***Leioproctus contrarius* – (native bee)**

This native bee has been collected on a number of occasions in Moore River National Park. It is apparently dependent on flowers of Goodeniaceae and possibly *Lechenaultia stenosepala.*

Habitat Assessment This species is known from Moore River National Park which is close to the study site. *Lechenaultia stenosepala* was not identified during the flora survey but other members of the Goodeniaceae family were. This species may occur in the study site.

***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). There are dated records (the last from 1989) of this species from Moore River National Park and Namming Nature Reserve, to the north and east of the site.

Habitat Assessment This species also requires large patches of vegetation to sustain its populations, and would be unlikely to occur at the Site.

***Hydromys chrysogaster* - Water-rat (Rakali)**

The water rat occupies habitat in the vicinity of permanent water and nests are constructed in logs or at the end of tunnels dug into banks. Unlike many other Australian rodents, the water rat is not entirely nocturnal, with activity usually high at sunset, though animals have been seen foraging during the day. The water rat is an opportunistic predator, feeding upon large aquatic insects, fish, crustaceans and mussels. They are also known to feed on frogs, lizards, small mammals, fresh carrion, and birds (CALM, 2005c).

Habitat Assessment There are no permanent waterways within the site and the Water-rat would be highly unlikely to occur in this site.

***Oreoica gutturalis gutturalis* - Crested Bellbird (southern)**

The Crested Bellbird is found across much of Australia and inhabits the drier mallee woodlands and heaths of the southern parts of the State. This species is sedentary and solitary.

Habitat Assessment The species could potentially occur within the study area.

***Galaxiella munda* - Western Mud Minnow**

The Western Mud Minnow is endemic to south-western West Australia, originally ranging from Moore River to Two Peoples Bay. However, the distribution of this species has been much reduced and is now not known from the northern part of its original range, apart from a very small population in Gingin Brook.

Habitat Assessment The distribution of this species has been much reduced and it is unlikely to occur in the general area. There are no waterways within the site and this species would not occur at the study site.

***Throscodectes xederoides* - Mogumber Bush Cricket**

This species is associated with heath and grassland and has a limited distribution around New Norcia and Mogumber.

Habitat Assessment This species has a limited distribution to the east of the Brand Highway and the likelihood of its occurrence at the site is low.

***Ardeotis australis* - Australian Bustard**

The Australian Bustard occurs across much of Australia, including across most of WA, excepting heavily wooded areas in the south. This species is now scarce on WA's mid-west coast. The Australian Bustard occurs mainly in open country, such as low heath or lightly wooded grassland. This species are often found in recently burnt areas.

Habitat Assessment Australian Bustards may occur in the general area and may be occasional visitors to the site but they tend to prefer more open habitat.

***Isoodon obesulus fusciventer* - Quenda**

The Quenda is an omnivorous marsupial that occurs in the south-west of Western Australia. This species prefers areas with dense understorey vegetation, particularly around swamps and along watercourses. However, it also occurs in woodlands, and may use less ideal habitat where this habitat occurs adjacent to the thicker, more desirable vegetation. On the Swan Coastal Plain Quenda are often associated with wetlands (CALM, 2005d). There is a population of this species around Guilderton, and this is currently the known northern extent of this species.

Habitat Assessment The site is north of the known northern extent of this species, and while it was historically recorded in this area (the record is from subfossil material) it is now highly 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 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 2km 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

Given the location of the interim site within the road reserve, to the southern extent of the passing lane, there may be some impact upon this site and potentially the need to apply for a Section 18, conditional approval to disturb an Aboriginal Heritage Site. Main Roads WA will follow recommendations made in this regard in 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 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 Gingin.

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 Frank Vallentine, Works Officer, Shire of Gingin.

» 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 54.20 to 56.00 SLK was conducted in mid-September 2006 and the results of the assessment concluded that:

- The vegetation at the site was a mosaic of low open woodland of *Banksia* spp. and *Eucalyptus todtiana,* and Scrub-heath. In the south of the site the vegetation is primarily low open woodland with occasional weedy grasses. In the uplands of the site scattered Marri (*Corymbia calophylla*) and Grass Trees (*Xanthorrhoea preissii*) occur.
- The vegetation at the site has been impacted in the past by disturbances such as road works. There is substantial weed invasion, particularly of grass species, along both sides of the highway adjacent to the shoulder. The vegetation adjacent to the highway was rated between Condition 4 ('Good') and Condition 6 ('Completely Degraded'). In general, the 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. The vegetation off the shoulder ranges from Condition 2 ('Excellent') to Condition 3 ('Very Good'), with a small portion of the northern end of the western verge rated as Condition 4 ('Good') to Condition 6 ('Completely Degraded'). One of the weed species, *Moraea* sp. (Cape Tulip), identified during the survey is declared under the *Agriculture and Related Resources Protection Act 1976*.
- The extent and status of Heddle et al. (1980) vegetation complexes are described in the EPA's *Guidance for the Assessment of Environmental Factors: Level of assessment for proposals affecting natural areas within the System 6 region and Swan Coastal Plain portion of the System 1* (EPA, 2006). It can be seen from this data that the vegetation complex at the study site has more than 30 % of its original distribution remaining indicating is above the 'threshold level'. The vegetation types recorded during the survey were also 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' are above 30 % which means they are above the 'threshold level'.
- 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. However, based on patterns of death of susceptible plants, there appears to be dieback present a few kilometres to the south of the site. As there is potential for dieback to occur within the site it is recommended that dieback hygiene measures are adhered to during roadworks at the site.
- The site has good species diversity with a total of 139 taxa (98 native taxa) from 43 families recorded within the surveyed area.
- No DRF or Priority Flora species were identified during the survey.
- The Site would be expected to support a number of bird species, and seven species were observed during the survey. The Site would be expected to support a number of reptile species, particularly lizard species. Signs of fox, rabbit 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.

- 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".

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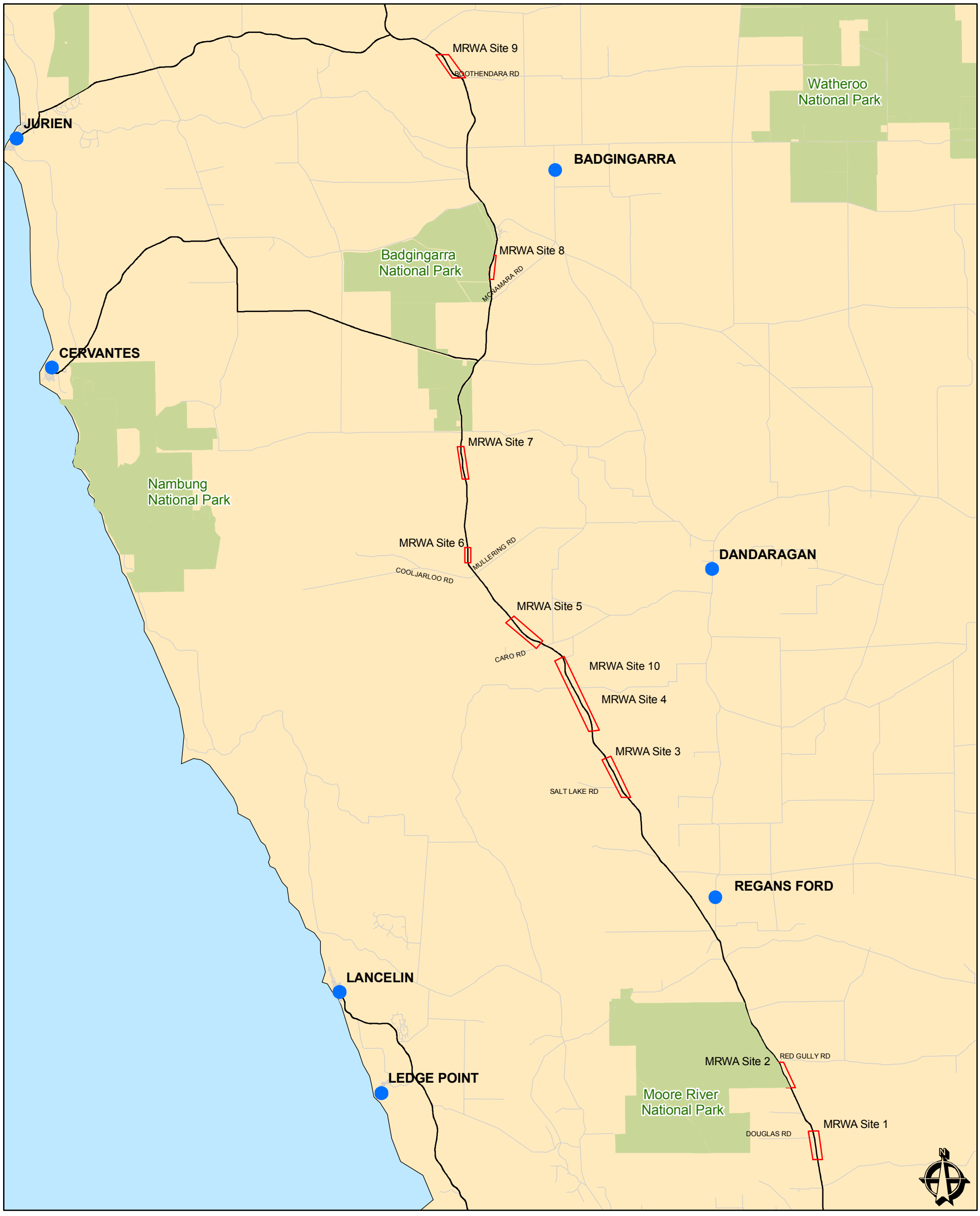
Figures



LEGEND

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

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

SCALE

0 2.5 5 10 15 Km

1:360 000 at A3

LOCALITY MAP

WESTERN AUSTRALIA

CREATED BY	CHECKED	APPROVED
PN		

HORIZONTAL DATUM: GDA 94 **PROJECTION:** MGA ZONE 50
HEIGHT DATUM: NA **METADATA RECORDED:** 100%

DATE	FILE LOCATION
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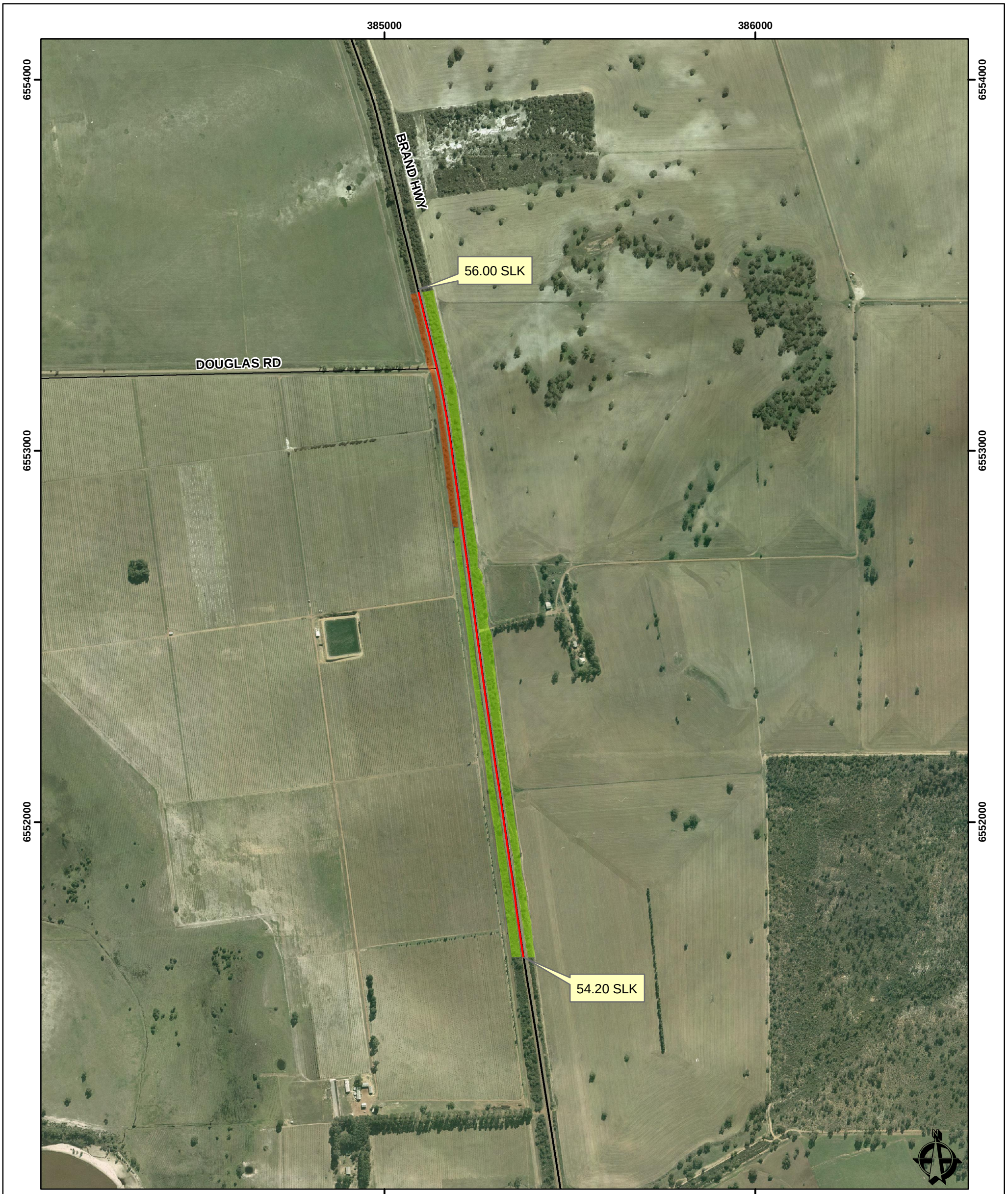
GHD CLIENTS | PEOPLE | PERFORMANCE

Proposed Passing Lanes, Brand Highway Gingin to Eneabba



LEGEND

- MRWA Site 1 : 54.20 - 56.00
- Major Roads
- Local Roads
- Degraded-Vegetation. Mainly introduced species with some natives
- Low Open *Banksia* Woodland

NOTE THAT ROAD SURFACE IS NOT INCLUDED IN VEGETATION COVERAGE AT THIS SCALE
NOTE THAT POSITIONAL ERRORS CAN BE > 5M IN SOME AREAS
AERIAL PHOTOGRAPHY SOURCED FROM LANDGATE - 2003 LEDGE POINT GINGIN MOSAIC
REPRODUCED BY PERMISSION OF LANDGATE, PERTH,WESTERN AUSTRALIA, COPYRIGHT LICENCE 30/2004

SCALE
100 0 100 200 300m
1:10,000 at A3

LOCALITY MAP

Central West

CREATED BY	CHECKED	APPROVED
WD		

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HEIGHT DATUM: NA **METADATA RECORDED:** 100%

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REVISION	**DRAWING NO**
0	6118367-G16

mainroads WESTERN AUSTRALIA

GHD CLIENTS|PEOPLE|PERFORMANCE

BIOLOGICAL ASSESSMENT

Figure 2: Site 1
Vegetation Type
SLK54.20 - SLK56.00

384750

385500

6553500

6552750

6552000

BRAND HWY

56.00 SLK

4-6

2-3

6

2-3

6

54.20 SLK

N

LEGEND

- MRWA Site 1 : 54.20 - 56.00
- Major Roads
- Local Roads

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

NOTE THAT ROAD SURFACE IS NOT INCLUDED IN VEGETATION COVERAGE AT THIS SCALE
NOTE THAT POSITIONAL ERRORS CAN BE > 5M IN SOME AREAS
AERIAL PHOTOGRAPHY SOURCED FROM LANDGATE - 2003 LEDGE POINT GINGIN MOSAIC
REPRODUCED BY PERMISSION OF LANDGATE, PERTH,WESTERN AUSTRALIA, COPYRIGHT LICENCE 30/2004

SCALE

75 0 75 150 225m

1:7,500 at A3

LOCALITY MAP

Central West

CREATED BY	CHECKED	APPROVED
WD		

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HEIGHT DATUM: NA **METADATA RECORDED:** 100%

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mainroads WESTERN AUSTRALIA

GHD CLIENTS | PEOPLE | PERFORMANCE

BIOLOGICAL ASSESSMENT

Figure 3: Site 1
Vegetation Condition
SLK54.20 - SLK56.00

Appendix A

Vegetation Descriptions and Photos

Vegetation Community Descriptions

JOB: Brand Highway Upgrade, Main Roads Western Australia

SITE: Site 1: 54.20 to 56.00 SLK

DATE OF SURVEY: 18th September 2006

SURVEYED BY: J. Foster, M. Dilly

Low Banksia Woodland

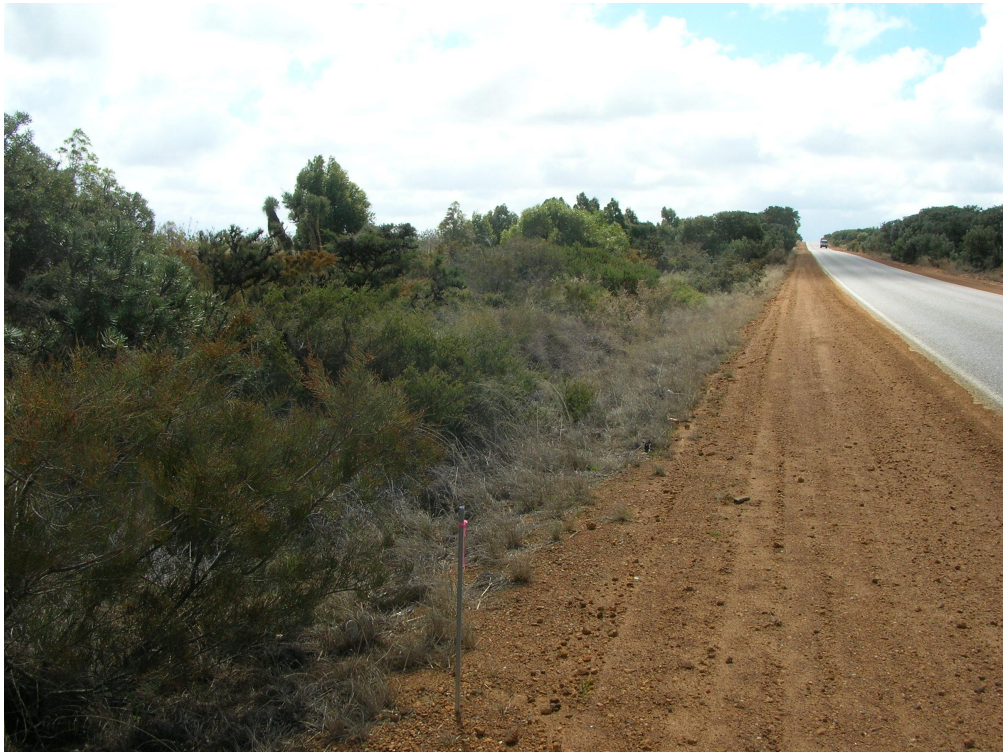

Plate 1: Vegetation at start of site, low open woodland of *Banksia* sp and *Eucalyptus todtiana.* Photo taken at beginning of site, looking north.

Vegetation Description

The vegetation of the site was a mosaic of the following vegetation types:

Low open woodland of *Banksia* spp. and *Eucalyptus todtiana* over shrubland species, with occasional *Nuytsia floribunda.*

Banksia attenuata, Banksia menziesii, Banksia ilicifolia and *Nuytsia floribunda over Calothamnus sanguineus, Eremaea pauciflora, Acacia pulchella, Baeckea crispiflora, Daviesia nudiflora, Hibbertia hypericoides, Phyllanthus calycinus, Mesomelaena pseudostygia, Neurache alopecuroidea,* with occasional weedy grasses, such as *Ehrharta calycina.*

Scrub – Heath

Plate 2: Vegetation of Quadrat 1 – Scrub-heath species

Vegetation Description

Calothamnus sanguineus, Eremaea pauciflora, Acacia pulchella, Baeckea crispiflora, Daviesia nudiflora, Hibbertia hypericoides, Dryandra shuttleworthiana, Mesomelaena pseudostygia, Neurache alopecuroidea, with occasional weedy grasses, such as *Ehrharta calycina.*

Road Reserve

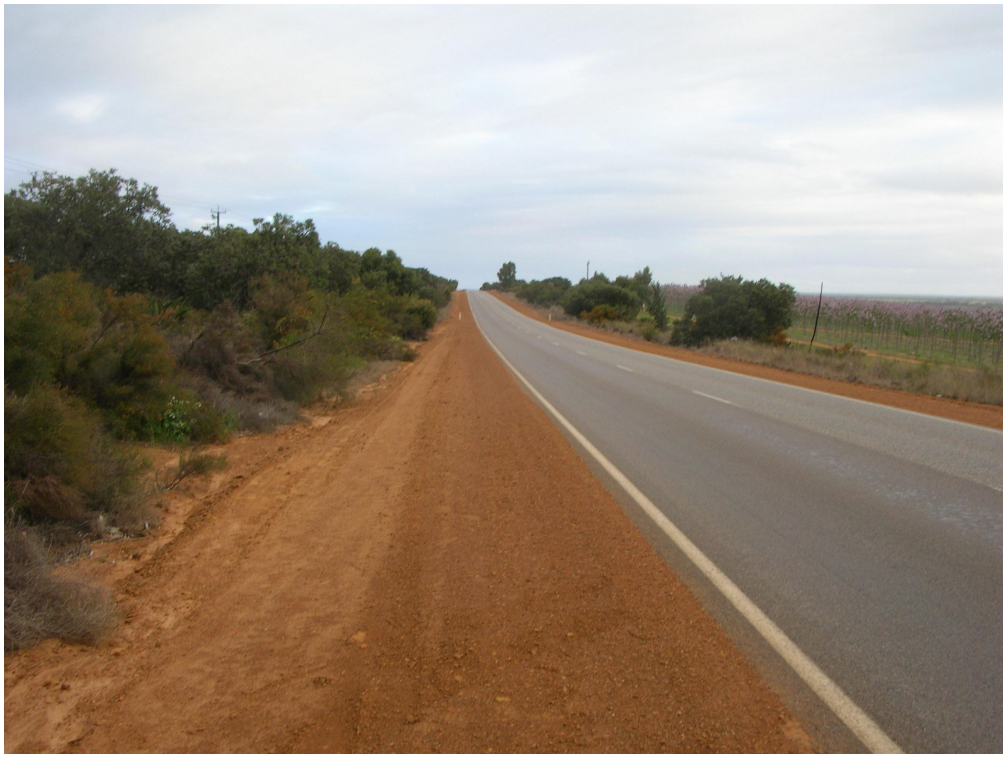

Plate 3: Northern section of site shows degraded road reserve on the west side of the highway, with native vegetation in better condition on east of highway. Photo taken looking south.

Appendix B

Flora and Vegetation

Table 8- Conservation Codes and Descriptions for the DEC Declared Rare and Priority Flora Species

Table 9- Significant Flora Species Previously Recorded within the General Vicinity of the Site (Source: The DEC and the WA Herbarium)

Table 10- Flora List for the Site: 54.20 to 56.00 SLK

Table 8 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 9 Significant Flora Species Previously Recorded within the General Region (Source: The DEC and the WA Herbarium)

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

Table 10 Flora List for the Site: 54.20 to 56.00 SLK (Results from field survey conducted 18th September 2006)

Family	Genus	Species	Common Name	Status
Amaranthaceous	*Pilots*	*polystichia's*	Prince of Wales Feather	
Anthericaceae	*Corynotheca*	*micrantha*	Sand Lily	
Anthericaceae	*Thysanotus*	*manglesianus*	Fringed Lily	
Apiaceae	*Trachymene*	*pilosa*	Native Parsnip	
Asteraceae	*Blennospora*	*drummondii*		
Asteraceae	*Arctotheca*	*calendula*	Cape Weed	*
Asteraceae	*Conyza*	*bonariensis*	Flaxleaf Fleabane	*
Asteraceae	*Hypochaeris*	*glabra*	Smooth Catsear	*
Asteraceae	*Monoculus*	*monstrosus*	Stinking Roger	*
Asteraceae	*Podotheca*	*gnaphalioides*	Golden Long-heads	
Asteraceae	*Sonchus*	*oleraceus*	Common Sowthistle	*
Asteraceae	*Urospermum*	*picroides*	False Hawkbit	*
Asteraceae	*Ursinia*	*anthemoides*	Ursinia	*
Brassicaceae	*Raphanus*	*raphanistrum*	Wild Radish	*
Caryophyllaceae	*Petrorhagia*	*dubia*		*
Caryophyllaceae	*Polycarpon*	*tetraphyllum*	Fourleaf Allseed	*
Caryophyllaceae	*Silene*	*gallica*	French Catchfly	*
Casuarinaceae	*Allocasuarina*	*humilis*	Dwarf Sheoak	
Colchicaceae	*Burchardia*	*bairdiae*		
Crassulaceae	*Crassula*	*colorata* var. *acuminata*	Dense Stonecrop	
Cucurbitaceae	*Citrullus*	*lanatus*	Pie Melon	*
Cucurbitaceae	*Cucumis*	*myriocarpus*	Prickly Paddy Melon	*
Cyperaceae	*Caustis*	*dioica*		
Cyperaceae	*Lepidosperma*	*leptostachyum*		
Cyperaceae	*Lepidosperma*	*squamatum*		
Cyperaceae	*Mesomelaena*	*pseudostygia*		
Dasypogonaceae	*Calectasia*	*narragara*		
Dasypogonaceae	*Lomandra*	*micrantha* subsp. *micrantha*	Small-flower Mat-rush	
Dilleniaceae	*Hibbertia*	*acerosa*	Needle Leaved Guinea Flower	

Family	Genus	Species	Common Name	Status
Dilleniaceae	*Hibbertia*	*huegelii*		
Dilleniaceae	*Hibbertia*	*hypericoides*	Yellow Buttercups	
Epacridaceae	*Astroloma*	*pallidum*	Kick Bush	
Euphorbiaceae	*Euphorbia*	*drummondii*	Caustic Weed	
Euphorbiaceae	*Phyllanthus*	*calycinus*	False Boronia	
Geraniaceae	*Erodium*	*cygnorum*	Blue Heronsbill	
Goodeniaceae	*Scaevola*	*?repens*		
Goodeniaceae	*Scaevola*	*canescens*	Grey Scaevola	
Goodeniaceae	*Verreauxia*	*reinwardtii*	Common Verreauxia	
Gyrostemonaceae	*Gyrostemon*	*subnudus*		
Haemodoraceae	*Conostylis*	*setigera*	Bristly Cottonhead	
Haemodoraceae	*Haemodorum*	sp.		
Iridaceae	*Gladiolus*	*caryophyllaceus*	Wild Gladiolus	*
Iridaceae	*Moraea*	sp	Cape Tulip	* DP
Iridaceae	*Romulea*	*rosea*	Guildford Grass	*
Lauraceae	*Cassytha*	*aurea* var. *hirta*		
Loranthaceae	*Nuytsia*	*floribunda*	Christmas Tree	
Malvaceae	*Malva*	sp		
Mimosaceae	*Acacia*	*pulchella* var. *pulchella*	Prickly Moses	
Mimosaceae	*Acacia*	*stenoptera*	Narrow Winged Wattle	
Molluginaceae	*Macarthuria*	*australis*		
Myrtaceae	*Baeckea*	*camphorosmae*	Camphor Myrtle	
Myrtaceae	*Baeckea*	*crispiflora*		
Myrtaceae	*Calothamnus*	*sanguineus*	Silky-leaved Blood Flower	
Myrtaceae	*Calytrix*	*oldfieldii*		
Myrtaceae	*Corymbia*	*calophylla*	Marri	
Myrtaceae	*Eremaea*	*pauciflora*		
Myrtaceae	*Eucalyptus*	*?camaldulensis*	River Gum	
Myrtaceae	*Eucalyptus*	*todtiana*	Coastal Blackbutt	
Myrtaceae	*Hypocalymma*	*xanthopetalum*		
Myrtaceae	*Leptospermum*	*erubescens*	Roadside Teatree	
Myrtaceae	*Melaleuca*	sp.		NF

Family	Genus	Species	Common Name	Status
Myrtaceae	*Scholtzia*	*involucrata*		
Myrtaceae	*Verticordia*	*centipeda*		
Onagraceae	*Oenothera*	sp.		*
Orchidaceae	*Caladenia*	*flava*	Cowslip Orchid	
Orchidaceae	*Microtis*	*sp.*		NF
Orchidaceae	*Pterostylis*	*?aff. nana*	?Snail Orchid	
Orchidaceae	*Pterostylis*	*sp.*		NF
Oxalidaceae	*Oxalis*	*pes-caprae*	Soursob	*
Papilionaceae	*?Bossiaea*	*eriocarpa*	Common Brown Pea	
Papilionaceae	*Chamaecytisus*	*palmensis*	Tagasaste	*
Papilionaceae	*Daviesia*	*angulata*		
Papilionaceae	*Daviesia*	*divaricata*		
Papilionaceae	*Daviesia*	*nudiflora*		
Papilionaceae	*Gastrolobium*	*capitatum*		
Papilionaceae	*Gompholobium*	*marginatum*		
Papilionaceae	*Gompholobium*	*knightianum*		
Papilionaceae	*Gompholobium*	*tomentosum*	Hairy Yellow Pea	
Papilionaceae	*Jacksonia*	*sternbergiana*	Stinkwood	
Papilionaceae	*Kennedia*	*prostrata*	Scarlet Runner	
Papilionaceae	*Lupinus*	*cosentinii*		*
Papilionaceae	*Trifolium*	*arvense* var. *arvense*		*
Papilionaceae	*Trifolium*	*campestre*	Hop Clover	*
Poaceae	*Aira*	*cupaniana*	Silvery Hairgrass	*
Poaceae	*Aristida*	*contorta*	Bunched Kerosene Grass	
Poaceae	*Austrostipa*	*elegantissima*		
Poaceae	*Avena*	*barbata*	Bearded Oat	*
Poaceae	*Avena*	*fatua*	Wild Oats	*
Poaceae	*Avena*	*sativa*	Common Oat	*
Poaceae	*Briza*	*maxima*	Blowfly Grass	*
Poaceae	*Briza*	*minor*	Shivery Grass	*
Poaceae	*Bromus*	*diandrus*	Great Brome	*
Poaceae	*Cynodon*	*dactylon*	Couch	*

Family	Genus	Species	Common Name	Status
Poaceae	*Ehrharta*	*calycina*	Perennial Veldt Grass	*
Poaceae	*Ehrharta*	*longiflora*	Annual Veldt Grass	*
Poaceae	*Eragrostis*	*curvula*	African Lovegrass	*
Poaceae	*Hordeum*	*leporinum*	Barley Grass	*
Poaceae	*Lolium*	*rigidum*	Wimmera Ryegrass	*
Poaceae	*Neurachne*	*alopecuroidea*	Foxtail Mulga Grass	
Poaceae	*Pentaschistis*	*airoides*	False Hairgrass	*
Primulaceae	*Anagallis*	*arvensis*	Pimpernel	*
Proteaceae	*Adenanthos*	*cygnorum*	Common Woollybush	
Proteaceae	*Banksia*	*attenuata*	Slender Banksia	
Proteaceae	*Banksia*	*candolleana*	Propeller Banksia	
Proteaceae	*Banksia*	*ilicifolia*	Holly-leaved Banksia	
Proteaceae	*Banksia*	*menziesii*	Firewood Banksia	
Proteaceae	*Conospermum*	*stoechadis*	Common Smokebush	
Proteaceae	*Dryandra*	*?lindleyana*		
Proteaceae	*Dryandra*	*shuttleworthiana*	Bearded Dryandra	
Proteaceae	*Grevillea*	*eriostachya*	Flame Grevillea	
Proteaceae	*Hakea*	*incrassata*	Marble Hakea	
Proteaceae	*Hakea*	*obliqua* subsp. *parviflora*		
Proteaceae	*Hakea*	*prostrata*	Harsh Hakea	
Proteaceae	*Hakea*	*ruscifolia*	Candle Hakea	
Proteaceae	*Hakea*	*trifurcata*	Two-leaf Hakea	
Proteaceae	*Persoonia*	*stricta*		
Proteaceae	*Petrophile*	*brevifolia*		
Proteaceae	*Petrophile*	*macrostachya*		
Proteaceae	*Petrophile*	*recurva*		
Proteaceae	*Stirlingia*	*latifolia*	Blueboy	
Proteaceae	*Synaphea*	sp.		NF
Proteaceae	*Synaphea*	*spinulosa* subsp. *spinulosa*		
Restionaceae	*Alexgeorgea*	*nitens*		
Restionaceae	*Lepidobolus*	*preissianus*		
Rhamnaceae	*Cryptandra*	*pungens*		

Family	Genus	Species	Common Name	Status
Rubiaceae	*Galium*	*murale*	Small Goosegrass	*
Rubiaceae	*Opercularia*	*vaginata*	Dogweed	
Rutaceae	*Boronia*	*ramosa* subsp. *anethifolia*		
Rutaceae	*Boronia*	*scabra* subsp. *scabra*		
Rutaceae	*Philotheca*	*spicata*	Pepper and Salt	
Scrophulariaceae	*?Misopates*	*orontium*	?Lesser Snapdragon	*
Scrophulariaceae	*Zaluzianskya*	*divaricata*	Spreading Night Phlox	*
Solanaceae	*Solanum*	*lasiophyllum*	Flannel Bush	
Solanaceae	*Solanum*	*nigrum*	Black Berry Nightshade	*
Stylidiaceae	*Stylidium*	*rigidulum*		
Stylidiaceae	*Stylidium*	*schoenoides*	Cow Kicks	
Violaceae	*Hybanthus*	*calycinus*	Wild Violet	
Xanthorrhoeaceae	*Xanthorrhoea*	*preissii*	Grass Tree	
Zamiaceae	*Macrozamia*	*?fraseri*		

***** Introduced species

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

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

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

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 at Brand Highway 54.20 to 56.00 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 (Specially Protected Fauna) Notice 2006*	EPBC Act Rating	CALM Database	EPBC Act Protected Matters search	*FaunaBase* search
Calyptorhynchus	*latirostris*	Carnaby's Cockatoo	Endangered / Schedule 1	Endangered	x		
Calyptorhynchus	*baudinii*	Baudin's Cockatoo	Endangered / Schedule 1	Vulnerable		x	
Pseudocheirus	*occidentalis*	Western Ringtail Possum	Vulnerable / Schedule 1	Vulnerable	x		
Dasyurus	*geoffroii*	Chuditch	Vulnerable / Schedule 1	Vulnerable	x	x	
Pseudomys	*shortridgei*	Heath Mouse (Dayang)	Vulnerable / Schedule 1	Vulnerable	x		
Leipoa	*ocellata*	Malleefowl	Vulnerable / Schedule 1	Vulnerable	x		
Hylaeus	*globuliferus*	*Hylaeus globuliferus* (native bee)	Priority 3		x		
Leioproctus	*contrarius*	*Leioproctus contrarius* (native bee)	Priority 3		x		
Macropus	*irma*	Western Brush Wallaby	Priority 4		x		x
Hydromys	*chrysogaster*	Water-rat (Rakali)	Priority 4		x		
Oreoica	*gutturalis gutturalis*	Crested Bellbird (southern)	Priority 4		x		
Ardeotis	*australia*	Australian Bustard	Priority 4				
Galaxiella	*munda*	Western Mud Minnow	Priority 4				
Throscodectes	*xederoides*	Mogumber Bush Cricket	Priority 4		x		

Genus	Species	Common Name	DEC / *Wildlife Conservation (Specially Protected Fauna) Notice 2006*	EPBC Act Rating	CALM Database	EPBC Act Protected Matters search	*FaunaBase* search
Isoodon	*obesulus fusciventer*	Quenda	Priority 5				
Haliaeetus	*leucogaster*	White-bellied Sea-eagle		Migratory		x	
Apus	*pacificus*	Fork-tailed Swift		Migratory		x	
Merops	*ornatus*	Rainbow Bee-eater		Migratory		x	

Table 15 Fauna species that may occur at Brand Highway 54.20 to 56.00 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						
Acanthizidae	*Gerygone*	*fusca*	Western Gerygone / Western Warbler			+ (obs.)
Anatidae	*Oxyura*	*australis*	Blue-billed Duck		+	
Columbidae	*Ocyphaps*	*lophotes*	Crested Pigeon			+ (obs)
Corvidae	*Corvus*	*coronoides*	Australian Raven			+ (obs.)
Cracticidae	*Cracticus*	*tibicen*	Australian Magpie			+ (obs.)
Laridae	*Sterna*	*caspia*	Caspian Tern	Marine	+	
Meliphagidae	*Lichenostomus*	*virescens*	Singing Honeyeater			+ (obs.)
Pardalotidae	*Pardalotus*	*striatus*	Striated Pardalote		+	
Psittacidae	*Calyptorhynchus*	*latirostris*	Carnaby's Cockatoo	Schedule 1 / Endangered		+ (obs.)
Psittacidae	*Platycercus*	*icterotis*	Western Rosella		+	
Psittacidae	*Platycercus*	*zonarius*	Australian Ringneck (Ring-necked Parrot)		+	+ (obs.)
Psittacidae	*Polytelis*	*anthopeplus anthopeplus*	Regent Parrot		+	
Recurvirostridae	*Recurvirostra*	*novaehollandiae*	Red-necked Avocet	Marine	+	
Tytonidae	*Tyto*	*alba*	Barn Owl		+	
Mammals						
Canidae	*Vulpes*	*vulpes*	Red Fox	*		+ (signs)
Leporidae	*Oryctolagus*	*cuniculus*	Rabbit	*		+ (signs)
Macropodidae	*Macropus*	*fuliginosus*	Western Grey Kangaroo			+ (obs)
Macropodidae	*Macropus*	*irma*	Western Brush Wallaby	P4	+	
Reptiles						
Elapidae	*Demansia*	*psammophis reticulata*	Yellow-faced Whipsnake		+	
Pygopodidae	*Lialis*	*burtonis*	Burton's Legless Lizard		+	
Amphibia						
Myobatrachidae	*Heleioporus*	*eyrei*	Moaning Frog		+	
Myobatrachidae	*Limnodynastes*	*dorsalis*	Bullfrog / Banjo Frog		+	

* Introduced

Appendix D

Summary of Environmental Impacts and Management

Table 16 Environmental Impacts Summary

Table 16 Environmental Impacts Summary

Environmental Aspect	Potential Impact	Management Measure (EMP Reference)	Timing
Native Vegetation Clearing	Clearing 1.8 ha of native vegetation. No DRF or Priority species were identified. The proposed clearing is not considered to be at variance with any of the ten clearing principles.	EMP Commitments – 5	Design and Construction
Dieback Disease	The Project area shows no indicating of being infected with dieback. The Project area is however, at risk from the introduction of dieback disease due to its location and annual average rainfall. There appears to be dieback present a few kilometres to the south of the site, based on patterns of death of susceptible plants. As there is potential for dieback to occur within the site it is recommended that dieback hygiene measures are adhered to during roadworks at the site.	EMP Commitments – 6	Design and Construction
Weeds	Most of the vegetation in the road reserve was in good condition and had minimal weed invasion. One of the weed species, *Moraea* sp. (Cape Tulip), identified during the survey 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". Biosecurity protocols should be adopted to ensure that this Declared Plant, and other weeds are not spread to other locations from the site and new weeds are not introduced to the site through road materials and machinery.	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

Environmental Aspect	Potential Impact	Management Measure (EMP Reference)	Timing
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
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	Unapproved impact to the Aboriginal Heritage artefacts / scatter site listed on the Register of Aboriginal Sites under the *Aboriginal Heritage Act 1972*. 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

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 (54.20 to 56.00 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 *Environmental Protection (Clearing of Native Vegetation) Regulations* 2004, 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 Main Roads WA utilise an existing bore, they will do so in accordance with the existing abstraction licence.	Compliance with the *Rights in the Water and Irrigation Act 1914*.	Project Manager	Pre-Construction

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 *in-situ* 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	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
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: » 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. » 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 Main Roads WA 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
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.	Minimise the introduction and spread of weeds within and from the Site.	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. Note, the declared weed Cape Tulip (*Moraea* sp) is known to occur at the site.	Minimise the introduction and spread of weeds within and from the Site.	Project Manager / Construction Contractor	Pre-construction/ Construction
Fire				
8.1	No burning will be permitted within the Project area.	No fires will occur as a result of the Project and the Project will not increase the risk to the surrounding area.	Construction Contractor	All
8.2	Machines and vehicles will be restricted to designated cleared areas.	Reduce the fire risk as a result of the Project.	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.	Comply with local fire management requirements.	Construction Contractor	All
8.4	During road construction activities, the following fire management requirements will be complied with: » 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. » 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.	Reduce the fire risk as a result of the Project.	Construction Contractor	Construction
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.	Minimise impacts to fauna and fauna habitats.	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.	Minimise direct impacts on fauna.	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.	Minimise direct impacts on fauna.	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. Note, dust suppression waters will not be sprayed directly onto native vegetation.	Dust lift will be minimised, minimising inconvenience to road users and risks of impacts to surrounding vegetation and public safety.	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.	Dust lift will be minimised, minimising inconvenience to road users and risks of impacts to surrounding vegetation and public 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.	No site contamination will occur as a result of this Project.	Construction Contractor	All
11.2	Major vehicle and plant servicing will not be conducted within the Site.	No site contamination will occur as a result of this Project.	Construction Contractor	All
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, particularly in relation to the site on the interim register located in the vicinity of the proposed passing lane.	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 *Manual 1742.3 of Uniform Traffic Control Devices: Part 3 Traffic Control Devices for Works On-Road* (Standards Australia) and the current Main Roads WA *Traffic Management Requirements for Works on Roads*.	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 *Traffic Management Requirements for Works on Roads* and the current Australian Standard *Manual 1742.3 of Uniform Traffic Control Devices: Part 3 Traffic Control Devices for Works On-Road* (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
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 *Traffic Management Requirements for Works on Roads*.	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

14.5	Recommendations made by BACTEC (2006) are addressed.	UXO materials are not disturbed.	Project Manager Construction Contractor	Pre-Construction/ Construction
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)*, as does taking groundwater (eg for dust suppression). The project site is within the Moore River Catchment (some portions of which are proclaimed).

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 no priority species at this location. No Environmentally Sensitive Area was identified at this site. Ms Lauritsen advised that it will be necessary for Main Roads WA to apply for a clearing permit as the previous exemption that applied to this activity has now expired, however, GHD advised of Main Roads WA's new purpose clearing permit.

Ms Jacqui Maguire, Conservation Officer - Swan District Office - Department of Conservation and Land Management.

Ms Maguire strongly recommended that a vegetation assessment be conducted by Main Roads WA prior to determination of site boundaries. These surveys should target threatened flora species and ecological communities known or likely to occur in the vicinity of the site. Further to this vegetation assessment CALM would also request that appropriate *Phytophthora cinnamomi* (Dieback) hygiene procedures are followed by Main Roads WA during construction of the passing lane. Correct *Phytophthora* hygiene procedures to be adhered to include a requirement that all machines and vehicles are to be clean on entry to each site, and that contractors be made aware of this requirement. Ms Maguire also concurred with previous comments from Ms Gina Broun of the Moora District Office (area covering the seven northern sites on Figure 2), which also included a recommendation to survey the area for Carnaby's Cockatoo nesting and feeding habitat, undertake remedial actions such as seed harvesting/propagule collection and ensure all staff involved in the works are aware of their duty of care in regards to Environmentally Sensitive Areas (as defined in the new clearing legislation attached to the *EPBC 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 advised that information received indicates that this site has no Declared Plants. He 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 Main Roads WA would need to seek clearances through DoE and CALM.

Mr Frank Vallentine, Works Supervisor, Shire of Gingin.

Mr Vallentine advised that he had no concerns with the proposed works from the Shire of Gingin perspective, and welcomed the construction of new passing lane.

Mr Andrew Arnold – UXO Liaison Officer, FESA.

Mr Arnold advised that this site lies well within two known unexploded ordinance (UXO) contamination sites, being the Boonanarring Brook Artillery Range and the Gingin Artillery Range. 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 Arnold recommended the site be fully searched for UXO as it lies well within the impact areas. Mr Arnold has offered to assist with the development of a "Scope of Works and Area Details" document to assist Main Roads WA with the appointment of an accredited UXO Contractor.

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 project area. There is a gas crossing of approximately 2.5km to the south and Mr Connell has suggested Agility would be interested in receiving information about roadworks at this locality. Mr Connell has advised that prior to any works commencing, Agility would be pleased to receive plans and work methodology and each crossing will require a letter of conditions to be sent out to the main proponent for agreement and signing off on the site specific conditions.

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