Main Roads Western Australia

Margaret River Perimeter Road
Environmental Impact Assessment

November 2012

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Executive summary

Main Roads Western Australia (Main Roads) proposes to construct a road, to the east of the Margaret River town site, to divert traffic, including heavy vehicles, around the Margaret River town centre. The road will reduce traffic congestion and noise, and improve safety for pedestrians and local traffic in the commercial and tourist precinct. The Project has been named the Margaret River Perimeter Road.

Planning for the road includes a 7 km dual carriage way road formation, extending from the Department of Environment and Conservation depot access road approximately 2 km north of the Margaret River townsite, linking back to the Bussell Highway approximately 1 km south of Rosa Brook Rd. This Environmental Impact Assessment (EIA) considers the dual carriageway project.

The Project initially involves the construction of a two lane single carriageway road formation, with a bridge crossing the Margaret River and a culvert crossing of Darch Brook. The Project will also include:

- Construction of the 1 650m long John Archibald Drive link,
- Intersections at the Airport Access, John Archibald Drive, Rosa Brook Road east and a proposed Light Industrial Area Access
- Fencing; and
- Landscaping.

Upgrade to the planned dual carriageway will be undertaken should traffic volumes warrant.

GHD has been commissioned to prepare an Environmental Impact Assessment (EIA) for the Project, which includes assessment of the existing environment, including physical, biological, social, aesthetic, heritage, noise and site contamination. The EIA will determine key environmental factors and if additional site investigations are required, include appropriate physical and biological field investigations and an assessment of the Project against the EP Act "Ten Clearing Principles".

The EIA also aims to provide necessary information to assist the Main Roads Project Manager in applying for necessary clearances, permits and licences relevant to the Project and recommend whether the Project is likely to have a significant environmental impact which may trigger referral to either the EPA or DSEWPaC.

The results of the EIA indicate that:

- Works may expose soils below the water table, particularly at the water crossings, potentially disturbing soils with acid generating potential. Main Roads should undertake targeted detailed ASS investigations, with management actions detailed in a project specific Construction Environmental Management Plan (CEMP).
- The Project Area is within a groundwater area proclaimed under the RIWI Act (DoW, 2012). Should groundwater be required for construction activities, a licence will be required under the RIWI Act.
- The Project traverses the Margaret River and Darch Brook which are proclaimed waterways under the RIWI Act. Permits will be required under the RIWI Act to disturb the Bed and Banks of these watercourses.
- No other wetlands are located within the Project Area.
- No ESAs occur within the Project Area.
- The Project has a total footprint of 42 ha, of which approximately 8.5 ha of native vegetation, is proposed to be cleared, 5.2 ha of which is rated as being in *good* to *very good* condition.

- The Beard (1975) and Mattiske and Havel (1998) vegetation associations and complexes present in the Project Area all retain more than the threshold level (30%) recommended in the National Objectives Targets for Biodiversity Conservation (Commonwealth of Australia, 2001). Approximately two thirds of the alignment traverses cleared agricultural land, with the remainder consisting of Pine Plantation, State Forest, National Park and existing roads.
- The Project is surrounded by 18 000 ha of native vegetation within 10 km, including the Bramley National Park and State Forest.
- During the 2011 Flora Survey (GHD) 168 plant taxa were recorded, comprising 134 native and 34 introduces species. No declared rare flora were recorded within the Project Area, with one P3 species, *Gastrolobium formosum*, identified on the banks of the Margaret River. A 2012 Targeted search confirmed *G. formosum* within the alignment, with the species also recorded on the northern banks of the Margaret River, for at least a further 50 m either site of the alignment.
- No TEC's were identified within Project Area.
- One WONS was identified during the 2011 Survey (Lantana camara).
- An assessment against the Ten Clearing Principles found that the project is at variance with Principle (f), may be at variance with Principles (a), (b) and (h), and is unlikely to be at variance with Principles (g) and (i).
- Four conservation significant fauna were recorded within the Project Area during the 2011 fauna survey (GHD 2012), including Baudin's Black Cockatoo (*Calyptorhynchus baudinii*), Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) and Western Ringtail Possum (*Pseudocheirus occidentalis*).
- Overall 41 potential Black Cockatoo breeding trees and 171 trees of suitable size for the development of Black Cockatoo nesting hollows (>500 mm DBH) within the next 100 years will be cleared from within the Project Area. Further, 4.54 ha of potential foraging habitat is proposed to be cleared.
- Approximately 0.86 ha of the Project clearing has been identified as being habitat for the Western Ringtail Possum.
- Due to impacts on conservation significant species, including the Black Cockatoo species and the Western Ringtail Possum, the Project should be referred to DEWSPaC under the *Environment Protection Biodiversity Conservation Act 1999*.
- The Project is considered to have an impact on one or more of the three black cockatoo species and is considered to trigger a requirement for referral under s38 of the EP Act.
- The alignment is determined to be a mosaic of Dieback infested and unmappable areas. The management actions detailed in the site specific Hygiene Management Plan should be incorporated into the CEMP.
- A corridor was provided for the perimeter road during gazettal of the Bramley National Park, although alignment changes and detailed design require excision of 0.54 ha from the Bramley National Park.
- One registered aboriginal heritage site will be impacted by the Project (Goode and Associates 2012). An application to disturb this site has been submitted under Section 18 of the Aboriginal Heritage Act 1972.
- Residents will be exposed to traffic noise from the Project, with noise to be managed consistent with the WAPC State Planning Policy 5.4.
- No listed contaminated sites have been identified within 5 km of the Project Area.

- Potential construction impacts will be managed through Main Roads specifications and the preparation and implementation of a Construction Environmental Management Plan (CEMP) for the Project

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Acronyms

ARRP Act	*Agricultural and Related Resources Protection Act 1976*
ASS	Acid Sulphate Soil
CEMP	Contractor's Environmental Management Plan
DEC	Department of Environment and Conservation
DSEWPaC	Department of Sustainability, Environment, Water, Population and Communities
dbh	Diameter at Breast Height
DAFWA	Department of Agriculture and Food Western Australia
DFWA	Department of Fisheries Western Australia
DIA	Department of Indigenous Affairs
DoW	Department of Water
DRF	Declared Rare Flora
EMP	Environmental Management Plan
EPA	Environmental Protection Authority
EP Act	*Environmental Protection Act 1986*
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
ESA	Environmentally Sensitive Area
IBRA	Interim Biogeographic Regionalisation for Australia
IUCN	International Union for Conservation of Nature
LPS	Local Planning scheme
MNES	Matter of National Environmental Significance
PDWSA	Public Drinking Water Source Area
PEC	Priority Ecological Community
PEIA	Preliminary Environmental Impact Assessment
PF	Priority Flora
PMST	EPBC Act Protected Matters Search Tool
RIWI Act	*Rights in Water and Irrigation Act 1914*
SBTP	Southern Brush-tailed Phascogale
TEC	Threatened Ecological Community
TFD	Threatened Flora Database

WAHERB	Herbarium of Western Australia
WAPC	Western Australian Planning Commission
WC Act	*Wildlife Conservation Act 1950*
WONS	Weeds of National Significance
WRTP	Western Ringtail Possum

1. Introduction and Planning Background

1.1 Purpose

Main Roads Western Australia (Main Roads) proposes to construct a 7 km perimeter road (the Project), to the east of the Margaret River town site, as part of the Bussell Highway. The Project aims to divert traffic, including heavy vehicles, around the Margaret River town centre, reducing traffic congestion and noise, while improving safety for pedestrians and local traffic in the commercial and tourist precinct.

A Preliminary Environmental Impact Assessment (PEIA) was undertaken in 2007 on two alignment options to the east of Margaret River. A final alignment option has since been selected (Figure 1; Appendix B) and is the subject of this Environmental Impact Assessment (EIA). To identify any potential constraints along the alignment, environmental investigations have been undertaken, including desktop reviews, a flora and fauna survey in November 2011 and a targeted flora search in September 2012 to supplement the flora survey.

Main Roads proposes to submit this EIA to the Environmental Protection Authority (EPA) for a determination under Section 38 (s38) of the *Environmental Protection Act 1986* (EP Act). Should the Project not be formally assessed, Main Roads will seek to conduct the clearing under its State-wide Purpose Clearing Permit (CPS 818/6), or seek a Purpose Clearing Permit under the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*.

Similarly, Main Roads propose to submit this EIA to the Commonwealth Minister for the Environment through the Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) for a decision under the provisions of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)*.

1.2 Background

The current alignment of Bussell Highway passes through the town of Margaret River, along the main street of the town and through the main commercial precinct. The need for an alternate route for heavy vehicles to bypass the commercial and tourist precinct was identified in the 1980s. Alignments to the east and west of the townsite have been examined, with an alignment to the east identified as the most feasible of the options. This alignment was approved by the WAPC in 2011 and forms the basis of Main Road's concept designs. This alignment is the subject of this EIA.

1.3 Proposed Works

Planning for the road includes a 7 km dual carriage way road formation, extending from the Department of Environment and Conservation depot access road approximately 2km north of Margaret River townsite, linking back to the Bussell Highway, approximately 1 km south of Rosa Brook Rd. The Project will include intersections at the Airport Access, John Archibald Drive, Rosa Brook Road east and a proposed Light Industrial Area Access; bridges crossing the Margaret River; a culvert crossing of Darch Brook; construction of the 1650m long John Archibald Drive link; fencing; and landscaping

Road construction will be undertaken through both cut and fill operations, with the Project comprising;

- Typically 90 m wide road reserve;
- Road comprising 2 x 3.5 m sealed lanes with 1.5 m sealed shoulders and 1.0 m unsealed shoulders;

- Two bridges across the Margaret River; and
- A culvert crossing at Darch Brook.

The typical road formation is represented in Appendix A.

The Margaret River Bridge consists of:

- A three span composite bridge approximately 85 m in length with a central span across the river of approximately 45 m;
- Piers to be designed on the river banks; and
- A bridge cross section comprising a total of 12 m wide road surface with a 2 m wide shared path on the eastern side.

The Project initially involves the construction of a two lane single carriageway road formation, with upgrade to the planned dual carriageway should traffic volumes warrant. This EIA assesses the impact of the planned dual carriageway.

1.4 Project Area

The town of Margaret River is situated approximately 100 km south of Bunbury, and 270 km south of Perth, in the southwest of Western Australia. The Project Area navigates east around the town of Margaret River, tying into the existing Bussell Highway. The Project Area is approximately 7 km long, the majority of which consists of agriculture land, forests and native vegetation (Figure 1 and Figure 2; Appendix B).

Residences are located within 100 m of the proposed alignment, in the south-west of the Project (chainage 4900 to 5300), in the Riverslea Residential Estate, (chainage 2300) and in the south of the Project Area (chainage 6400 and 6700), although these residences are greater than 200 m from the proposed perimeter.

2. Scope

2.1 Environmental Impact Assessment

This EIA has been prepared to identify the primary environmental and social impacts associated with the dual carriageway. This EIA makes recommendations for additional work, and/or preparation and implementation of specific management plans, to address relevant environmental factors through the development and construction of the Project (Section 7). Main Roads scope of work for this Project includes an examination of the following items:

- Description and assessment of the existing environment, including physical, biological, social, aesthetic, heritage, noise and site contamination;
- Determination of key environmental factors and scope of any additional site investigations required;
- Appropriate physical and biological field investigations;
- Assessment of the Project against the EP Act "Ten Clearing Principles" in accordance with the Department of Environment and Conservation's (DEC's) Guide to Assessment – Clearing of Native Vegetation;
- Provision of necessary information to obtain, and assist the Main Roads Project Manager in applying for clearances, permits and licences which may be required under various Acts and regulations relevant to the Project; and
- Assessment of whether the Project is likely to have a significant environmental impact which may trigger referral to either the EPA or DSEWPaC.

This EIA has used the designs provided by Main Roads as the basis for this assessment in addition to information provided by Main Roads Project Manager (Mr N McCarthy). Investigations and activities conducted for the preparation of this EIA include:

- Preliminary Environmental Impact Assessment, including a 2005 Biological Survey (GHD, 2007);
- Site specific Level 2 flora and vegetation surveys (Spring 2011), including a review of DEC's Rare and Threatened Flora database (GHD 2012) (Appendix C);
- A targeted search for the P4 flora species *Gastrolobium formosum* (Spring 2012) (Appendix C);
- Site specific Level 1 fauna surveys (Spring 2011) including a review of DEC's Rare and Threatened Flora database and a review of the Western Australian Museum database for threatened and endangered fauna (GHD 2012) (Appendix C);
- Heritage Survey - Ethnographic Consultation (Brad Goode & Associates, 2007) (Appendix E);
- Aboriginal Heritage Survey (Brad Goode & Associates, 2012) (Appendix F);
- Dieback Survey – Hygiene Management Plan (Glevan Consulting, 2012) (Appendix D);
- A review of the DSEWPaC's database for issues listed under the EPBC Act;
- A review of the DEC's *Naturemap* database for rare and threatened flora and fauna;
- A review of European and Aboriginal Heritage within the Project Area.

The EIA also identifies and may be used to support application for additional clearances required under legislative requirements, including those required under the following Acts:

- *Environment Protection and Biodiversity Conservation Act 1999 (Cth);*
- *Environmental Protection Act 1986 (WA);*
- *Environmental Protection (Noise) Regulations 1997 (construction);*
- *Environmental Protection (Clearing of Native Vegetation) Regulations 2004 (WA);*
- *Rights in Water and Irrigation Act 1914 (WA);*
- *Conservation and Land Management Act 1984 (WA)*
- *Wildlife Conservation Act 1950 (WA);*
- *Heritage of Western Australia Act 1990 (WA); and*
- *Aboriginal Heritage Act 1972 (WA).*

Other than the database searches, no other environmental agencies were consulted during the preparation of this EIA.

2.2 Environmental Factors Considered in this Assessment

Based on an assessment of the Project and a review of studies completed, relevant environmental factors that require consideration to define the impact of the Project, and/or require consideration throughout Project development and construction have been determined as follows:

- Acid sulphate soils;
- Hydrology and hydrogeology – wetlands, waterways, groundwater and public drinking water sources;
- Environmentally Sensitive Areas;
- Terrestrial flora and vegetation – vegetation type, vegetation extent and status, vegetation condition, clearing, significant flora, Threatened Ecological Communities and Priority Ecological Communities;
- Dieback;
- Weeds and Declared Plants;
- Topsoil management;
- Rehabilitation;
- Fauna – threatened fauna, habitat values, habitat linkages;
- Reserves and conservation areas;
- Fire;
- Non-Indigenous Heritage;
- Indigenous Heritage;
- Air Quality;
- Noise and Vibration;
- Contaminated Sites
- Public Safety and Traffic;
- Waste;
- Hazardous Substances
- Visual Amenity; and
- Construction Phase Impacts.
- Community consultation

These factors are addressed in the following sections of this report.

3. Environmental Assessment

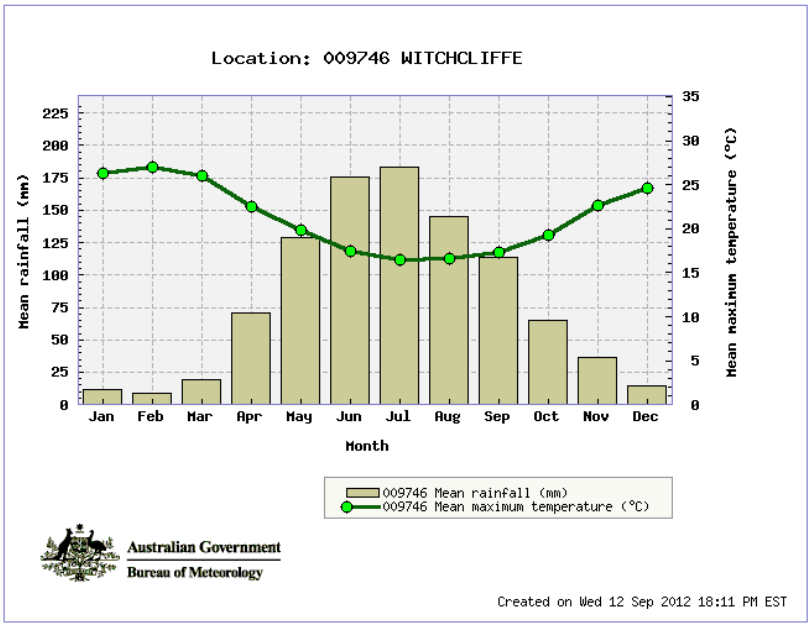
The environmental and social factors considered relevant to this Project are outlined in this section. For each factor a baseline environmental description is included and, where appropriate, is followed by an assessment of potential environmental impacts. Recommendations are provided for additional investigations and/or management measures to be conducted or implemented during the development of the Project as part of this EIA.

3.1 Climate

The south west of Western Australia experiences a Mediterranean climate, with cool winters and hot summers. The nearest Bureau of Meteorology weather station to the Project Area is located at Witchliffe, approximately 8 km south of the Margaret River townsite.

The area experiences a wide range of temperatures with summer mean maximum temperatures of approximately 27°C and winter mean maximum temperatures of approximately 16.4°C (BOM, 2012). A summary of the recorded average monthly maximum temperature and rainfall for Witchcliffe are presented in Plate 1.

Plate 1 Mean Maximum Temperature (°C) and Rainfall (mm) in Witchcliffe (Station 009746) (BOM 2012)



3.2 Geology and Soils

3.2.1 Geology

The Project Area is situated within the South West Physiographic Division, close to the boundary between the Leeuwin Naturaliste Ridge and the Blackwood Plateau (GHD, 2007). The Leeuwin Naturaliste Ridge is a narrow area along the west coast, extending between Cape Naturaliste and Cape Leeuwin. The Leeuwin Ridge is dominated by a gently undulating lateritic plateau which lies 2080 m above sea level. The Blackwood Plateau to the east is gently undulating, underlain by Mezoic rocks capped with laterite and sand (Department of Agriculture, 2003).

3.2.2 Soils

The Project Area traverses two soil systems and several subsoil systems as described in Table 1 (GHD, 2007). The majority of the Project traverses the lateritic flats, low rises and gentle slopes of the Cowaramup Uplands System, except around the Margaret River and its tributaries where it traverses the narrow valley and gentle to moderate valley slopes of the Wilyabrup Valleys System (Department of Agriculture, 2003).

Table 1 Soil Systems and Sub-systems in the Project Area

Soil Systems and Sub-systems	Description
Wilyabrup Valleys System - 216Wv	
Wilyabrup narrow valley floor phase (WLv)	Narrow valleys; Loamy gravels, Duplex sandy gravels, Brown deep loamy duplexes and Friable red/brown and Brown loamy earths
Wilyabrup undifferentiated hillslope phase (WLh)	Gentle to moderate valley slopes; Loamy gravels, Duplex sandy gravels, Brown deep loamy duplexes and Friable red/brown and Brown loamy earths
Cowaramup Uplands System – 216Co	
Cowaramup undifferentiated upland phase (COu)	Lateritic flats, low rises and gentle slopes; Loamy gravels, duplex sandy gravels, semi-wet soils and grey deep sandy duplexes
Cowaramup wet vales phase (COvw)	Broad, swampy floored drainage depressions; Wet and semi-wet soils, grey deep sandy duplexes, loamy gravels and duplex sandy gravels
Cowaramup wet flats phase (COw)	Poorly drained flats and depressions; Semi-wet and wet soils with grey deep sandy duplexes and pale sandy earths

3.3 Acid Sulphate Soils

DEC (2011) describes Acid Sulphate Soils (ASS) as naturally occurring soils and sediments containing sulphide minerals, predominantly pyrite (an iron sulphide). If the soils are exposed to oxygen, through excavation or lowering of the water table, the sulphides react with oxygen to form sulphuric acid.

Mapping of ASS by the Western Australian Planning Commission (WAPC) has been prepared for areas of the state, particularly where the impact of ASS has been assessed as being more significant. A review of the DEC ASS risk mapping, available through the Landgate Shared Land Information Portal (SLIP) (2012), indicates that the majority of the proposed alignment overlies an area of 'no known risk of ASS occurring within 3 m of natural soil surface' with pockets of 'moderate to low risk of ASS occurring within 3 m of the natural soil surface' (Figure 3).

As the Project includes both cut and fill construction methods, it is possible that works may expose soils below the water table potentially disturbing soils with acid generating potential, particularly at the water crossings. DEC's guidance recommends investigation to characterise

ASS materials in situ prior to commencement of development works. Consequently, Main Roads should undertake ASS investigation in areas where works are likely to result in exposure of the soil profile below the water table.

Recommendation 1

Main Roads undertake detailed ASS investigation in areas where works are likely to result in exposure of the soil profile below the water table. The Construction Environmental Management Plan (CEMP) should incorporate specific ASS management measures to mitigate any potential impact.

3.4 Hydrogeology and Hydrology

A summary of the Department of Water (DoW) Hydrogeographic Atlas queries for the Project Area is provided in Table 2.

Table 2 Hydrogeographic Atlas query results (DoW 2012)

Aspect	Details	Results
RIWI Groundwater Areas	Groundwater areas proclaimed under the RIWI Act	Blackwood Groundwater Area
		Busselton - Capel Groundwater Area
Groundwater subareas	Groundwater areas proclaimed under the RIWI Act	Cape to Cape North, within Busselton - Capel Groundwater Area
		Cape to Cape South, within Blackwood Groundwater Area
RIWI Watercourses	Watercourses proclaimed under the RIWI Act	Margaret river and tributaries, including Darch Brook
RIWI surface water areas	Surface water areas proclaimed under the RIWI Act	Cape to Cape South Surface water area
Surface water allocation		Busselton Coast
Surface water suballocation areas		Margaret town
		Bramley
		Boodijidup

3.4.1 Groundwater

The Project Area is situated upon an active, shallow groundwater system which maintains a number of permanent pools along Margaret River, as well as a more dormant, deeper groundwater system (Schafer, Johnson and Kern, 2008). Schafer et al (2008) indicates that the Leederville aquifer and the Margaret River are directly connected.

Groundwater salinity within the Project Area is low and given the scale of the proposed clearing, it is unlikely deterioration of groundwater will result (GHD, 2012).

A search of the Department of Water (DoW) Geographic Data Atlas (2012) indicates that the Project is within the groundwater sub-area Cape to Cape North, located within the Busselton-Capel Groundwater Area. The Project Area is within a groundwater area proclaimed under the RIWI Act (DoW, 2012).

Should groundwater be required for construction activities, a licence will be required under the RIWI Act.

3.4.2 Public Drinking Water Source Areas

Public Drinking Water Source Areas (PDWSAs) is a collective term used for the description of Water Reserves, Catchment Areas and Underground Pollution Control Areas declared (gazetted) under the provisions of the *Metropolitan Water Supply, Sewage and Drainage Act 1909* or the *Country Areas Water Supply Act 1947*.

A search of the DoW Geographic Data Atlas (2012) indicates that the Project is not within a PDWSA, with the nearest being approximately 1 km to the west.

Given the nature and location of the Project, no impacts are expected to occur upon this PDWSA.

3.4.3 Surface Water

The Project Area is within the Busselton coast surface water allocation area, and in the Cape to Cape South surface water Area, proclaimed under the *Rights in Water and Irrigation Act 1914* (RIWI Act). Should surface water be required for the Project, a licence will be required under the RIWI Act

The Project traverses the Margaret River, including Darch Brook (Figure 2) which are proclaimed under the RIWI Act. As the proposed works will involve construction of a bridge over the Margaret River and a culvert where the Project crosses the Darch Brook, a 11 / 17 / 21A Permit to Interfere with Bed and Banks permits will be required under the RIWI Act.

Surface water runoff from the road and water crossing may result in impacts on both the Margaret River and Darch Brook. Runoff from the road may contain contaminants such as hydrocarbons, heavy metals and sediment. Detailed design should include consideration of water management such that there is no direct runoff to the water courses, and to stabilise the banks of the watercourse following construction.

There are a number of drainage lines and areas across which the Project traverses, including a drainage line in State Forest 56. However, the Project is not expected to have any long term effects on the hydrology of the area. There may be minor short term impacts on surface water during construction due to clearing and earthworks (ie sediment and hydrocarbons), with these impacts recommended to be managed through a CEMP.

Recommendation 2

Road drainage should be developed to ensure that there is no direct discharge or road runoff to the Margaret River or its tributaries. Drainage design for the final alignment should aim to maintain existing surface water drainage patterns and avoid exacerbating waterlogging in susceptible areas.

Recommendation 3

Runoff from disturbed areas may be minimised through the preparation and implementation of a CEMP, including site treatments such as sediment curtains, settling basins etc. Measures to control spills should be included in the CEMP.

Recommendation 4

Main Roads prepare an application to the DoW for a permit to disturb the bed and banks of the Margaret River and the Darch Brook, once construction details and impacts are known.

3.4.4 Wetlands

Wetlands of International Significance are listed under the Ramsar Convention, which is an international treaty that covers the conservation of internationally important wetlands. A search of the EPBC Protected Matters Search Tool (PMST) indicates that there are no Wetlands of International Significance within the Project Area, with the nearest located approximately 40 km to the north-east.

Given the nature of the Project and its distance from the wetland, it will not impact upon the wetland.

No wetlands identified as Nationally significant were identified within 5 km of the Project Area (GHD, 2012), and as such the Project will not result in impacts on any known or registered wetlands.

3.5 Environmentally Sensitive Areas (ESA)

ESAs are subject to definition under Section 51B of the EP Act and include areas requiring special management attention to protect important scenic values, fish and wildlife resources, historical and cultural values, and other natural systems or processes.

A search of DEC's Native Vegetation Map Viewer (2012) indicates that no ESAs occur within the Project Area, with the nearest being approximately 4 km to the south.

Given the nature and location of the Project, no impacts are expected to occur upon this ESA.

3.6 Terrestrial Flora and Vegetation

A Level 2 Flora and Vegetation Survey of the Project Area was conducted by GHD in spring 2011 with the Flora and Vegetation assessment report (GHD 2012) provided in Appendix C. A summary of the findings from the survey are discussed below.

To supplement the spring 2011 survey, a targeted search for the Priority 3 species, *Gastrolobium formosum*, was undertaken on 10 September 2012, with the results provided in Appendix C and a summary below.

Surveys of similar alignments were undertaken in Ecologia 2000 and GHD in 2005, with the Northern section of the alignment, to the Margaret River crossing, following a similar alignment to the Project (GHD 2007). No Declared Rare Flora (DRF) were identified, with the two priority species identified in the 2005 survey either being removed from the priority list or not within the current Project Area.

3.6.1 Bioregion

The Interim Biogeographic Regionalisation of Australia (IBRA) divides the Australian continent into 85 biogeographic regions based on their climatic, faunal, vegetation, landform and geological features. The Project Area is located predominantly within the Warren (WAR) IBRA region (Department of Conservation and Land Management, 2002) although a small section to the east is situated within the Southern Jarrah Forest (JF2) subregion.

The Warren IBRA region comprises dissected undulating country of the Leeuwin Complex, Southern Perth Basin (Blackwood Plateau), South West intrusions of the Yilgarn Craton and western parts of the Albany Orogen. Loamy soils support Karri forest, laterites support Jarrah-Marri forest, leached sandy soils in depressions and plains support low Jarrah woodlands and

paperbark/sedge swamps, and Holocene marine dunes support *Agonis flexuosa* thickets, Banksia woodlands and heaths (Hearn, Williams and Comer, 2002).

The Southern Jarrah Forest subregion comprises of duricrusted plateau of Yilgarn Craton characterised by Jarrah-Marri forest on laterite gravels and, in the eastern part, by Wandoo-Marri woodlands on clayey soils. Eluvial and alluvial deposits support Agonis shrublands. In areas of Mesozoic sediments, Jarrah forests occur in a mosaic with a variety of species-rich shrublands (Hearn, Comer and Beacham 2002).

3.6.2 Vegetation Associations

Broadscale vegetation mapping undertaken by Beard (1975) indicates two vegetation associations are present within the Project Area, including:

- Boranup_1: Tall Forest; karri (*Eucalyptus diversicolor*)
- Boranup_3: Medium Forest; jarrah-marri

The Project is situated predominantly within the Boranup_3 vegetation association, with a small section at the north of the alignment occurring within Boranup_1.

The Project is also located within the Cowaramup Uplands and Wilyabrup Valley Systems of the Margaret River Plateau. According to vegetation mapping conducted by Mattiske and Havel (1998) the vegetation complexes occurring within the Project Area are summarised as follows:

- Cowaramup (C1) is comprised of an open to tall open forest of *Eucalyptus marginata* subsp. *marginata* (Jarrah) – *Corymbia calophylla* (Marri) – *Banksia grandis* on lateritic uplands in the hyperhumid zone.
- Wilyabrup (W1) is comprised of tall open forest of *Eucalyptus diversicolor* (Karri) – *Corymbia calophylla – Allocasuarina decussata – Agonis flexuosa* (Peppermint) on deeply incised valleys in the hyperhumid zone.
- Cowaramup (Cw1) is comprised of a mixture of open forest to woodland of *Eucalyptus diversicolor – Corymbia calophylla* and woodland of *Eucalyptus marginata* subsp. *marginata – Corymbia calophylla* on slopes and low woodland of *Melaleuca preissiana – Banksia littoralis* on depressions in the hyperhumid zone.

3.6.3 Vegetation Extent and Status

A vegetation type is considered under represented if there is less than 30% of its original distribution remaining. From a purely biodiversity perspective and not taking into account any other land degradation issues, there are several key criteria now being applied to vegetation clearing (EPA, 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/pre-1750 extent of the vegetation type;
- A level of 10% of the original extent is regarded as being a level representing Endangered; and
- Clearing which would put the threat level into the class below its current level should be avoided.

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

- *Presumed Extinc*t: 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 of remnant native vegetation has been assessed by the Government of Western Australia (2011) based on vegetation association mapping undertaken by Beard (1975). Additionally, Molloy O'Connor, Wood and Wallrodt (2007), assessed the extent of remnant native vegetation based on vegetation complexes mapped by Mattiske and Havel (1998).

The extent of the vegetation associations within the Project Area; their regional extent and reservation status drawn from the CAR Analysis Report 2011 (GOWA, 2011) are listed in Table 3.

Table 3 Vegetation type, extent and status of pre-European vegetation Beard (1975) vegetation mapping

		Pre-European extent (ha)	Current extent remaining (ha)	% Remaining	% in DEC managed Reserves
Total in Warren Bioregion		833,982.00	664,123.16	79.63	N/A
Total in Shire of Augusta Margaret River		211680.81	133600.42	63.11	74.14
Statewide	Association 1	72,410.18	57,543.13	79.47	81.52
	Association 3	2,661,405.07	1,844,285.31	69.30	80.13
Shire of Augusta Margaret River	Association 1	12,555.63	6,535.58	52.05	56.46
	Association 3	159,115.48	99,703.25	62.66	77.83
Warren Bioregion	Association 1	69,117.78	55,019.32	79.60	81.82
	Association 3	250,262.60	198,873.43	79.47	85.39

The extent of the Beard vegetation associations within the Project Area are considered of Least Concern, with over 50% of the pre-European extents remaining.

Molloy et al. (2007) has determined the extent of the vegetation complexes within the Project Area, based on the Mattiske and Havel mapping (1998). The regional extent for these complexes is listed in Table 4.

Table 4 Vegetation type, extent and status of pre-European vegetation Mattiske and Havel (1998) vegetation mapping

Vegetation Type	Region	Pre-European extent (ha)	Current extent (ha)	Remaining extent (%)
Cowaramup (C1)	Shire of Augusta-Margaret River	18,982	7,903	42
Wilyabrub (W1)	Shire of Augusta-Margaret River	7,296	4,420	61
Cowaramup (CW1)	Shire of Augusta-Margaret River	6,144	2,062	34

The extent of the Cowaramup (C1 and CW1) complexes within the Project Area are considered to be Depleted, with between 30% to 50% of pre-European extent remaining, while the extent of the Wilyabrup (W1) vegetation complex is considered of Least Concern, with over 50% of the pre-European extents remaining.

The Beard (1975) and Mattiske and Havel (1998) vegetation associations and complexes present in the Project Area all retain more than the threshold level (30%) recommended in the National Objectives Targets for Biodiversity Conservation (Commonwealth of Australia, 2001). Furthermore, the Project does not occur within an extensively cleared landscape, with 67% of pre-European vegetation extent remaining within the Shire of Augusta Margaret River (Shire of AMR).

Consequently, the clearing is unlikely to trigger referral to EPA, as the extent is not expected to fall within the trigger threshold level.

3.6.4 Vegetation Type

Six vegetation types were identified within the Project Area, including cleared farmland, pine plantations, and previously cleared/highly degraded or planted vegetation (GHD, 2012). Remnant vegetation remaining within the Project Area consisted predominantly of Jarrah/Marri Forest with emergent Peppermint trees in gullies and along the river and creek lines.

The location and extent of these vegetation types is detailed in GHD's (2012) Flora and Vegetation Assessment (Appendix C) and Figure 4 Appendix B.

3.6.5 Vegetation Condition

The condition of the vegetation within the Project Area was assessed using the vegetation rating scale developed by Keighery (1994) and Bush Forever (Department of Planning, 2000) that recognises the intactness of vegetation. Vegetation condition consists of six rating levels as outlined in Table 5.

Table 5 Vegetation condition scale (after Keighery, 1994)

Rating	Description	
1	Pristine	Pristine or nearly so.
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 condition within the Project Area ranged from Very Good (3) to Completely Degraded (6), with the majority of the Project Area considered to be Completely Degraded (6).

The vegetation condition within the Project Area ranged from Very Good (3) to Completely Degraded (6), with the majority of the Project Area considered to be Completely Degraded (6).

Approximately two-thirds of the Project Area traverses cleared agricultural land, predominately used for annual crops, sheep and cattle grazing and viticulture. The Project also traverses pine plantations, native bushland, conservation reserve, and existing roads and private properties. The remaining one third of the Project Area consists of native vegetation of predominantly Jarrah/Marri Forest and riparian vegetation.

The area of remnant vegetation between chainages 1800 and 2300 (Keenan State Forest No. 56, Timber Reserve and Margaret River) is generally in very good condition however it has been historically logged and has had a fire within the last 10-15 years (GHD, 2012). The vegetation condition of the Project Area is further detailed in Appendix C.

The footprint area for the proposed John Archibald Drive extension (chainage 3700 to 3800) was not subject of the 2011 flora survey. As such, a site visit was undertaken of this area at the same time as the targeted search in September 2012, with GHD ecologists noting that the area consisted of agricultural pasture, with a variety of common weed species, although several large Marri (*Corymbia calophylla*) trees were present. As no other native vegetation was present, the area has been determined to be Completely Degraded (6).

Additionally, Main Roads undertook a site visit on 25 October 2012 to determine the condition of the vegetation in a section of Jarrah Marri Forest, between chainages 3200 to 3600. Main Roads advised that this vegetation has been historically logged, and determined to have a condition rating of 5, Degraded (Pers Comm N McCarthy).

3.6.6 Vegetation Clearing

Construction of the Project will create a footprint of 42 ha, comprising remnant vegetation, pine plantation and previously disturbed areas, including areas cleared for agriculture. This estimate is based on the latest Concept Design provided by Main Roads (August, 2012), and includes

construction of the road and an approximate clearing area through native vegetation for subsidiary infrastructure such as noise bunds, fencing and paths. However, the area required for subsidiary infrastructure will be further refined as detailed design work is completed. No clearing of native vegetation is required for temporary work areas (site offices, storage areas or access tracks), with this to be located in previously disturbed areas.

Of the 42 ha footprint, approximately 8.5 ha of native vegetation will require clearing, of which 5.2 ha is Jarrah Marri Forest, Jarrah Marri Peppermint Forest and Closed Scrub in *Good* or *Very Good* condition. The remaining 36.8 ha of the footprint consists of cleared farmland, pine plantation, highly disturbed/planted vegetation or native vegetation rated *Degraded* or *Completely Degraded*. A detailed breakdown of the vegetation type within the Project footprint is provided in Table 6 and shown in Figure 5 Appendix B.

Table 6 Vegetation type and condition within the Project footprint

Vegetation Type	Condition	Area within the Project footprint (ha)
Jarrah Marri Forest	3	2.8
	4	1.1
	5	3.3
	Total	7.2
Jarrah Marri Peppermint Forest	3	0.6
	4	0.6
	6	0.1
	Total	1.3
Closed Scrub	3	0.1
	6	0.1
	Total	0.2
Cleared farmland	6	19.6
Highly Disturbed/Planted	5	0.6
	6	2.6
	Total	3.2
Pine Plantation	6	10.2
Total Footprint (including 0.3 ha identified as water body)		**42**

While it is not expected that there will be a significant change during final design, clearing areas may differ slightly due to unforeseen circumstances.

The removal of vegetation has a number of actual and potential impacts, including:

- Loss of fauna habitat;
- Instability and increased erosion;
- Increased runoff; and
- Loss of visual appeal.

3.6.7 Threatened Ecological Communities (TECs)

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

TECs are listed by both State and Federal jurisdictions, with Federally listed TECs protected under the EPBC Act. DEC maintains a list of TECs for Western Australia, some of which are also protected under the EPBC Act. DEC listed ecological communities are given special consideration in environmental impact assessments and have special status under the land clearing regulations of the EP Act. The EPA's position on TECs states that proposals that result in the direct loss of TECs are likely to require formal assessment.

Possible TECs that do not meet survey criteria are added to DEC's PEC Lists under Priorities 1, 2 and 3. PECs are not specifically listed under any formal Federal or State legislation but are considered important by DEC as whole ecosystems (including their processes and communities). Priority 1, 2 and 3 PECs are ecological communities that are adequately known; are rare but not threatened, or meet criteria for Near Threatened. PECs that have been recently removed from the threatened list are placed in Priority 4. These ecological communities require regular monitoring. Conservation Dependent ecological communities are placed in Priority 5.

GHD (2007) undertook a search of the DEC's TEC database and found there are no known occurrence of TECs within the Project Area. A more recent PMST query (2012) and DEC database search (GHD 2012) confirmed that no known TECs occur within 5 km of the Project Area. The 2011 survey confirmed that no TEC's or PEC's occur within the Project Area.

3.6.8 Site Flora

A desktop query undertaken using DEC's NatureMap (2012) database identified 379 flora taxa collected within 5 km of the Project Area; 95 of which are naturalised (introduced) taxa. Given that large sections of the Project Area have been cleared and for agriculture, it is very unlikely the majority of the species recorded are present. The results of these searches are provided in Appendix C.

GHD's (2012) flora survey recorded a total of 168 plant taxa (including subspecies and varieties), representing 52 plant families and 116 genera, within the Project Area. This total comprised 134 native species and 34 introduced (exotic) species. A full list of flora species present in the Project Area is provided Appendix C.

Dominant families recorded from the Project Area include:

- Fabaceae 27 taxa;
- Poaceae 14 taxa;
- Myrtaceae 13 taxa; and
- Proteaceae 9 taxa.

The spring 2011 survey did not include the footprint of the proposed John Archibald Drive extension (chainage 3700 to 3800). Consequently, a site visit of this area was undertaken at the same time as the targeted *G. formosum* survey, in September 2012. The area consisted of agricultural pasture, with a variety of common weed species, including clover (*Trifolium spp*.), rye grass (*Lolium spp*.) and capeweed (*Arctotheca calendula*). GHD ecologists identified several large Marri (*Corymbia calophylla*) trees within the survey area as being potential feeding and breeding habitat for Black Cockatoos, although no other native vegetation was present (Appendix C).

3.6.9 Conservation Significant Flora

Species of significant flora are protected under both State and Federal Acts. Activities that are deemed to have a significant impact on species and are recognised by the EPBC Act and the WC Act can trigger referral to DSEWPaC and/or the EPA.

In Western Australia, the DEC produces a supplementary list of Priority Flora, being species that are not considered Threatened under the WC Act but for which the Department feels there is a cause for concern. These species have no special legislative protection, but their presence would normally be considered relevant to an assessment of the conservation status of an area. Such taxa need further survey and evaluation of conservation status before consideration can be given to declaration as threatened flora.

PMST desktop queries identified nine Endangered flora species as potentially occurring within 5 km of the Project Area (2012), while NatureMap identified eight Threatened and six Priority species within 5 km of the Project Area (2012). The results of these searches are provided in Appendix C, along with a likelihood of occurrence assessment.

The DEC database query identified the potential presence of six Threatened and 32 Priority species within 3 km of the project area (GHD 2012). Of these Priority flora, four species have been recorded within 500 m of the alignment, including *Hemigenia rigida* (P1), *Franklandia triaristata* (P4), *Gastrolobium formosum* (P3) and *Gahnia sclerioides* (P3), with the locations shown on Figure 3. A 2012 DEC database query identified the potential presence of 28 Priority and four Threatened species within 5 km of the Project Area (DEC 2012). This identified the possible presence of one threatened and three priority species not identified in previous desktop searches.

None of the Threatened flora species identified through any of the desktop searches were recorded within the Project Area during the field survey (GHD, 2012) although a population of approximately 20 individuals of *Gastrolobium formosum* (Priority 3) were recorded along the northern bank of the Margaret River during GHD's (2012) survey. The additional conservation species listed in the 2012 PMST and *Naturemap* queries were not recorded in the 2011 survey.

A targeted search was undertaken for *G. formosum* by GHD ecologist on 10 September 2012, which identified approximately 400 plants with an average cover of 70% of the area, within the proposed Project footprint. An additional 200 plants, were identified approximately 50 m along the banks, outside the Project Area. All plants were identified as occurring within a narrow band (3 to 10 m) along the water edge, with the band occurring for at least 50 m on either side of the Project footprint, and covering approximately 70% of the survey area.

Herbarium records also list several populations of *G. formosum*, as common or locally abundant in the Margaret River area.

Additionally, no Declared Rare Flora were identified during the 2000 (Ecologia) or 2005 surveys (GHD 2006).

3.6.10 Weeds and Declared Plants

The spread of weeds is important in the context of socio-economic and environmental values. Weeds that pose a risk to environmental factors can be declared as a Weed of National significance (WoNS), while weeds that are, or may become, a problem to agriculture or the environment can be formally classified as Declared Plants under the West Australian *Agriculture and Related Resources Protection Act 1976* (ARRP Act). The DAFWA administers the ARRP Act and maintains the list of Declared Plants for Western Australia.

Native vegetation within the Project Area has been identified as generally being in very good condition with minimal, non-aggressive weed species (GHD, 2012). However, the majority (approximately 5 km length) of the Project Area has been cleared and/or disturbed, and dominated by introduced pasture grasses and herb species. A number of introduced trees and shrubs have also been planted along road verges and private properties. Not all of these species were collected and recorded from the Project Area.
A total of 34 introduced/weed species were recorded within the Project Area, two of which, *Lantana camara* (Lantana) and**Hypericum perforatum* (St. John's wort) are listed as Declared Plants under Section 37 of the ARRP Act.

Lantana is listed as a P1; for the whole of the State which prohibits movement of plants or their seeds, and is also listed as a Weed of National Significance (WoNS) by the Australian Government.

St John's Wort is a perennial plant that reproduces from seed and from creeping underground rhizomes. This species can densely infest grazing land, particularly when pastures become denuded. However, St John's Wort is not Declared within the Shire of AMR as detailed in the ARRP Act.

Recommendation 5

Main Roads undertakes mapping of WONS within the Project Area.

Recommendation 6

Main Roads include in the CEMP, the management of weeds, and prioritise management of WONS populations, within the Project Area prior to and during road construction, and as part of on-going road reserve management.

3.7 Dieback

The occurrence of *Phytophthora cinnamomi* (Dieback) is extensive in the south west of Western Australia, where the mean annual rainfall exceeds 800 mm. As the mean annual rainfall in the Project Area is 1130.7 mm, Dieback poses a risk to the native vegetation within the Project Area.

Site surveys conducted by GHD (2007) identified the majority of the Project Area to be "uninterpretable" for the presence of Dieback and concluded that there is the potential risk for Dieback to be introduced and spread during construction. Glevan Consulting (2012) further assessed the Project Area, in March 2012, with the full report provided in Appendix D, and summarised in Table 7.

Table 7 Dieback locations and interpretations (Glevan Consulting, 2012)

Chainage	Dieback Interpretation (Glevan Consulting, 2012)
0 to 100	A mosaic of Dieback infested and unmappable vegetation.
100 to 1800	The pine plantation within the Keenan State Forest no. 56 is considered unmappable.
1800 to 2400	Previous assessments have determined that the transmission line easement is infested with Dieback, and samples have been taken during previous surveys which have proven the presence of the pathogen. Remnant vegetation on the northern and southern side of the transmission line is downslope and therefore threatened by the infestation on the easement. Scattered deaths attributable to Dieback were noted.
2400 to 6300	The remnant vegetation within this section of the Project Area is confined to narrow road reserves, or grazed sections on private property, therefore not providing any reasonable condition to assess
6300 to 6400	The vegetation between Darch Road and the private property show symptoms of Dieback presence.
6400 to 7000	No reasonable remnant vegetation to assess.

Sections of the Project Area have been identified as unmappable, with some sections having been confirmed as infected. The area is considered to be susceptible to Dieback due to the high potential for infection from upstream sources (Section 3.8), while soil moving activities, such as clearing and construction operations, have a high risk of introducing and spreading Dieback. This risk is further increased in wet soil conditions.

Construction activities have the potential to spread dieback from infected areas to uninfected areas and to off-site areas. Areas potentially at risk include the Keenan State Forest No. 56 and Bramley National Park (GHD, 2007).

Recommendation 7

Main Roads incorporates into the CEMP, the recommendations detailed in the Hygiene Management Plan developed by Glevan Consulting (2012) (Appendix D).

3.8 Topsoil Management

The management of topsoil during roadworks is important to optimise the use of the resource by its regeneration potential, and to minimise the risk of transporting weeds and dieback within the Project Area.

Poor topsoil management can result in the spread of weeds and Dieback, or degradation of the topsoil resource. The movement of topsoil and weed seeds can result in new weed populations and increased weed density at existing weedy sites.

Recommendation 8

Main Roads prepares and implements a Topsoil Management Plan (TMP) for the Project to identify the use and management of in-situ topsoil during road works.

3.9 Rehabilitation and Landscaping

Opportunities to enhance the visual amenity, floral diversity and fauna habitat of the broader area exist along the entire Project length. Rehabilitation of the disturbed soil surface will maximise riverbank stability and minimise visual impacts.

Rehabilitation activities are not necessary for the entire alignment. However, Main Roads should consider revegetating cleared areas adjacent to the newly constructed road to stabilise soil, prevent soil erosion and restore native vegetation within the landscape. A Landscape Plan should be developed to identify and guide rehabilitation and landscaping that will be undertaken.

Recommendation 9

Main Roads prepares and implements a Landscape Plan for the Project.

3.10 Fauna

3.10.1 Existing Fauna Records

A 2012 query of current names from DEC's NatureMap database identified 172 fauna species potentially occurring within 5 km of the Project Area. This includes 105 birds, 19 reptiles, 8 amphibians, 15 mammals, 1 fish, 1 crustacean and 23 invertebrates. The results of this search are detailed in Appendix C.

3.10.2 Fauna Survey

A Level 1 fauna survey was conducted by GHD in spring 2011 in accordance with Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia – Guidance Statement No. 56 (EPA, 2004) and Technical Guide- Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment (EPA, 2010). The entire fauna report, prepared by GHD for Main Roads, is included in Appendix C, with the following sections included as a summary of the findings from the survey.

During the survey, 82 species were identified (GHD 2012), comprising 56 birds, nine reptiles, three amphibians and 14 mammals. Of these, four introduced/pest species were recorded with these further discussed in Section 3.10.5.

3.10.3 Conservation Significant Fauna

The significance levels for fauna used in the EPBC Act are those recommended by the International Union for the Conservation of Nature and Natural Resources (IUCN). A description of Conservation Categories delineated under the EPBC Act and the circumstances under which a project will trigger referral to the DSEWPaC are described in Appendix D.

The State conservation level of fauna species and their significance status is currently assessed under the WC Act and delineated within the *Wildlife Conservation (Specially Protected Fauna) Notice 2012*. The DEC also produces a supplementary list of Priority Fauna, being species that are not considered Threatened under the WC Act but for which the DEC feels cause for concern. These species have no legislative protection, but their presence would normally be considered relevant to an assessment of the conservation status of an area. Such taxa need further survey and evaluation of conservation status before consideration can be given to declaration as threatened fauna. Levels of Priority are described in Appendix D.

The DSEWPaC maintains a database of Matters of National Environmental Significance (MNES) that are protected under the EPBC Act. It should be noted that some species that

appear in PMST results are often not likely to occur within the specified area. This search tool provides an approximate guide to MNES that require further investigation.

Records from the DEC searches of threatened fauna provide more accurate information for the general area. However, GHD notes that some of the records on the NatureMap database are historical, and therefore species originally recorded on the database, may now be locally extinct. Additionally these records may include species that are vagrants/opportunistic users or present in the general area but not present within the Project Area due to lack of suitable habitat.

Searches of the EPBC PMST (2012) and DEC's NatureMap (2012) database identified thirteen threatened species, with a further six marine and/or migratory bird species, within 5 km of the Project Area (Appendix C). Six additional DEC listed Priority fauna species were recorded within 5 km of the Project Area. Conservation significant fauna identified in the desktop assessment are listed in Table 8.

Table 8 Threatened and Priority fauna identified from the desktop assessment

Species	Common Name	Listing under WC Act or DEC Priority List	Listing under EPBC Act	Source of Information	
				EPBC Act Protected Matters Search	NatureMap
Birds					
Calyptorhynchus banksii naso	Forest Red-tailed Black Cockatoo	Schedule 1	Vulnerable	+	+
Calyptorhynchus baudinii	Baudin's Black Cockatoo	Schedule 1	Vulnerable	+	+
Calyptorhynchus latirostris	Carnaby's Black Cockatoo	Schedule 1	Endangered	+	+
Botaurus poiciloptilus	Australasian Bittern	Schedule 1	Endangered	+	
* *Leipoca ocellata*	Malleefowl	Schedule 1	Vulnerable	+	
Falco peregrinus macropus	Peregrine Falcon	Schedule 4			+
Tyto novaehollandiae	Masked Owl (SW pop.)	Priority 3			+
Ixobrychus flavicollis australis	Black Bittern	Priority 3			+
Mammals					
Dasyurus geoffroii	Chuditch	Schedule 1	Vulnerable	+	+
Setonix brachyurus	Quokka	Schedule 1	Vulnerable	+	
Pseudocheirus occidentalis	Western Ringtail Possum	Schedule 1	Vulnerable	+	+
Phascogale tapoatafa	Southern Brush-tailed Phascogale	Schedule 1	Vulnerable	+	
Isoodon obesulus fusciventer	Southern Brown Bandicoot	Priority 5		+	
Hydromys chrysogaster	Water Rat	Priority 4		+	

Macropus irma	Western Brush Wallaby	Priority 4			+
Amphibia					
Geocrinia alba	White bellied Frog	Schedule 1	Endangered	+	
Crustaceans					
Cherax tenuimanus	Margaret River (Hairy) Marron	Schedule 1	Critically Endangered	+	+
Fishes					
Geotria australis	Pouched Lamprey	Priority 1			+
Nannatherina balstoni	Balston's Pygmy Perch	Schedule 1	Vulnerable	+	
Migratory Birds					
Haliaeetus leucogaster	White-bellied Sea-Eagle		Migratory	+	
Apus pacificus	Fork-tailed Swift		Migratory	+	
Merops ornatus	Rainbow Bee-eater		Migratory	+	+
Ardea alba	Great Egret		Migratory	+	+
Ardea ibis	Cattle Egret		Migratory	+	
** Actitis hypoleucos*	Common Sandpiper		Migratory		+
** Calidris ruficollis*	Red-necked Stint		Migratory		+

** Additional species identified in 2012 database searches*

Main Roads consulted the Department of Fisheries Western Australia (DFWA) regarding the potential impact of the Project on the Hairy Marron. DFWA advise that the Hairy Marron area now almost entirely restricted to the upper reaches on the Margaret River, within the Rapids Conservation Park, and as such the Project is unlikely to impact on the population in the Margaret River (Pers Com DFWA 2012).

Of the 82 species identified during the fauna survey, four are classified as Vulnerable under the EPBC Act and Schedule 1 under the WC Act (GHD 2012). These recorded conservation significant species were:

- Baudin's Black Cockatoo (*Calyptorhynchus baudinii*);
- Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*);
- Western Ringtail Possum (*Pseudocheirus occidentalis*); and
- Southern Brush-tailed Phascogale (*Phascogale tapoatafa*).

A summary of the observations relevant to these species recorded during the field assessment is detailed below.

Baudin's Black Cockatoo (*Calyptorhynchus baudinii*) Schedule 1, Vulnerable

Baudin's Black Cockatoo, also known as the Long-billed Black-Cockatoo, is found in the south-west of WA in the forest and woodlands of Jarrah (*Eucalyptus marginata*), Karri (*E. diversicolor*) and Marri (*Corymbia calophylla*) (DSEWPaC, 2012). The primary food source of this cockatoo is the seed of the Marri (Garnett and Crowley, 2000). This species has been impacted by the removal of large Marri trees throughout its range as this species is its principal food source. Baudin's Black Cockatoo has been listed as Vulnerable under the EPBC Act and as Schedule 1 under the WC Act.

Observations: A pair of Baudin's Black Cockatoo's was observed feeding (on Marri) in Lot 2150 and had one juvenile present. Several individual birds were also observed close by, feeding on Marri. Due to the number of suitable feeding trees within the remnant vegetation areas and treed areas in paddocks, this species is considered to be endemic and to utilise this area opportunistically for feeding. The same areas had trees suitable for breeding and combined with the above observations it is likely that the area is potentially used for breeding.

Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) Schedule 1, Vulnerable

The Forest Red-tailed Black Cockatoo species is essentially a cockatoo of the Jarrah forest (*Eucalyptus marginata*) but also uses Marri (*Corymbia calophylla*) and woodlands for foraging, with Marri seeds (along with Jarrah) being its principal food source (DSEWPaC, 2012). This species is also known to feed on *Allocasuarina* spp. and introduced species (DSEWPaC, 2012). The Forest Red-tailed Black Cockatoo has reduced in range due to habitat loss and now persists in the Jarrah forest of the South West.

Observations: This species was observed and heard several times during the field assessment. Like the Baudin's Black Cockatoo, the Forest Red-tailed Black Cockatoo utilises the area for both feeding and breeding as required. Habitat areas calculated are the same as for the Baudin's Black Cockatoo.

Western Ringtail Possum (*Pseudocheirus occidentalis*) Schedule 1, Vulnerable

Western Ringtail Possums occur only in the south-west region of WA where they feed upon Peppermint (*Agonis flexuosa*) and Eucalyptus trees. Around urban environments the species is known to feed on introduced species favouring fruit trees, roses and *Ficus* species. The

species is now restricted to wetter coastal areas of the south west; with smaller populations occurring inland in Jarrah, Wandoo and Marri forests (Menkhorst and Knight, 2004).

Observations: During GHD's (2012) field survey, three active individuals were observed at night along riparian vegetation in the northern section of the Project. Two dreys (resting platforms in trees) were also recorded in this area and their locations are detailed in Appendix C. Droppings were also recorded along Margaret River in the riparian vegetation and in the valley of Lot 2150, between chainages 3200 and 3600 (Appendix C).

Southern Brush-tailed Phascogale (*Phascogale tapoatafa*) Schedule 1, Vulnerable

The Southern Brush-tailed Phascogale (SBTP) occurs in dry sclerophyll forests and open woodlands with a generally sparse understorey. This species' habitat requirements also include hollow-bearing trees, rotted stumps or tree cavities which they use as nest sites (Van Dyck and Strahan, 2008). Tree hollows that have a small and secure entrance with a large internal cavity are highly favoured by breeding SBTPs, although the size and weight also enables them to utilise existing birds nests (Van Dyck and Strahan, 2008).

Observations: No sightings of the species were recorded during GHD's (2012) field survey; however a dropping was recorded on a log in Lot 2150 that is thought to be of a SBTP. The remnant areas of habitat in the Project Area including Lot 2150 have suitable trees with hollows and excellent ground coverage of logs. It is likely that SBTP would be within remnant areas of vegetation in the Project Area.

3.10.4 Habitat Value

GHD (2012) identified three broad important fauna habitat types within the Project Area, based on predominant landforms, soil and vegetation structure of the area. Habitat types within the Project Area closely correspond with the broad vegetation types described previously in Section 3.6.4. These habitat types are described as follows:

- Riparian;
- Riverine; and
- Jarrah/Marri Forest.

The location of these habitat types is mapped and detailed in Appendix C.

The fragmented remnant vegetation traversed by the alignments contains evidence of degradation and disturbance with no significant linkages to larger vegetated areas (GHD, 2007).

Potential feeding and breeding habitat for Black Cockatoos includes Jarrah, Marri and Banksia grandis, with approximately 4.54 ha of Black Cockatoo feeding habitat within the alignment. The field survey recorded 41 potential Black Cockatoo breeding trees (Jarrah/Marri) within the entire Project corridor, and 171 trees being of a suitable size for the development of Black Cockatoo nesting hollows (>500 mm DBH) within the next 100 years. The actual number of trees to be cleared is likely to be refined down as the design is finalised.

Overall, the vegetated areas within the Project corridor have high habitat value, based on usage by significant fauna including Western Ringtail Possum, Red-tailed Black Cockatoo, Baudin's Black Cockatoo and Southern Brush-tailed Phascogale (GHD, 2012). However, approximately 18,000 ha of native vegetation is located within 10 km of the Project Area. This surrounding vegetation includes the Bramley National Park (3,892 ha) and Keenan State Forest No. 56 (610 ha), which are expected to provide significant areas of fauna habitat, including habitat suitable for conservation significant fauna. Consequently, the significance of the Project on fauna habitat is expected to be reduced due to the habitat in surrounding vegetated areas.

Construction of the Project may inhibit fauna movement, with Main Roads proposing to implement fauna management measures to assist fauna movement within Bramley National Park and the Keenan State Forest No. 56 (Sections 3.10.6 and 3.10.7).

3.10.5 Introduced Species

Nine introduced species were identified from the desktop assessment. These include:

- Laughing Turtle Dove (*Streptopelia senegalensis*);
- Laughing Kookaburra (*Dacelo novaeguineae*);
- Sulphur-crested Cockatoo (*Cacatua galerita*);
- Mallard (*Anas platyrhynchos*);
- Fox (*Vulpes vulpes*);
- Cat (*Felis catus*);
- European Rabbit (*Oryctolagus* cuniculus);
- Black Rat (*Rattus rattus*); and
- Common Furniture Beetle (*Anobium punctatum*).

Of these, only the Laughing Kookaburra, Fox, Cat and European Rabbit were recorded during the spring fauna survey (GHD, 2012).

3.10.6 Habitat Linkages

Habitat linkages are important to allow animals to move between areas of resource availability. Habitat linkage is important for ground and aerial fauna, providing cover, resources, and linking areas suitable for rest and reproduction. Fragmentation of habitat limits the resources available to species, particularly sedentary species, which means they may be more vulnerable to natural disasters or habitat changes over time. Fragmentation of habitat can also lead to edge effects, leading to degradation of the habitat.

Agricultural areas within the Project Area provide little habitat linkage based on the lack of native contiguous vegetation present. The vegetation north of the Margaret River provides an important linkage east-west along the Margaret River, between the Bramley National Park, Keenan State Forest No. 56 and surrounding pine plantation.

The vegetation along Darch Brook also provides a linear corridor between remnant vegetation to the north and south. The surrounding area has been heavily cleared for agricultural purposes. The proposed road is considered likely to cause a significant break in the habitat linkage between the east-west habitat corridor along the Margaret River. However, Main Roads is proposing to implement fauna management measures to assist fauna movement, for example within Bramley National Park and the Keenan State Forest No. 56 (Sections 3.10.6 and 3.10.7).

Recommendation 10

Where the Project traverses the timber reserve (between chainages 2000 and 2300), adjacent Bramley National Park, fauna fencing and/or fauna underpasses should be considered in the final design. This would assist in providing a safer road user environment and protecting fauna from roadkill.

3.10.7 Fauna Impact

The majority of the Project Area has been identified as disturbed, and has minimal native vegetation which would offer suitable habitat for native fauna, (GHD 2012). However, the native

habitat types, outlined in Section 3.10.4 provide habitat for native fauna, including some conservation significant species.

Potential impacts to vertebrate fauna associated with the Project may include:

- Habitat loss and damage;
- Hydrological changes;
- Change to habitat through the spread of weeds; and
- Direct death or harm to fauna during construction.

The majority of the Project Area has been identified as disturbed, and has minimal native vegetation which would offer suitable habitat for native fauna, (GHD 2012). However, the native habitat types, outlined in Section 3.10.4 provide habitat for native fauna, including some conservation significant species.

An assessment of the likelihood of occurrence of the threatened and priority listed species has been prepared and detailed in the GHD (2012) Flora and Fauna Assessment, with the likelihood of occurrence for additional species listed in the updated database searches provided in Appendix C. The likelihood of occurrence has been assessed based on the known locations and distributions of the species, habitat requirements and observations made during the field assessment.

Black Cockatoo Species

The 2011 fauna survey included an assessment and identification of possible habitat trees within the two alignment options. These alignments have been further revised to the current Project, with the fauna survey data used to identify 41 trees within the Project Area as potentially suitable for Black Cockatoo breeding (Jarrah/Marri), with a further 171 identified as a size suitable for the development of nesting hollows (>500 mm at DBH) within the next 100 years. The total area of potential Black Cockatoo feeding habitat within the Project Area, and therefore likely to be cleared during construction, is approximately 4.54 ha. The location of all potential Cockatoo breeding trees is detailed in Appendix C, including cockatoo feeding habitat.

DSEWPaC provide a risk referral table which provides guidance to both proponents and regulators for where impacts on Black Cockatoos are likely to trigger referral under the EPBC Act. This risk referral table has been completed for the Project, are the results presented in Table 9.

Table 9 Black cockatoo risk referral (to DSEWPaC) table

Risk type	Referral Trigger
High risk of significant impacts: referral to DSEWPaC recommended	
Clearing of any known nesting tree.	**Referral is not triggered.** There are no known breeding trees within the Project Area.
Clearing of any part or degradation of breeding habitat in a woodland or forest within a species' known breeding range.	**Referral may be triggered.** There is potential breeding habitat present within the Project Area (approximately 4.54 ha). The species has not been recorded breeding in the area. Up to 41 trees identified as possible breeding trees and a further 171 as suitable for the development of nesting hollows (>500 mm at

	DBH) will require removal.
Clearing of more than 1 ha of quality foraging habitat.	**Referral may be triggered.** Clearing of up to 4.54 ha of potential Black Cockatoo feeding habitat is required for the Project.
Creating a gap or greater than 4 km between patches of Black Cockatoo habitat (breeding, foraging or roosting).	**Referral is not triggered.**
Clearing or degradation (including pruning of top canopy) of a known roosting site.	**Referral is not triggered.**
Uncertainty: referral recommended or contact the DSEWPaC	
Degradation (such as through altered hydrology or fire regimes) of more than 1 ha of foraging habitat. Significance will depend on the level and extent of degradation and the quality of the habitat.	**Referral may be triggered.** Clearing of up to 4.54 ha of potential Black Cockatoo feeding habitat associated with the Project.
Clearing or disturbance in areas surrounding Black Cockatoo habitat that has the potential to degrade habitat through introduction of invasive species, edge effect, hydrological changes, increase human visitation or fire.	**Referral is not triggered.**
Actions that do not directly affect the listed species but that have the potential for indirect impacts such as increasing competitors for nest hollows.	**Referral may be triggered.** Up to 41 trees identified as possible breeding trees and a further 171 as suitable for the development of nesting hollows (>500 mm at DBH) will require removal.
Actions with the potential to introduce known plant diseases such as *Phytophthora* spp.	**Referral may be triggered.** The site is considered to be susceptible to Dieback.
Low risk of significant impacts: referral may not be required but may refer to DSEWPaC for legal certainty	
Actions that do not affect Black Cockatoo habitat or individuals.	**Not applicable**
Actions whose impacts occur outside the modelled distribution of the three Black Cockatoos.	**Not applicable**

DEWSPaC also produce the Significant Impact Guidelines 1.1 (2009) which provide advice on where an impact on a MNES may be determined as significant. The Significant Impact Criteria and the applicability to the Project has been listed in Table 10.

Table 10 Significant Impact Criteria table

Significant Impact Criteria	Applicability to Project
Lead to a long-term decrease in the size of a population	Unable to determine if the Project will lead to a long-term decrease in the size of the population. Approximately 41 potential habitat trees (and 171 potentially suitable within next 100 years) and 4.54 ha of foraging habitat to be cleared. Significant areas of native vegetation, including Bramley National Park (BNP), which covers 3892 ha, occur within 10 km of the Project. These areas are likely to contain similar vegetation and therefore suitable habitat.
Reduce the area of occupancy of the species	The area of potential foraging and breeding habitat to be cleared is 4.54 ha. Approximately 18 000ha of native vegetation occurs within 10 km of the Project including BNP, within this likely to contain similar vegetation and therefore similar habitat value.
Fragment an existing population into two or more populations	According to the Black Cockatoo Referral Guidelines, creation of a 4 km gap between habitat areas triggers referral. In this case, the study area is surrounded by intact vegetation, including the BNP, which is likely to contain suitable habitat, and as such would be unlikely to fragment existing populations.
Adversely affect habitat critical to the survival of a species	4.54 ha of foraging/breeding habitat is proposed to be cleared. The Project is surrounded by intact vegetation, including the 3892 ha BNP. These areas are likely to contain similar vegetation and therefore similar habitat, and on that basis the Project is unlikely to adversely affect the critical survival of the species
Disrupt the breeding cycle of a population	No actual breeding was observed during the survey, although the presence of a feeding juvenile, along with the identification of numerous potential breeding trees within Project Area, suggests breeding may occur.
Modify, destroy, remove, isolate or decrease the availability of habitat to the extent that the species is likely to decline	4.54 ha of potential foraging and breeding habitat will require clearing, along 41 potential breeding trees and 171 identified as potentially suitable within next 100 years. However, the Project transects the 3892 ha Bramley National Park, which is likely to have similar vegetation and as such similar habitat.
Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the critically endangered or endangered species'' habitat	Unlikely that Project will result in introduction of invasive species harmful to any species in question and established on site.
Introduce disease that may cause the species to decline, or	Areas are identified as either infected or unmappable and should be treated as unprotectable. Uninfected areas outside the project area are upslope.
Interfere with the recovery of the species	Localised impacts may include car strikes, loss of habitat (feeding and breeding), and interference. However, at a regional level, as the 4.54 ha to be cleared is surrounded by significant areas of intact vegetation and transects the BNP, little impact may be expected.

The Significant Impact Guidelines cover similar points to the referral guidelines, but consider the broader impact, ie regional extent. As outlined in Table 10, the surrounding native vegetation and nearby Bramley National Part may offer similar habitat value and therefore reduce the significance of the impact that the Project will have on the Black Cockatoo species.

Based on the assessment against the referral guidelines, the Project has been identified as likely to result in an impact on the Black Cockatoo, although some uncertainty remains with regard to known breeding and/or quality foraging habitat within the Project Area (GHD, 2012),

as no known breeding or foraging was recorded during the field survey. Regardless of the uncertainty, the assessment concludes that the Project will require referral under the EPBC Act.

Western Ringtail Possum

Approximately 0.86 ha of vegetation within the Project Area has been identified as being habitat for the Western Ringtail Possum (WRTP). No assessment has been undertaken to determine the impact of the Project on the WRTP population within the Project Area. The Project may result in a reduction and/or fragmentation of WRTP habitat due to clearing of riparian vegetation along the Margaret River and Darch Brook, resulting in a significant impact on this species (GHD, 2012). Other potential impacts to the WRTP include breaks in habitat corridors/isolating populations, increased roadkills from traffic and introduced species thus increasing predation.

The impact on the WRTP is likely to be minimal due to the extensive area of similar vegetation surrounding the Project, notably the 3892 ha Bramley National Park.

Recommendation 11

Specific fauna management measures should be included in the design and construction of the Project. Management measures to be incorporated into the CEMP include:

Design lighting at construction to include consideration of potential impacts to fauna;

- Clearing to occur along only one front/direction preferably towards remaining vegetation areas, to ensure any fauna present have an escape path;
- Minimise clearing within the section of remnant vegetation within and/or adjacent to the Bramley National Park;
- If protected species are encountered, they will not be disturbed without authority; and
- Any test pits, trenches or construction sumps to be constructed with a ramped or stepped edge to allow fauna to escape.

Recommendation 12

Main Roads to submit determine the required referrals.

Recommendation 13

Main Roads to submit a referral to the DSEWPAC under the EPBC Act, for proposed impacts to Black Cockatoo and Western Ringtail Possum habitats.

3.11 Reserves and Conservation Areas

North of the proposed Margaret River crossing, between chainages 0 and 2300, the Project traverses the Keenan State Forest No. 56; a timber reserve and the Bramley National Park (Figure 2). A section of the Bramley National Park was excluded from the National Park at the request of Main Roads and the Shire of AMR, for the road. However, due to alignment changes, the Project will require exclusion of 0.54 ha, from the National Park.

Recommendation 14

Main Roads should submit an application to have approximately 0.54 ha excised from the Bramley National Park.

3.12 Fire

Fire can pose a threat to human life, property and livestock as well as flora and fauna. The area of remnant vegetation between the pine plantations and Margaret River is generally in very

good condition. The area has been historically logged and had a fire within the last 10-15 years (GHD, 2012).

Where the Project traverses or occurs adjacent to forested areas (between chainages 0 – 2400 and 3200 - 3600) Main Roads will liaise with DEC and FPC to define fire access requirements ie fire breaks, access tracks and gates etc to facilitate fire management to provide a safer road user environment and protect native species.

Additionally, with the Project Area traversing both existing paddock areas and forested areas, fire poses a risk to both the Project, and surrounding areas during construction, particularly during summer.

Recommendation 15

Main Roads include fire management, including adherence to vehicle movement bans issued by Shire of AMR, in the CEMP.

3.13 Non-Indigenous Heritage

A desktop search of the Australian Heritage Places Inventory (2012) and State Heritage Office (2012) has indicated that there are no non-indigenous heritage significant listed sites present within the Project Area. The nearest non-indigenous heritage site (Margaret River Hotel) is situated approximately 1.8 km west of the Project (Figure 2).

Due to the separation distance, the Project is not expected to impact on this non-indigenous heritage site.

3.14 Indigenous Heritage

Brad Goode and Associates undertook an ethnographic (2007) and Aboriginal Heritage Surveys (2012) of the Project Area (see Appendix E; Appendix F). Both assessments included archival research involving an examination of the Department of Indigenous Affairs (DIA) Sites Register, a review of any relevant site files and a review of any unpublished ethnographic reports that relate to the Margaret River Area (Brad Goode and Associates, 2007 and 2012). The 2012 review identified one Aboriginal Heritage site within the Project Area, as detailed in Table 11.

Table 11 Aboriginal Heritage Site within the Project Area

Aboriginal Heritage Site ID	Chainage
Site ID 4495 Margaret River	2300 to 2400

The registered Aboriginal Heritage Site ID 4495, Margaret River, intersects the Project corridor (see Figure 2) and is considered a significant mythological site (DIA, 2012). Site ID 4495 includes Darch Brook, which intersects the Project corridor at John Archibald Drive and Rosa Brook Road. Site ID 4495, Margaret River, will be affected by the construction of the bridge crossing (Figure 2) and as such requires ministerial consent under Section 18 of the *Aboriginal Heritage Act 1972* (AH Act). Any plans that may impact other tributaries of the Margaret River, within 30 m of their normal high water mark of the water courses, will require clearance under Section 18 of the AH Act.

The buffer of other sites were identified within the Project Area, with the buffer of registered Aboriginal Heritage Site ID 4494, Rosa Brook Roads (Lore Ground), intersecting the south-east section of the Project Area (see Figure 2). Brad Goode and Associates (2007) confirmed the actual location of Site ID 4494, Rosa Brook Roads (Lore Ground), to be some 500 m east of the Project Area. Therefore, the actual site does not place any constraints upon the Project and is not anticipated to be impacted by the Project (Brad Goode and Associates, 2007).

Two ethnographic sites, Site ID 21037 Wcm/01 Red Gum Tree and Site ID 21038 Wcm/02 Water Course (Waugly Site) were also identified to intersect John Archibald Drive, located to the west (see Figure 2). Both these Aboriginal Heritage sites have been accessioned as 'Stored Data' on the DIA database and as such are no longer protected under the AH Act (Brad Goode and Associates, 2007).

Consultation with local Nyungar informants stated that they would support Main Roads request for a Section 18 clearance to cross the Margaret River, and requested that the proposed bridge span entirely across the Margaret River and that Main Roads develop strategies to minimise disturbance to the embankments and not to adversely interfere with the natural flow of the waterway (Brad Goode and Associates, 2012). An application has been submitted by Main Roads for consent to use the land on which the site occurs (Margaret River & Darch Brook) under Section 18 of the AH Act.

Recommendation 16

Main Roads incorporate into the CEMP, the recommendations detailed in the Ethnographic and Heritage survey reports by Brad Goode and Associates (2007 and 2012) (Appendix E; Appendix F) during the construction

Recommendation 17

Main Roads complies with any conditions provided as part of a Section 18 approval.

3.15 Air Quality

Main Roads WA Environmental Guideline on Air Quality (Document No. 6707/007) provides guidance on when investigation of air emissions is required, and the extent of investigation. In the first instance, the guidelines detail a preliminary assessment to determine if further investigation is required. An assessment against the preliminary assessment criteria is provided in Table 12.

Table 12 Main Roads preliminary air quality assessment criteria

MRWA preliminary assessment guideline	Project
Traffic flow less than (or a major upgrade resulting in an increase of traffic flows less than) 10,000 vehicles per day in urban areas or 15,000 vehicles per day in rural areas	Projected traffic volumes of less than 1500 vehicles per day
Residential or other sensitive receptors are not within 200 metres of the road centre	Two residences and three short stay accommodation chalets are located within 100 m of the road centreline
Where background air quality (measured by the nearest DoE fixed monitoring site) does not exceed 25% of the NEPM for ambient air quality (Appendix B) and has remained below this level for the 12 months ending at the time of the assessment	No monitoring is undertaken in the Margaret River area. The nearest air quality monitoring station that monitors carbon monoxide and nitrogen dioxide is South Lake, within the Perth metropolitan area. This monitoring site is in the Perth metropolitan area more than 200 km distant from the Project site.

Main Roads has decided not to conduct a preliminary air emissions assessment based on:

- The rural nature of the Project Area
- The very low traffic volumes expected to use the road;
- The small number of sensitive receptors within 200 m of the road; and
- The unavailability of suitable background data.

Local air quality may be temporarily affected during construction (machinery exhaust and dust); however these potential impacts are not considered significant.

During construction of the Project, dust may be generated from clearing of vegetation, earthworks, spillage of soil material and vehicle movements along sealed and unsealed roads. Excessive dust emissions have the potential to impact on the health of the local community and surrounding vegetation.

Recommendation 18

Main Roads includes management actions to address dust emissions in the CEMP.

3.16 Noise and Vibration

Noise modelling has been undertaken by Lloyd George Acoustics to determine the potential impact of the Project. The Noise Assessment Report, prepared by GHD for Main Roads, is included in Appendix H, with the following section included as a summary of the findings.

Sensitive receptors are located within 100 m of the proposed Perimeter Road alignment, in the south-west of the Project (chainage 4900 to 5300). Sensitive receptors are also located in the Riverslea Residential Estate, (chainage 2300) and in the south of the Project Area (chainage 6400 and 6700) although these residences are greater than 200 m from the proposed Perimeter Road.

Noise modelling was undertaken by Lloyd George Acoustics (2012a) to determine expected traffic noise exposure from the new road and compliance with State Planning Policy 5.4 Road and Rail Transport Noise and Freight Considerations in Land Use Planning (WAPC, 2009).

Modelling was based on the dual carriageway and assumed two urban development scenarios; low development of and full development of the Margaret River area (Lloyd George Acoustics, 2012), with the full report is provided in Appendix H.

Monitoring of existing noise levels on Bussell Highway noted an average 11 dB difference between day and night time noise levels. As the difference between the night time and daytime noise levels is greater than the 5 dB difference detailed in the WAPC policy, daytime levels have been determined to be the constraining factor. This difference has been assumed to exist in future years, indicating that night time noise will comply with the WAPC Policy.

The results of this assessment indicated that for the Perimeter Road dual carriageway option, future traffic noise is predicted to be under the WAPC State Planning Policy 5.4 limit criteria at all noise sensitive receivers assuming the "low development" scenario for Margaret River; and would exceed the limit criteria at seven noise sensitive receivers assuming the "full development" scenario for Margaret River.

Main Roads will implement management measures as required to comply with the WAPC policy. Noise Contour maps showing the expected noise levels resulting from both the single and dual carriageway options for the Project are provided in Appendix I

Noise modelling was undertaken separately to assess the potential impact of the proposed John Archibald Drive (Lloyd George Acoustics 2012b), which forms a component of the project and will be a Shire road. 56 existing residences are located within 100 m of the proposed John Archibald Drive centreline, with this number expected to increase as vacant lots in the vicinity are developed.

The John Archibald Drive Traffic Noise Assessment identified approximately five existing residences that are expected to experience noise levels between the WAPC target and limit levels at opening. The modelling predicted that these limits would not be exceeded for these existing residences.

Under the two development scenarios considered in the traffic noise assessment (low and full development of the Margaret River area), the number of existing residences expected to experience noise above the WAPC target level by 2031 increases to nine for the low development scenario and 11 for the full development scenario. Of the predicted target exceedances under the low development scenario, no existing residences are expected to experience noise levels above the limit. Under the full development scenario, seven of the 11 exceedances of the target also exceed the WAPC limit. The full noise assessment report for John Archibald Drive is provided in Appendix H, with the noise contours provided in Appendix I.

Management measures will form a key consideration during detailed design and be implemented along John Archibald Road to ensure compliance with the WAPC policy.

As discussed above, residents will be exposed to traffic noise once the road opens. However, this noise will be managed to be consistent with the WAPC policy for existing residences, through the use of engineering measures (ie bunds, noise walls, road surface treatment) by Main Roads and the Shire of Augusta Margaret River.

Post construction of the Project, any development will be required to implement measures to ensure noise impacts from the road are consistent with WAPC State Planning Policy 5.4.

Residents will be exposed to short term noise during construction activities from vehicle and machinery movement. The construction phase of the Project will be temporary and is regulated under the *Environmental Protection (Noise) Regulations 1997*, which under Regulation 13, provides an exemption from compliance with the requirements of Regulation 7, for noise emitted from construction works on a construction site.

Recommendation 19

Main Roads manages noise from construction activities.

Recommendation 20

Main Roads and the Shire of Augusta Margaret River comply with the *Environmental Protection (Noise) Regulations 1997* and WAPC State Planning Policy 5.4 Road and Rail Transport Noise and Freight Considerations in Landuse Planning (WAPC, 2009).

Recommendation 21

Main Roads and the Shire of Augusta Margaret River determine the party responsible to manage noise associated with John Archibald Drive.

3.17 Amenity

The Project will traverse State Forest and an existing rural environment. Construction and operation of the Project will have an impact on the amenity of the local area through:

- Traffic noise;
- Visual amenity; and
- Changes to the local road system.

These impacts will be offset to some extent in a wider community sense, by the expected reduction of heavy vehicle traffic on the main street of Margaret River. This reduction in heavy vehicle traffic will;

- Improve pedestrian and local traffic safety through the tourist precinct;
- Provide for the implementation of street scaping works; and
- Allow for additional traffic management on the main street.

Properties that abut the Project, will have existing side road access maintained, with private property access to the bypass road limited to two (2) existing properties.

Measures such as the project design, traffic noise management and roadside landscaping will reduce amenity impacts to some extent, but residual impact can be expected in the long term.

Additional short term amenity impacts through noise, dust and vibration will be experienced by residents and landowners during construction of the Project. These impacts will be managed through the implementation of Main Roads roadworks Specifications and a Project specific Construction Environmental Management Plan.

The expected longer term amenity impacts of the Project are discussed below.

Traffic Noise Exposure

As noted at Section 3.16, modelling has indicated that traffic noise from the single carriageway, at adjacent private properties, will comply with the WAPC State Planning Policy 5.4, with engineering and management measures adopted to ensure compliance with the WAPC policy in the dual carriageway, Despite compliance with the policy, there will be an increase in traffic noise exposure at residences, including within the Riverslea Estate, along John Archibald Drive, individual farmhouses, businesses (including short stay accommodation) and homes near the intersection with Rosa Brook Road.

However, the Project will reduce traffic noise on the existing Bussell Highway and in the Margaret River main street precinct.

Visual Amenity

There will be some loss of visual amenity from adjacent properties as a consequence of the Project, although this is expected to be limited to:

- Several multi-storey residences within the Riverslea Estate to the west of the Project
- Isolated farmhouses; and
- Several properties in the vicinity of Rosa Brook Road.

At the northern approach to the Margaret River crossing point, the road will be in approximately 7m of cut (below existing ground level). Consequently the eastern cut batter, but not the road or traffic, will be visible along the existing cleared powerline easement from the south. As such, this batter will be visible to some residences in the Riverslea Estate along this existing powerline easement.

The proposed bridges across the Margaret River have been designed as low as practicable within the landscape, to reduce visual intrusion. The bridge decks are approximately 10 m above the river and will be noticeable, from the river, approximately 150m and 100m up and downstream of the bridge crossing respectively. The closest private property within the Riverslea Estate, is approximately 250m from the bridge crossing. However, the bridges will not be visible with existing vegetation on Darch Brook and the Margaret River screening these properties to the bridge.

South of the Margaret River, the Project traverses farmland and alternates between cut and fill, reducing the visual impact from the adjacent residential and rural residential properties. The closest house to the Project Area within Riverslea Estate is some 275m through this section. Existing vegetation along Darch Brook will block the view to the road from Riverslea Estate, aside from several multi-storey houses which will be able to observe the new road from their upper levels.

In the vicinity of Rosa Brook Road, three houses and several short stay accommodation units will be within 100 m of the road, with the closest being a short stay unit approximately 70m to the west.

The Project will require the acquisition of land from, and abut, the existing Stella Bella Vineyard, located on the north side of Rosa Brook Road.

Proposed revegetation works within the road reserve will reduce the visual impact of the road from adjacent and distant properties in the medium to long term, once this vegetation becomes established.

Similarly, the construction of John Archibald Drive will be within 20-30m of a number of residences in the adjacent residential estate. Main Roads and/or the Shire of Margaret River will implement re-vegetation works, to create a vegetated buffer between these properties and John Archibald Drive where possible.

Local Road System

The project will require some changes to the existing local road system. The expected changes are:

- Minor upgrades to log haul roads in State Forest pine plantation;
- Improved access to the Margaret River Airport and the Margaret River Waste Water Treatment Plant;
- Construction of John Archibald Drive, to link the Perimeter Road with Bussell Highway; and
- Closure of Rosa Brook Road (west).

These changes are not expected to have any significant effect on local property access for residents.

3.18 Contaminated Sites

The DEC contaminated sites database provides a record of all sites that are classified as either contaminated - remediation required, contaminated - restricted use, or remediated for restricted use. A search of this database (DEC 2012) did not identify any listed contaminated sites within 5 km of the Project Area.

3.19 Public Safety and Traffic

Power and telephone cables are present in the area, however where necessary any services will be relocated and managed in accordance with Main Roads standard procedures. No nearby features (such as major pipelines) were identified that pose a significant public safety risk (GHD, 2007).

Proposed construction works to be undertaken adjacent road traffic, in particular adjacent Bussell Highway have the potential to impact road users and site personnel.

Recommendation 22

Public safety and traffic will be managed in accordance with Main Roads specifications and Traffic Management Requirements for Works on Roads.

3.20 Waste

Construction works are likely to generate considerable waste materials. Waste management pertains to the controlled disposal of products that cannot be used onsite, and may include construction waste, general office waste, and controlled wastes.

Poor management of waste materials may lead to litter or contamination of the Project Area and surrounds. This in turn may impact on the aesthetics of the area (e.g. visual amenity) and the health of aquatic and terrestrial ecosystems.

Recommendation 23

Main Roads prepare and include in the CEMP waste management requirements to address waste generated during construction.

3.21 Hazardous Substances

A hazardous material is one that poses a hazard to human health or the environment when improperly handled, stored or disposed.

Hazardous materials, including hydrocarbons, will be used during construction. Spills and discharges of these hazardous materials may result in small scale contamination of soil, or contamination of surface water bodies, including Margaret River. Consequently, hazardous material during construction will require management.

Recommendation 24

Main Road includes appropriate storage of hazardous substances in the CEMP.

3.22 Construction Phase Impacts

Additional potential impacts requiring consideration and management during the Project's construction phase include the following:

- Aboriginal heritage salvage and monitoring;
- Materials transport to site;
- Traffic access and safety;

- Supply of construction materials;
- Use of water in construction; and
- Gravel and limestone aggregates.

These impacts are expected to be short term and likely to be limited to the construction site and its near environs, including the local road system. Management of these issues should be clearly defined through the preparation and implementation of a CEMP for the Project.

Construction of the Project is to be staged, with Stage 1 construction (Southern link to Rosa Brook Road) currently scheduled to commence in the summer of 2013/14.

4. Native Vegetation Clearing

4.1 Assessment against the "Ten Clearing Principles"

The Project footprint is 42 ha, of which 8.5 ha is native vegetation. However, only 5.2 ha of native vegetation (less than 10% of the Project footprint) has been identified as *Good* or *Very Good* condition, with the remaining *Degraded* or *Completely Degraded*.

Clearing of native vegetation is regulated by DEC under Part V of the EP Act. Main Roads has been issued with a Statewide Purpose Clearing Permit (CPS 818/6) which provides for clearing for roadworks to occur under certain conditions and prescribes specific management and offset requirements.

CPS 818/6 requires an assessment to be conducted against the "Ten Clearing Principles" outlined in Schedule 5 of the *Environmental Protection Amendment Act 2003.* These Principles aim to ensure that all potential impacts resulting from removal of native vegetation can be assessed in an integrated way.

An assessment was undertaken against the "Ten Clearing Principles" as part of the Flora and Vegetation Assessment (GHD 2012) detailed in Appendix C. However, the clearing footprint of the Project has changed since this survey, due to alignment redesign. Consequently, the Project has been re-assessed against the Ten Clearing Principles and found:

- Proposal is at variance with Principles (f);
- Proposal may be at variance with Principles (a), (b) and (h); and
- Proposal is unlikely to be at variance with Principles (g) and (i).

The assessment against the Ten Clearing Principles is provided in Appendix G.

Recommendation 25

If the Project is not formally assessed by the EPA, Main Roads complies with the requirements detailed in Main Roads State-wide Clearing Permit (CPS 818/6).

5. Stakeholder Consultation

Various alignment options have been considered by the Shire of AMR since 1996. Consideration of these alignment options has entailed consultation with the community in a number of forms as discussed below.

More recently, the Shire completed a broader shire land use study and prepared the Margaret River Local Planning Strategy (LPS) and Margaret River Concept Plan. The LPS included a proposed perimeter road alignment which has been further developed through consultation with the affected owners and Main Roads, and forms the alignment addressed in this EIA.

The LPS documents were formally advertised for public comment and resulted in the final strategy being adopted by Council in June 2009. The Margaret River LPS was then endorsed by the Western Australian Planning Commission (WAPC) in May 2011.

Main Roads has consulted with a range of environmental stakeholders over the past three years, during the development of the Margaret River Perimeter Road.

Consultation with directly affected landowners

Main Roads in partnership with Shire of AMR has consulted with directly affected landowners over the past three years to discuss property impacts and negotiate a preferred alignment across these properties. The consultations with landowners included a route definition assessment and planning to reduce environmental and social impacts and maximise opportunities to site the alignment in an location that is acceptable to all parties.

The consultation and communication program included periodic meetings with landowners to keep them informed on progress and development of the project.

Consultation with other stakeholders

Briefings, workshops and presentations to the shire council and government agencies began in June 2011 and are listed in Table 13.

Meetings have been regularly held with Indigenous stakeholders (Brad Goode and Associates, 2007 and 2012), relevant Government Departments and environmental stakeholders on project progress.

Table 13 Environmental Stakeholder Consultation

	Agency	Date	Attendees
1	Department of Environment and Conservation Bunbury office	Nov 11, 2011	Peter Hanley, Andrew Webb Kim Williams, Brad Comins, Jeremy Chick
		Feb 14, 2012	Peter Hanley, Kim Williams, Andrew Webb, Grant Lamb
		Oct 18, 2012	Peter Hanly, Brad Commins, Kim Williams, Grant Lamb and Chris Bishop
	Department of Environment and Conservation Margaret River office	May 4, 2012	Jeremy Chick
		Sept 11, 2012	Jeremy Chick
2	Office of the Environmental Protection Authority	Feb 15, 2012	Murray Hogarth, Han Jacobs
		October 22, 2012	Hans Jacob, John McPherson (DEC)
3	Shire of Augusta Margaret River	June 23, 2011	Full Council meeting
		Feb 1, 2012	Planning & Technical group
		March 29, 2012	Full Council meeting
		August 22, 2012	Full Council meeting
4	Fisheries WA	Feb 15, 2012	Nathan Harrison
5	Margaret River Environment Centre	Dec 9, 2011	Noel Whittle, Tracey Skippings, Dave Rankin

Community Briefings

Main Roads identified Riverslea Estate residents as key stakeholders, due to their proximity to the alignment. In response, addresses of residents within this area were sourced from the Shire's ratepayer database and letters were sent to residents on 19 August 2012 inviting them to technical briefings in Margaret River about the project. The estate was divided into four areas with separate briefings for each area to ensure all interested residents were able to raise any issues in a smaller group environment.

Each briefing was two hours (Monday 27 August and Tuesday 28 August: 4:30-6:30pm; 6:30-8:30pm). This allowed queries to focus on specific issues for each area, and to gain feedback on both alignments. The actions from these briefings included:

- Requests for briefings in Perth or Bunbury are being accommodated and continuing as requested.
- Absentee owners have been in contact via telephone and email.
- Landowners will be kept informed, through a fact sheet and relevant diagrams (via post or email).
- Queries will continue to be taken by phone and email.

Main Roads has also provided briefing sessions to residents located on the southern end of the project area. Residents from Darch Brook Road and Rosa Brook Road attended.

Community Reference Group

A Community Reference Group (CRG) has been established in order to deal with the issues that will be associated with this Project. Issues the CRG may provide advice on will include noise mitigation, landscaping, and environmental aspects. Main Roads anticipates that the CRG may continue through the project's construction phases.

The group will be independently facilitated and have representative input from the following:

- LGA technical officer/s
- LGA elected member (1)
- Chamber of Commerce (1)
- Leeuwin Conservation Group (1)
- General community members (4-5)
- Main Roads Senior Project Manager, Community Engagement Representative and other staff as required.

The CRG had its first meeting on October 18, 2012 and is expected to meet irregularly as the Project develops, with the next meeting expected to be in late January 2013.

Other Activities:

- Project information is available on the Main Roads website.
- A project contact (Community Engagement Consultant) is available to address community concerns and queries.
- Queries for briefings prior to the July 2012 newsletter distribution have been accommodated on request.
- A newsletter will be developed with the latest project information and announcement of the CRG membership in October 2012.

It is understood that Main Roads will continue to consult with these, and other relevant stakeholders through the development of the Project.

Recommendation 26

Main Roads continues to consult with relevant stakeholders during the development and implementation of the Project, through the development of the Community Reference Group.

6. Impact Management and Mitigation

Construction and operation of the Project will result in a number of long term primary environmental impacts as detailed in Section 3. These include:

- Clearing of vegetation;
- Loss of fauna habitat;
- Loss of/severance of fauna migration pathway
- Drainage impacts;
- Changes in the release of vehicle emissions in the local and regional airshed;
- Traffic noise exposure; and
- Loss of amenity.

The recommendations detailed in this report will provide for the management and minimisation of these impacts but some residual environmental impacts are anticipated.

7. Summary of Recommendations

The following section lists the recommendations proposed throughout this EIA (Section 3) for additional work to be conducted during the development and implementation of the Project.

Recommendation 1

Main Roads undertake detailed ASS investigation in areas where works are likely to result in exposure of the soil profile below the water table. The Construction Environmental Management Plan (CEMP) should incorporate specific ASS management measures to mitigate any potential impact.

Recommendation 2

Road drainage should be developed to ensure that there is no direct discharge or road runoff to the Margaret River or its tributaries. Drainage design for the final alignment should aim to maintain existing surface water drainage patterns and avoid exacerbating waterlogging in susceptible areas.

Recommendation 3

Runoff from disturbed areas may be minimised through the preparation and implementation of a CEMP, including site treatments such as sediment curtains, settling basins etc. Measures to control spills should be included in the CEMP.

Recommendation 4

Main Roads prepare an application to the DoW for a permit to disturb the bed and banks of the Margaret River and the Darch Brook, once construction details and impacts are known.

Recommendation 5

Main Roads undertakes mapping of WONS within the Project Area.

Recommendation 6

Main Roads include in the CEMP, the management of weeds, and prioritise management of WONS populations, within the Project Area prior to and during road construction, and as part of on-going road reserve management.

Recommendation 7

Main Roads incorporates into the CEMP, the recommendations detailed in the Hygiene Management Plan developed by Glevan Consulting (2012) (Appendix D).

Recommendation 8

Main Roads prepares and implements a Topsoil Management Plan (TMP) for the Project to identify the use and management of in-situ topsoil during road works.

Recommendation 9

Main Roads prepares and implements a Landscape Plan for the Project.

Recommendation 10

Where the Project traverses the timber reserve (between chainages 2000 and 2300), adjacent Bramley National Park, fauna fencing and/or fauna underpasses should be considered in the final design. This would assist in providing a safer road user environment and protecting fauna from roadkill.

Recommendation 11

Specific fauna management measures should be included in the design and construction of the Project. Management measures to be incorporated into the CEMP include:

- Design lighting at construction to include consideration of potential impacts to fauna;
- Clearing to occur along only one front/direction preferably towards remaining vegetation areas, to ensure any fauna present have an escape path;
- Minimise clearing within the section of remnant vegetation within and/or adjacent to the Bramley National Park;
- If protected species are encountered, they will not be disturbed without authority; and
- Any test pits, trenches or construction sumps to be constructed with a ramped or stepped edge to allow fauna to escape.

Recommendation 12

Main Roads to submit a referral to the EPA under s38 of the EP Act, for proposed impacts to Black Cockatoo and Western Ringtail Possum habitats.

Recommendation 13

Main Roads to submit a referral to the DSEWPAC under the EPBC Act, for proposed impacts to Black Cockatoo and Western Ringtail Possum habitats.

Recommendation 14

Main Roads submits an application to have approximately 0.1 ha excised from the Bramley National Park.

Recommendation 15

Main Roads include fire management, including adherence to vehicle movement bans issued by Shire of AMR, in the CEMP.

Recommendation 16

Main Roads incorporate into the CEMP, the recommendations detailed in the Ethnographic and Heritage survey reports by Brad Goode and Associates (2007 and 2012) (Appendix E; Appendix F) during the construction

Recommendation 17

Main Roads complies with any conditions provided as part of a Section 18 approval.

Recommendation 18

Main Roads includes management actions to address dust emissions in the CEMP.

Recommendation 19

Main Roads manages noise from construction activities.

Recommendation 20

Main Roads and the Shire of Augusta Margaret River comply with the *Environmental Protection (Noise) Regulations 1997* and WAPC State Planning Policy 5.4 Road and Rail Transport Noise and Freight Considerations in Landuse Planning (WAPC, 2009).

Recommendation 21

Main Roads and the Shire of Augusta Margaret River determine the party responsible to manage noise associated with John Archibald Drive.**Recommendation 22**

Public safety and traffic will be managed in accordance with Main Roads specifications and Traffic Management Requirements for Works on Roads.

Recommendation 23

Main Roads prepare and include in the CEMP waste management requirements to address waste generated during construction.

Recommendation 24

Main Road includes appropriate storage of hazardous substances in the CEMP.

Recommendation 25

If the Project is not formally assessed by the EPA, Main Roads complies with the requirements detailed in Main Roads State-wide Clearing Permit (CPS 818/6).

8. Environmental Approvals

8.1 Commonwealth Approvals

8.1.1 Referral to the Department of Sustainability, Environment, Water, Populations and Communities (DSEWPaC)

Referral to DSEWPaC under the EPBC Act is triggered if a proposed action has/or potentially has a significant impact on Matters of National Environmental Significance (MNES) as outlined in the MNES: Significant impact guidelines 1.1 (DEWHA, 2009). Table 14 outlines details the likely impact upon MNES within the Project Area.

Table 14 Assessment of the Project against Matters of National Environmental Significance

Matters of National Environmental Significance	Present	Impact
World Heritage Places	No	None
National Heritage Places	No	None
Ramsar Wetlands	No	None
Threatened species and ecological communities	Yes – Potential black cockatoo feeding and breeding habitat and Western Ringtail Possum habitat.	Removal of up to 4.54 ha of potential black cockatoo feeding/breeding habitat. Removal of up to 0.86 ha of Western Ringtail habitat.
Listed Migratory Species	May be present	No significant impacts
Commonwealth marine areas	No	None
Nuclear Actions	No	None

Conservation Significant Species are likely to be impacted by the Project, with clearing of both Black Cockatoo and Western Ringtail Possum habitat required.

DSEWPaC's (2012) referral guidelines for three threatened black cockatoo species provide advice on when an impact associated with a proposed Action is likely to require referral. Section 3.10.7 provides an assessment of the Project against the referral guidelines, with the proposal likely to trigger referral based on;

- clearing or degradation of breeding habitat;
- clearing of more than 1 ha of quality foraging habitat;
- degradation of more than 1 ha of foraging habitat;
- potential for indirect impacts such as increasing competitors for nest hollows; and
- potential to introduce known plant diseases such as Phytophthora spp.

As detailed in Section 3.10.7, referral of the Project under the EPBC Act is likely to be required due to impacts on the Black Cockatoo Species.

The MNES: Significant Impact Guidelines 1.1 (DEWHA, 2009) state that an action will require approval if the action has, will have, or is likely to have a significant impact on an endangered or vulnerable species.

With regard to the Black Cockatoo Species, as outlined in Table 10, the surrounding native vegetation and nearby Bramley National Part may offer similar habitat value and therefore reduce the significance of the impact that the project will have on the Black Cockatoo species.

No WRT population assessment has been undertaken in the area, and as such an assessment of the impacts of the Project on the WRT possum population cannot be undertaken. However, by assessing habitat, the significance of clearing approximately 0.86 ha of WRT habitat, which may reduce the area of occupancy of the species. However, the impact on the WRTP is likely to be reduced due to the extensive area of similar vegetation surrounding the Project, notable the 3892 ha Bramley National Park.

Referral is likely to be required based on the loss of Western Ringtail Possum habitat and impacts on this species.

8.2 State Approvals

8.2.1 Referral to the Environmental Protection Agency (EPA)

Significant proposals (e.g. subdivision and development applications) must be referred to the EPA under s38 of the EP Act.

In deciding whether a proposal will be subject to the formal environmental impact assessment process, the EPA takes into account the environmental significance of any potential impacts that may result from the implementation of the scheme or proposal.

The Project is likely to have an impact on one or more of the three black cockatoo species and the WRTP, and is considered to trigger a requirement for referral under s38 of the EP Act.

8.2.2 Department of Environment and Conservation

The clearing of vegetation in Western Australia is governed under the EP Act.

Main Roads has been granted a statewide vegetation clearing permit (Purpose Permit CPS 818/6), granted under section 51E of the EP Act, from DEC. The Purpose Permit allows Main Roads to clear native vegetation for road realignment projects and associated construction activities (including preconstruction 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 at variance with the clearing principles; or
- Those project activities are incorporated in any proposal that is referred to and assessed under Part IV of the EP Act by the EPA.

An assessment against the ten clearing principles was undertaken and identified the Project to be at variance to Principle (f), may be at variance to Principles (a), (b) and (h), while (g) and (i) are unlikely to be at variance to the Ten Clearing Principles.

Should the proposal be formally assessed under s38 of the EP Act, Main Roads would not be required to obtain a clearing permit to undertake clearing activities associated with the Project. However, exemptions under Schedule 6 of the EP Act do not apply in the case that the EPA decides not to assess a proposal. As such, if the Project was ‘not assessed’ under Part IV of the EP Act, Main Roads would be required to obtain a permit to clear native vegetation. Clearing may be considered possible in accordance with Main Roads State-wide purpose “Clearing Permit” (CPS 818/6).

Clearing associated with the Project may be at variance with the clearing principles (outlined in Section 4.1). Clearing may be undertaken in accordance with Main Roads State-wide purpose permit (CPS818/6) to clear native vegetation, although consultation with DEC is recommended.

8.2.3 Department of Water

The RIWI Act covers the regulation, management, use and protection of water resources and irrigation in Western Australia.

A Permit to Interfere with Bed and Banks will be required for this Project due to construction works on the bridge over the Margaret River and the culvert crossing of the Darch Brook.

8.2.4 Department of Indigenous Affairs

The Aboriginal Heritage Act 1972 (AH Act) protects Aboriginal Heritage and sites in Western Australia. The Project has the potential to impact upon the registered Aboriginal heritage site of the Margaret River (Site ID 4495).

The proposed bridge construction across the Margaret River will require ministerial consent under Section 18 of the AH Act. An application has been submitted by Main Roads for under Section 18 of the AH Act.

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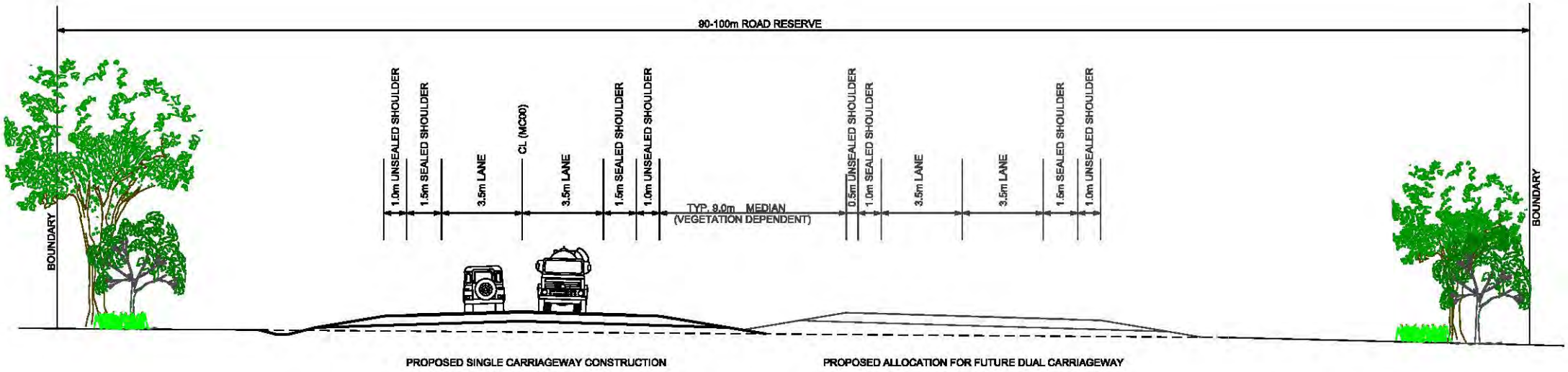
Appendices

Appendix A – Typical Road Formation



TYPICAL CROSS-SECTION

NOT TO SCALE

Appendix B - Figures

LEGEND

Project Area

1: 100,000 (at A3)

0 0.5 1 2 3 4 5

Kilometres

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

N

Main Roads Western Australia
Margaret River Bypass

Job Number 61-27189
Revision 0
Date 14 Nov 2012

Project Location

Figure 1

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

322,000 324,000 326,000

6,244,000 6,242,000 6,240,000 6,238,000

Keenan State Forest

0 100 200 300 400 500 600 700 800 900 1000 1100 1200 1300 1400 1500 1600 1700 1800 1900 2000 2100 2200 2300 2400 2500 2600 2700 2800 2900 3000 3100 3200 3300 3400 3500 3600 3700 3800 3900 4000 4100 4200 4300 4400 4500 4600 4700 4800 4900 5000 5100 5200 5300 5400 5500 5600 5700 5800 5900 6000 6100 6200 6300 6400 6500 6600 6700 6800 6900 7000

Site 4495

Site 4494

MARGARET RIVER

Bramley National Park

JOHN ARCHIBALD DR

BUSSELL HWY

DARCH BROOK

OLD ROSA BROOK RD

ROSA BROOK RD

ROSA BROOK RD

Locality Map

GRACETOWN

Indian Ocean

MARGARET RIVER

WITCHCLIFFE

BUSSELL HWY

LEGEND

Rivers
Project Area

Public Drinking Water Source Areas
Protection Area-P1

DEC Estate
National Park
State Forest
Timber Reserve

Heritage
European Heritage
Aboriginal Heritage

2300 Chainage Point

1: 20,000 (at A3)

0 100 200 400 600 800 1,000

Metres

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

N

Main Roads Western Australia
Margaret River Bypass

Job Number 61-27189
Revision 0
Date 14 Nov 2012

Environmental Context - DEC Estate, PDWSA, and Heritage

Figure 2

G:\61\27189\GIS\Maps\MXD\6127189_G010_Fig2_Rev0.mxd

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

Data source: MRWA: Roads - 20091028; GHD; Project Area - 20121023, Chainage Point - 20120828; DEC: DEC Estate - 20120823; DOW: Public Drinking Water Source Areas - 20100408; DIA: Aboriginal Heritage- 20120823; DoP: European Heritage - 20120823; Landgate: Bussleton 2010 Mosaic -20111206; GA: NatMap Geodata 250K Topographic Series 3 - 2006. Created by: cagilbert, erice

322,000 324,000 326,000

6,244,000 6,242,000 6,240,000 6,238,000

MARGARET RIVER

JOHN ARCHIBALD DR

BUSSELL HWY

DARCH BROOK

OLD ROSA BROOK RD

ROSA BROOK RD

ROSA BROOK RD

0 100 200 300 400 500 600 700 800 900 1000 1100 1200 1300 1400 1500 1600 1700 1800 1900 2000 2100 2200 2300 2400 2500 2600 2700 2800 2900 3000 3100 3200 3300 3400 3500 3600 3700 3800 3900 4000 4100 4200 4300 4400 4500 4600 4700 4800 4900 5000 5100 5200 5300 5400 5500 5600 5700 5800 5900 6000 6100 6200 6300 6400 6500 6600 6700 6800 6900 7000

Locality Map

GRACETOWN

Indian Ocean

MARGARET RIVER

WITCHCLIFFE

BUSSELL HWY

LEGEND

Threatened (Declared Rare) & Priority Flora

- (T) Threatened Rare Flora - Extant Taxa
- Priority 1 - Poorly Known Taxa
- Priority 2 - Poorly Known Taxa
- Priority 3 - Poorly Known Taxa
- Priority 4 - Rare Taxa
- Priority 5 - Conservation Dependent Taxa

Project Area

Acid Sulfate Soil Risk Mapping

Moderate to low ASS disturbance risk (<3m from surface)

2300 Chainage Point

1: 20,000 (at A3)

0 100 200 400 600 800 1,000

Metres

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

N

powered by SLIP ENABLER

Main Roads Western Australia
Margaret River Bypass

Environmental Context - Flora and Acid Sulfate Soil Risk

Job Number 61-27189
Revision 0
Date 14 Nov 2012

Figure 3

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

Data source: MRWA: Roads - 20091028; GHD; Chainage Point - 20120828, Project Area - 20121023; DEC Threatened (Declared Rare) & Priority Flora - 20111104, Acid Sulfate Soil Risk Mapping - 20120823; Landgate: Bussleton 2010 Mosaic -20111206; GA: 250K Topographic Series - 2006.
Created by: cagilbert, erice

322,000 324,000 326,000

6,244,000 6,242,000 6,240,000 6,238,000

CARTERS RD
NOZZLE RD
MIKE RD (F)
WHARNCLIFFE RD
Rails to Trails Trail (F)
BUSSELL HWY
BACK RD
R2
Q3
Q1
Q2
Gastrolobium formosum
JOHN ARCHIBALD DR
R1
DAM RD
NILSSON RD
OLD ROSA BROOK RD
ROSA BROOK RD
DARCH RD

Locality Map
Indian Ocean
GRACETOWN
MARGARET RIVER
WITCHCLIFFE
BUSSELL HWY

LEGEND

- Quadrat
- Releve

GHD Declared Rare & Priority Species
- (T) Threatened Flora - Extant Taxa
- Priority 1 - Poorly Known Taxa
- Priority 2 - Poorly Known Taxa
- Priority 3 - Poorly Known Taxa
- Priority 4 - Rare Taxa

- Roads
- Project Area

Vegetation Type
- Cleared Farmland
- Closed Scrub
- Highly Disturbed/Planted
- Jarrah Marri Forest
- Jarrah Marri Peppermint Forest
- Pine Plantation
- Water Body

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

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

N

Main Roads Western Australia
Margaret River Bypass

Job Number 61-27189
Revision 2
Date 14 Nov 2012

Vegetation Type

Figure 4

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

Data source: MRWA: Roads - 2012; GHD;Project Area - 20121023, Vegetation Type - 20121113, GHD Declared Rare & Priority Species - 20111207, Quadrat - 20111207, Releve - 20111207; Landgate: Bussleton 2010 Mosaic -20111206; GA: 250K Topographic Series - 2006. Created by: cagilbert, erice

322,000 324,000 326,000

6,244,000 6,242,000 6,240,000 6,238,000

CARTERS RD
NOZZLE RD
MIKE RD (F)
WHARNCLIFFE RD
Rails to Trails Trail (F)
BUSSELL HWY
BACK RD
JOHN ARCHIBALD DR
DAM RD
NILSSON RD
OLD ROSA BROOK RD
ROSA BROOK RD
DARCH RD

Locality Map
Indian Ocean
GRACETOWN
MARGARET RIVER
WITCHCLIFFE
BUSSELL HWY

LEGEND

Roads
Project Area

Vegetation Condition
1. Pristine or Nearly So
2. Excellent
3. Very Good
4. Good
5. Degraded
6. Completely Degraded

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

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

N

Main Roads Western Australia
Margaret River Bypass

Job Number 61-27189
Revision 2
Date 14 Nov 2012

Vegetation Condition

Figure 5

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

Data source: MRWA: Roads - 2012; GHD; Project Area - 20121023, Vegetation Condition - 20121113; Landgate: Bussleton 2010 Mosaic -20111206; GA: 250K Topographic Series - 2006. Created by: cagilbert, erice

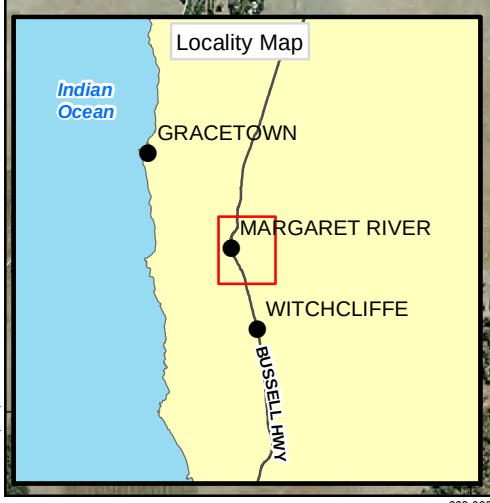
322,000 324,000 326,000

6,244,000 6,242,000 6,240,000 6,238,000

NOZZLE RD

BACK RD

OLD ROSA BROOK RD



LEGEND

Potential Cockatoo Breeding Trees

- Trees > 500mm DBH
- Possible Black Cockatoo Breeding Areas (Large tree with Hollows)

- Roads
- Project Area

1: 20,000 (at A3)

0 100 200 400 600 800 1,000

Metres

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

N

Main Roads Western Australia
Margaret River Bypass

Job Number 61-27189
Revision 2
Date 14 Nov 2012

Potential Cockatoo Breeding Trees

Figure 6

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

Data source: MRWA: Roads - 20091028; GHD; Project Area - 20121023, Potential Cockatoo Breeding Trees - 20111207; Landgate: Bussleton 2010 Mosaic -20111206; GA: 250K Topographic Series - 2006. Created by: cagilbert

Appendix C –Flora and Fauna Assessment

2012 Site visit results

2012 Naturemap and PMST database results

Likelihood of occurrence

Margaret River Bypass – Flora and Fauna Assessment

CLIENTS | PEOPLE | PERFORMANCE

Main Roads Western Australia

Report for Margaret River Bypass

Flora and Fauna Assessment

March 2012

INFRASTRUCTURE | MINING & INDUSTRY | DEFENCE | PROPERTY & BUILDINGS | ENVIRONMENT

This Proposed Margaret River Outer Ring Road Flora and Fauna Assessment Report ("Report"):

1. *has been prepared by GHD Pty Ltd ("GHD") for Main Roads Western Australia (Main Roads);*
2. *may only be used and relied on by Main Roads;*
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- *were limited to those specifically detailed in section 1.4 of this Report;*

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Subject to the paragraphs in this section of the Report, the opinions, conclusions and any recommendations in this Report are based on conditions encountered and information reviewed at the time of preparation and may be relied on until 12 months, after which time, GHD expressly disclaims responsibility for any error in, or omission from, this Report arising from or in connection with those opinions, conclusions and any recommendations.

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Executive Summary

Main Roads Western Australia (Main Roads) proposes to construct a bypass, east of the Margaret River town site, adjoining the Bussell Highway. GHD Pty Ltd (GHD) has been commissioned by Main Roads to undertake environmental investigations along this preliminary alignment. The study area includes two partial alignment options immediately north of the Margaret River, referred to as the eastern and western alignments.

The Environmental investigations included a desktop review and field survey to identify any potential constraints and to identify and map flora, vegetation, fauna and fauna habitat. These will provide information for advice on environmental approvals required and the feasibility of developing the Margaret River bypass. The study area is approximately 7.13 km long and 100 m wide and comprises an area of 71.3 ha.

The following is a summary of the findings of the flora and fauna assessment:

- The proposed alignment options north of the Margaret River crossing traverse through the Keenan State Forest and timber reserve. The western alignment option also traverses the Bramley National Park. The eastern alignment option was excluded from the National Park by request of Main Roads and the Shire of Augusta-Margaret River. The proposal may potentially seek to excise a section of the National Park dependent on the final road design and defined impact area.
- Margaret River and its tributaries are a proclaimed waterway under the WA *Rights in Water and Irrigation Act 1914* (RIWI Act). The proposed alignment options will traverse Margaret River and two of its tributaries, including Darch Brook.
- Six vegetation types were identified within the study area, including previously cleared/highly disturbed vegetation. Remnant vegetation remaining within the study area consisted predominantly of Jarrah/Marri Forest with emergent Peppermint trees in gullies and along the river and creek lines. These forests have a long history of logging. The majority of the study area however, was considered to be completely degraded, traversing through cleared agricultural land, pine plantations, roads/tracks, private properties and grape vines. No TECs or PECs were identified within the study area.
- A total of 168 plant taxa, representing 52 plant families and 116 genera, were recorded from the study area. This total is comprised of 134 native species and 34 introduced (exotic) species. No Threatened flora was recorded from the study area. One Priority Flora species was recorded from the study area, *Gastrolobium formosum* (Priority 3). A small population of *G. formosum* of approximately 20 individuals was recorded along the northern bank of Margaret River within the western alignment option.
- During the survey, 82 species comprised of 56 birds, 9 reptiles, 3 amphibians and 14 mammals were recorded within the study area. Four Threatened fauna species listed as Vulnerable under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and Schedule 1 under the WA

Wildlife Conservation Act 1950 (WC Act) were observed during the field investigation. These species were the Baudin's Black Cockatoo, Forest Red-tailed Black Cockatoo, Western Ringtail Possum and Southern Brush-tailed Phascogale. The Southern Brush-tailed Phascogale was only recorded from Lot 2150 (potential offset area), which will not be impacted by the proposed project. Several other species identified from desktop assessment that have the potential or are likely to occur in the area are Chuditch, Carnaby's Black Cockatoo, Australasian Bittern, Peregrine Falcon and Hairy Marron. A number of Priority species listed by the DEC which are either found in, or are potentially in the area, are the Pouched Lamprey, Water Rat, Southern Brown Bandicoot, Black Bittern, Western Brush Wallaby and the Australian Masked Owl (SW population).

- Within the study area there are 123 potential Black Cockatoo breeding trees. These trees are Jarrah, Marri or stag Eucalyptus trees and contain nesting hollows suitable for Black Cockatoo breeding. A further 445 trees were identified as a size suitable for the development of nesting hollows (>500 mm at DBH) within the next 100 years. The total area of Black Cockatoo feeding habitat within the study area is approximately 14.6 ha.
- During the field survey three Western Ringtail Possums were observed active at night along riparian vegetation in the northern section of the alignment. Two dreys (resting platforms in trees) were also recorded in this area. Droppings were also recorded along Margaret River in the riparian vegetation and in the valley of Lot 2150. One hundred and twenty-three large Eucalypts were recorded within the alignment which had hollows suitable for this species. The area of core habitat that Western Ringtail Possums may utilise is approximately 1.71 ha.

Offset Area - Lot 2150

- Lot 2150 is 36 ha in size and primarily consists of Marri/Jarrah Woodland with emergent Peppermint trees in the gully. The lot appears to have some edge effects from weeds due to historical grazing activities and the lack of fencing. Habitat within the Lot appears intact and some threatened fauna species were identified from an initial assessment. To gather a true reflection of the site's potential, additional assessments should be undertaken. Assessments could include a small trapping program or additional spotlighting and camera trap monitoring. These would be beneficial in establishing use by other threatened fauna.

1. Introduction

1.1 Background

Main Roads Western Australia (Main Roads) proposes to construct a bypass, east of the Margaret River town site, as part of the Bussell Highway. A Preliminary Environmental Assessment was undertaken in 2007 on two alignments east of Margaret River. The currently proposed alignment sits in between the previously surveyed areas and requires additional assessment. It is recognised that some minor modifications to the alignment may still be required to best fit the new road into the environment. These areas are included into this survey.

GHD Pty Ltd (GHD) has been commissioned by Main Roads to undertake environmental investigations along this preliminary alignment. This included undertaking a desktop review and field survey to identify any potential constraints and to identify and map flora, vegetation, fauna and fauna habitat.

These assessments will provide information for advice on environmental approvals required and on the feasibility of developing the Margaret River bypass in relation to environmental approvals.

1.2 Study Area

The study area is along the preliminary alignment for the Margaret River bypass, north of the Margaret River town site and approximately 270 km from the Perth CBD. The study area is approximately 7.13 km long and 100 m wide and comprises an area of 71.3 ha (Figure 1). The majority of the alignment runs through cleared, agricultural areas, with a portion going through State Forest No. 56.

The study area includes two partial alignment options immediately north of the Margaret River, referred to as the eastern and western alignments.

1.3 Scope of Works

The scope of works included:

- A desktop assessment of the study area including searches of relevant databases;
- Flora field survey to identify flora, vegetation units and vegetation condition;
- Fauna habitat assessment to obtain opportunistic records of fauna species; determine the likelihood that significant fauna that may utilise the study area; the value of fauna habitat present; and to determine any fauna linkage corridors;
- A report on the findings of the field survey;
- Assessment of the Project against the Environmental Protection Act's 10 Clearing Principles (Schedule 5);
- Consultation and liaison with relevant statutory authorities or specialists; and

- Indication and discussion of the requirement for referral to statutory authorities or for other clearances for the Project.

1.4 Limitations

Any changes to the Project, outside the description provided in Section 1.3 are outside the scope of this assessment.

GHD has, in part, relied upon external data, namely publicly available databases and historical reports.This information was ground-truthed during the GHD (2011) vegetation and flora assessment. However, the accuracy of this data lies with the provider, not with GHD.

This Report has been prepared by GHD for Main Roads and may only be used and relied on by Main Roads for the purpose agreed between GHD and Main Roads as set out in section 1.3 of this Report.

GHD otherwise disclaims responsibility to any person other than Main Roads arising in connection with this Report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this Report were limited to those specifically detailed in the Report and are subject to the scope limitations set out in the Report.

The opinions, conclusions and any recommendations in this Report are based on conditions encountered and information reviewed at the date of preparation of the Report. GHD has no responsibility or obligation to update this Report to account for events or changes occurring subsequent to the date that the Report was prepared.

The opinions, conclusions and any recommendations in this Report are based on assumptions made by GHD described in this Report. GHD disclaims liability arising from any of the assumptions being incorrect.

2. Methodology

2.1 Desktop Assessment

Prior to the commencement of field surveys, a comprehensive desktop review was undertaken. The desktop review included:

- Adjoining land uses including conservation reserves and other listed areas;
- Broad vegetation types in existing mapping;
- Presence of Threatened Ecological Communities (TECs) and Priority Ecological Communities (PECs);
- Presence or likely occurrence of Declared Rare and Priority Flora;
- Presence or likely occurrence of Threatened and Priority Fauna;
- Remnant vegetation clearing in relation to EPA guidelines;
- Presence of wetlands and public drinking water catchment areas; and
- Other lists of significant areas.

2.2 Field Survey

A field survey was undertaken to verify the desktop study and provide a detailed assessment of the existing environment in the study area and its relationship to adjoining areas.

Survey work was conducted by two experienced GHD ecologists; Glen Gaikhorst and Erin Lynch. The survey consisted of a flora, vegetation and fauna survey designed to complement previous works conducted within the area and was undertaken on 16 - 18 November 2011. In the three month period leading up to the site survey the Witchcliffe (Margaret River District) Bureau of Meteorology Station (station: 009746) recorded 310.8 mm of rainfall.

During the field investigation maximum day-time temperatures ranged from 18^0 C to 21^0 C, with 11.6 mm (from the Witchcliffe Station) of rainfall recorded.

The survey was carried out during the Spring season to target the optimal flowering time for the plant species in the area.

2.2.1 Flora and Vegetation

The flora and vegetation survey was undertaken to provide a description of the dominant vegetation types present, vegetation condition and flora species present at the time of the survey. In particular, the survey was undertaken to identify the presence of any Threatened and Priority flora within the study area and map these if they were present. The survey was also undertaken to describe and map landform, floristic community types and vegetation condition.

The survey methodology GHD employed was consistent with the Environmental Protection Authority (EPA) guidelines for flora surveys as outlined in Guidance

Statement No. 51 Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia (EPA, 2004a) and Terrestrial Biological Surveys as an Element of Biodiversity Protection, Position Statement No. 3 (EPA, 2002).

Field assessment methodology involved sampling three quadrats (10 x 10 m) and two relévés (unbounded search areas) within representative vegetation types. Sections of the alignment were also traversed on foot to record plant species present (visible) particularly targeting areas with habitat for conservation significant species. The location of the sampling sites is shown on Figure 2, Appendix A.

The information recorded at each quadrat and relévé is provided in Table 1.

Table 1 Information recorded at each quadrat and relévé

Location	Coordinates recorded in GDA94 datum using a hand-held Global Positioning System (GPS), to an accuracy usually within 5 m; reading taken for the north-east corner of the quadrat
Physical Features	Aspect, Soil Attributes Percentage surface cover by: rocks, logs and branches, leaf litter, bare open soil
Vegetation Classification	Broad vegetation description
Vegetation Condition	As per Bush Forever Vegetation Condition Rating Scale (Keighery, 1994)
Disturbance	Level and nature of disturbances (e.g. weed presence, fire – and time since last fire, grazing)
Flora	List of flora within quadrat; Measure of plant heights and percentage foliar cover. % Cover classed into ranges (<2%, 2-10%, 10-30%, 30-70%, 70-100%)

2.2.2 Species Identification

Species that were well known to the survey botanists were identified in the field, while species that were unknown were collected and assigned a unique number to facilitate tracking. Plant species were identified by the use of local and regional flora keys and by comparison with the named species held at the Western Australian Herbarium. Plant taxonomists who are considered to be an authority on a particular plant group were consulted, when necessary.

The conservation status of all recorded flora was compared against the current lists available on FloraBase and the *Environment Protection and Biodiversity Act 1999* (EPBC Act) Threatened species database provided by the Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC).

2.2.3 Vegetation Condition

The condition of the vegetation at the project area was assessed using the Vegetation Condition rating scale developed by Keighery (1994) that recognises the intactness of vegetation, which is defined by the following:

- Completeness of structural levels;
- Extent of weed invasion;
- Historical disturbance from tracks and other clearing or dumping; and
- The potential for natural or assisted regeneration.

The scale, therefore, consists of six rating levels as outlined below in Table 2.

Table 2 Vegetation Condition Rating

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

2.2.4 Terrestrial Fauna

The methodology used to undertake the fauna assessment was as follows:

- Opportunistic searching across all habitat types. This ensured that the maximum suite of species potentially occurring at the site was observed. This involved searching through microhabitats including turning over logs or rocks, turning over leaf litter and examining hollow logs. Particular note was taken of any migratory species or significant fauna;

- A night search for significant fauna such as Chuditch, Phascogale, Quokka, Bandicoot, Water Rat, Western Ringtail Possum and Masked Owl;
- Undertaking two nights of Anabat assessment recording micro-bat species in the area;
- Opportunistic visual and aural surveys. This accounted for any bird species potentially utilising the site;
- The site was searched for tracks, scats, bones, diggings and feeding areas for both native and feral fauna;
- Particular note was taken of the presence of any habitats of significance and potential fauna habitat trees;
- An assessment of the value of the roadside in providing habitat and facilitating movement between conservation areas;
- A review of the presence and abundance of pest, declared or feral animals; and
- An inventory species list of all fauna observed.

The survey methodology GHD employed was consistent with the EPA Guidance Note for the Assessment of Environmental Factors for Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia (Guidance Statement No. 56) (EPA, 2004b).

2.3 Survey Limitations

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

Some flora species, such as annuals, are only available for collection at certain times of the year, and others are only identifiable at certain times (such as when they are flowering). Additionally, climatic and stochastic events (such as fire) may affect the presence of plant species. Species that have a very low abundance in the area are more difficult to locate, due to above factors.

Flora composition changes over time, with flora species having specific growing periods, especially annuals and ephemerals (some plants lasting for a markedly brief time, some only a day or two). The composition is also likely to alter as a result of fire. The results of future botanical surveys in this location may differ from the results of this survey. As the survey was conducted during one calendar year as opposed to over a time period of several years, abundance and/or the presence of some annual, ephemeral condition specific species within the study area may vary over time.

The fauna assessment undertaken was a reconnaissance survey only and thus only sampled those species that can be easily seen, heard or have distinctive signs, such as tracks, scats, diggings etc. Many cryptic and nocturnal species would not have been identified during a reconnaissance survey.

The fauna assessment was aimed at identifying habitat types within the study area. In addition, terrestrial vertebrate fauna using the study area were identified. No sampling

for invertebrates or aquatic species occurred. The information available on the identification, distribution and conservation status of invertebrates is generally less extensive than that of vertebrate species.

This survey was carried out during only one season, and in one year. Complete faunal surveys often require multiple surveys, at different times of year, and over a period of a number of years, to enable full survey of all species present.

This assessment considered terrestrial fauna only, freshwater aquatic fauna (fish, freshwater macroinvertebrates, etc.) and marine fauna (cetaceans, marine birds, etc.) were not considered.

3. Existing Environment

3.1 Climate

The Project area experiences a Mediterranean climate, with cool winters and hot summers. The nearest meteorological station is located at Margaret River. A summary of the recorded climatic data from Margaret River is presented in Table 3.

Table 3 Margaret River Climate Data

Mean Annual Maximum Temperature Range:	30.6°C (Feb) and 16.7°C (Jul) (1970-1975)
Mean Annual Minimum Temperature Range:	14.0°C (Feb) and 6.7°C (Sept) (1970-1975)
Mean Annual Rainfall:	1133.0 mm (1929-2011)

(Bureau of Meteorology Climate Statistics for Australian Locations, 2011)

3.2 Adjoining Land Use

The majority of the proposed alignment traverses cleared agricultural land used for predominantly crops, sheep and cattle grazing and viticulture. The alignment also traverses pine plantations, native bushland, conservation reserve, and existing roads and private properties.

3.2.1 Conservation Estates, Reserves and Environmentally Sensitive Areas

North of the Margaret River crossing, the western alignment traverses the Bramley National Park, Keenan State Forest and a small section of timber reserve. The eastern alignment traverses the Keenan State Forest and a timber reserve and lies adjacent to the Bramley National Park (Figure 1). This section of the alignment was excluded from the National Park by request of Main Roads and the Shire of Augusta-Margaret River.

The proposal may potentially seek to excise a section of the National Park dependent on the final road design and defined impact area.

There are no Environmentally Sensitive Areas (ESAs) within or in close proximity to the study area.

3.3 Wetlands, Rivers and other Surface Water Drainage

There are no Wetlands of International Significance (Ramsar Wetlands) or other important wetlands within or in close proximity to the study area.

Margaret River and its tributaries are a proclaimed waterway under the WA *Rights in Water and Irrigation Act 1914* (RIWI Act). The proposed alignment options will traverse Margaret River and two of its tributaries, including Darch Brook.

3.3.1 Public Drinking Water Catchment Areas

Public Drinking Water Source Areas (PDWSAs) is a collective term used for the description of Water Reserves, Catchment Areas and Underground Pollution Control Areas declared (gazetted) under the provisions of the *Metropolitan Water Supply, Sewage and Drainage Act 1909* (MWSSD Act) or the *Country Area Water Supply Act 1947* (CAWS Act). The Department of Water (DoW) Geographic Data Atlas indicates that there are no PDWSAs within the vicinity of the study area.

3.4 Likelihood of Acid Sulphate Soils (ASS)

The DEC (2011) describes Acid Sulphate Soils (ASS) as naturally occurring soils and sediments containing sulphide minerals, predominantly pyrite (an iron sulphide). In an undisturbed state below the water table, these soils are benign and not acidic. However, if the soils are drained, excavated or exposed by lowering of the water table, the sulphides will react with oxygen to form sulphuric acid.

Mapping of ASS by the Western Australian Planning Commission has been prepared for areas of the state, particularly where the impact of ASS has been assessed as being more significant. A review of DEC ASS risk mapping, available through the Landgate Shared Land Information Portal (SLIP), indicates that the majority of the proposed alignment overlies an area of 'no known risk of ASS occurring within 3 m of natural soil surface' with pockets of 'moderate to low risk of ASS occurring within 3 m of the natural soil surface'. If the soil surface is to be disturbed it is recommended that an ASS investigation is undertaken prior to construction to ensure the risk of ASS impacts is understood.

3.5 Vegetation

3.5.1 Bioregion

The study area is located predominantly within the Warren (WAR) bioregion of the Interim Biogeographic Regionalisation for Australia (IBRA) (Department of Conservation and Land Management, 2002). A small section of the alignment is also situated within the Southern Jarrah Forest (JF2) subregion.

The Warren region comprises of dissected undulating country of the Leeuwin Complex, Southern Perth Basin (Blackwood Plateau), South West intrusions of the Yilgarn Craton and western parts of the Albany Orogen. Loamy soils support Karri forest, laterites support Jarrah-Marri forest, leached sandy soils in depressions and as plains support low Jarrah woodlands and paperbark/sedge swamps, and Holocene marine dunes support *Agonis flexuosa* thickets, Banksia woodlands and heaths (Hearn *et al*., 2002a).

The Southern Jarrah Forest subregion comprises of duricrusted plateau of Yilgarn Craton characterised by Jarrah-Marri forest on laterite gravels and, in the easterm part, by Wandoo-Marri woodlands on clayey soils. Eluvial and alluvial deposits support *Agonis* shrublands. In areas of Mesozoic sediments, Jarrah forests occur in a mosaic with a variety of species-rich shrublands (Hearn *et al*., 2002b).

3.5.2 Vegetation Associations

Broadscale vegetation mapping of the study area previously undertaken by Beard (1975) indicates two vegetation associations present within the study area, including:

- Boranup_1: Tall Forest; karri (*Eucalyptus diversicolor*)
- Boranup_3: Medium Forest; jarrah-marri

The study area is situated predominantly within the Boranup_3 vegetation association, with a small section in the north of the alignment occurring within Boranup_1.

The study area is located within the Cowaramup Uplands and Wilyabrup Valley Systems of the Margaret River Plateau. According to vegetation mapping conducted by Mattiske and Havel (1998) the vegetation complexes occurring within the study area are summarised as follows:

- Cowaramup (C1) is comprised of an open to tall open forest of *Eucalyptus marginata* subsp. *marginata* (Jarrah) – *Corymbia calophylla* (Marri) – *Banksia grandis* on lateritic uplands in the hyperhumid zone.
- Wilyabrup (W1) is comprised of tall open forest of *Eucalyptus diversicolor* (Karri) – Corymbia calophylla – *Allocasuarina decussata* – *Agonis flexuosa* (Peppermint) on deeply incised valleys in the hyperhumid zone.
- Cowaramup (Cw1) is comprised of a mixture of open forest to woodland of *Eucalyptus diversicolor* – *Corymbia calophylla* and woodland of *Eucalyptus marginata* subsp. *marginata* – *Corymbia calophylla* on slopes and low woodland of *Melaleuca preissiana* – *Banksia littoralis* on depressions in the hyperhumid zone.

3.5.3 Native Vegetation Extent and Status

A vegetation type is considered under represented if there is less than 30 percent of its original distribution remaining. From a purely biodiversity perspective and not taking into account any other land degradation issues, there are several key criteria now being applied to vegetation clearing (EPA, 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/pre-1750 extent of the vegetation type;
- A level of 10% of the original extent is regarded as being a level representing Endangered; and clearing which would put the threat level into the class below its current level should be avoided.

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

- Presumed Extinct: Probably no longer present in the bioregion
- Endangered*: <10% of pre-European extent remains
- Vulnerable*: 10-30% of pre-European extent exists
- Depleted*: >30% and up to 50% of pre-European extent exists

- Least Concern: >50% pre-European extent exists and subject to little or no degradation over a majority of this area.

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

The extent of remnant native vegetation has been assessed by the Government of Western Australia (2010) and Molloy *et al.* (2007) based on vegetation association mapping undertaken by Beard (1975) and vegetation complexes mapped by Mattiske and Havel (1998), respectively.

The remaining extent of the vegetation associations within the study area based on Government of Western Australia (2010) and Molloy et al. (2007) for the Local Government Area (LGA), and Bioregion, is detailed in Table 4.

Table 4 Vegetation type, extent and status of pre-European vegetation based on Beard (1975) and Mattiske a vegetation mapping

Vegetation Type	Region	Pre-European extent (ha)	Current extent (ha)	% remaining
	IBRA Bioregion Warren*	833,982	667,165	80%
	Shire of Augusta-Margaret River*	233,619	150,535	67.32%
Boranup_1*	Warren Bioregion	69,117	55,534	80.35%
	Shire of Augusta-Margaret River	12,555	7,032	56%
Boranup_3*	Warren Bioregion	250,262	200,890	80.27%
	Shire of Augusta-Margaret River	169,669	114,082	67.24%
Cowaramup (C1)**	Shire of Augusta-Margaret River	18,982	7,903	42
Wilyabrub (W1)**	Shire of Augusta-Margaret River	7,296	4,420	61
Cowaramup (CW1)**	Shire of Augusta-Margaret River	6,144	2,062	34

***** Government of Western Australia (2010)

** Molloy *et al.* (2007)

The extent of the vegetation complexes Cowaramup (C1) and Cowaramup (CW1) are considered to be *Depleted*, i.e. between 30% to 50% of pre-European extent remaining. The extent of the vegetation complex Wilyabrub (W1) and the two Beard vegetation associations within the study area are considered of *Least Concern*, i.e. intact, with over 50% of the pre-European extents remaining.

The Beard and Mattiske vegetation associations and complexes present in the study area all retain more than the threshold level (30%) recommended in the National Objectives Targets for Biodiversity Conservation, below which species loss appears to accelerate exponentially at an ecosystem level (Commonwealth of Australia, 2001). Furthermore, the study area does not occur within an extensively cleared landscape as approximately 67% of pre-European vegetation extent remains in the Shire of Augusta-Margaret River.

3.5.4 Threatened Ecological Communities

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

The DEC maintains a list of TECs which have been endorsed by the Minister for the Environment (August 2010). Some of these TECs are protected under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). DEC listed ecological communities are given special consideration in environmental impact assessments and have special status under the land clearing regulations of the *Environmental Protection Act 1986* (EP Act). The EPA's position on TECs states that proposals that result in the direct loss of TECs are likely to require formal assessment.

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

A search of the EPBC Act Protected Matters Search Tool database revealed no known TECs to occur within 5 km of the study area.

No State or Federally listed TECs or PECs were identified within 5 km of the study area.

3.6 Flora Diversity

A NatureMap search identified 379 flora taxa collected within 5 km of the study area; 95 of which are naturalised (introduced) taxa. Results of this search are provided in Appendix C. Given that large parts of the study area are cleared and used for cropping and grazing, it is very unlikely all species recorded in the general area are present.

3.6.1 Threatened and Priority Flora

Threatened flora species are protected under both State and Commonwealth Acts. Any activities that are deemed to have a significant impact on species that are

recognised by the EPBC Act and/or the State *Wildlife Conservation Act 1950* (WC Act) can trigger referral to DSEWPaC and/or the EPA.

Also in Western Australia, DEC produces a supplementary list of Priority Flora, these being species that are not considered Threatened under the WC Act but for which the Department feels there is a cause for concern. These species have no special legislative protection, but their presence would normally be considered relevant to an assessment of the conservation status of an area. Such taxa need further survey and evaluation of conservation status before consideration can be given to declaration as threatened flora.

Relevant Commonwealth and State conservation codes are provided in further detail in Appendix B and results of desktop searches provided in Appendix C.

The EPBC Act Protection Matters search tool identified five Endangered flora species as potentially occurring within 5 km of the study area. The DEC database query identified the potential presence of six Threatened and 32 Priority species within 3 km of the project area. Of these Priority flora, four species have been recorded within 500 m of the alignment, including *Hemigenia rigida* (P1), *Franklandia triaristata* (P4), *Gastrolobium formosum* (P3) and *Gahnia sclerioides* (P3).

However it has been advised by Mrs Melanie Smith, Senior Botanist at DEC, that there are some taxonomic issues associated with the records of the Priority 1 *Hemigenia rigida*. The name *H. rigida* was mis-applied to *H. pritzelii* (in the absence of reference/type material of either species at the WA Herbarium), which is a very common species in the south-west. The true *H. rigida* is only known from two collections near Wagin, hence warranting Priority 1 status. Therefore the records of *H. rigida* in the Margaret River region should be deemed to be the common species, *H. pritzelii*, and not the one which is of conservation significance (M. Smith pers comm., March 2012).

Conservation significant flora identified in the database searches are listed in Table 5.

Table 5 Conservation significant flora identified from the desktop assessment

Species	Listing under WC Act or DEC Priority List	Listing under EPBC Act	Source of Information	
			EPBC Act Protected Matters Search	DEC Database search
Caladenia excelsa	Threatened	Endangered	+	+
Caladenia lodgeana	Threatened			+
Caladenia hoffmanii	Threatened	Endangered	+	
Caladenia winfieldii	Threatened	Endangered	+	
Centrolepis caespitosa	Priority 4	Endangered	+	

Species	Listing under WC Act or DEC Priority List	Listing under EPBC Act	Source of Information	
			EPBC Act Protected Matters Search	DEC Database search
Sphenotoma drummondii	Threatened	Endangered	+	
Drakaea micrantha	Threatened	Vulnerable		+
Acacia inops	Priority 3			+
Acacia lateriticola (Glabrous variant)	Priority 3			+
Acacia subracemosa	Priority 3			+
Acacia tayloriana	Priority 4			+
Astroloma sp. Nannup	Priority 4			+
Franklandia triaristata	Priority 4			+
Boronia anceps	Priority 3			+
Boronia capitata gracilis	Priority 3			+
Boronia tetragona	Priority 3			+
Bossiaea disticha	Priority 3			+
Caladenia abbreviata	Priority 3			+
Conospermum paniculatum	Priority 3			+
Dampiera heteroptera	Priority 3			+
Franklandia triaristata	Priority 4			+
Gahnia sclerioides	Priority 3			+
Galium leptogonium	Priority 3			+
Gastrolobium formosum	Priority 3			+
Grevillea brachystylis brachystylis	Priority 3			+
Grevillea bronwenae	Priority 3			+
Hemigenia rigida	Priority 1			+
Hybanthus volubilis	Priority 2			+
Hypocalymma cordifolium minus	Priority 4			+
Juncus meianthus	Priority 2			+

Species	Listing under WC Act or DEC Priority List	Listing under EPBC Act	Source of Information	
			EPBC Act Protected Matters Search	DEC Database search
Lambertia rariflora rariflora	Priority 4			+
Leptomeria furtiva	Priority 2			+
Meeboldina thysanantha	Priority 3			+
Pimelea ciliate longituba	Priority 3			+
Pultenaea pinifolia	Priority 3			+
Thomasia laxiflora	Priority 3			+
Tripterococcus brachylobus	Priority 4			+
Xyris maxima	Priority 2			+

An assessment of the likelihood of occurrence of the threatened and priority listed species listed has been prepared and is provided in Appendix E. The likelihood of occurrence has been assessed based on the known locations and distributions of the species and habitat requirements. This assessment has identified 23 taxa that may possibly occur within the study area and 15 taxa that are unlikely to occur in the study area due to the absence of suitable habitat.

3.7 Terrestrial Fauna

3.7.1 Fauna Diversity

A NatureMap search identified 178 fauna species recorded from within 5 km of the study area. This includes 120 birds, 19 reptiles, 7 amphibians, 17 mammals, 1 fish, 1 crustacean and 13 invertebrates. Nine naturalised (introduced) species have been previously recorded in the area. Results of this search are shown in Appendix C.

3.7.2 Pest Species

Nine introduced species were identified from desktop assessment and include Laughing Turtle Dove, Laughing Kookaburra, Sulphur-crested Cockatoo, Mallard, Fox, Cat, European Rabbit, Black Rat and Common Furniture Beetle.

3.7.3 Threatened and Priority Fauna

Threatened fauna species are protected under both State and Commonwealth Acts. Any activities that are deemed to have a significant impact on species that are

recognised by the EPBC Act and/or the WC Act can trigger referral to the DSEWPaC and/or the EPA.

Also in Western Australia, the DEC produces a supplementary list of Priority Fauna, these being species that are not considered Threatened under the WC Act but for which the Department feels there is a cause for concern. These species have no special legislative protection, but their presence would normally be considered relevant to an assessment of the conservation status of an area. Such taxa need further survey and evaluation of conservation status before consideration can be given to declaration as threatened fauna.

Relevant Commonwealth and State conservation codes are provided in further detail in Appendix B and results of desktop searches provided in Appendix C.

The desktop queries identified twelve EPBC Act and WC Act threatened species and a further five marine and/or migratory bird species. Six additional DEC listed Priority fauna species have been recorded within 5 km of the study area. Conservation significant fauna identified in the database searches are listed Table 6.

Table 6 Threatened and Priority fauna identified from the desktop assessment

Species	Common Name	Listing under WC Act or DEC Priority List	Listing under EPBC Act	Source of Information	
				EPBC Act Protected Matters Search	NatureMap
Birds					
Calyptorhynchus banksii naso	Forest Red-tailed Black Cockatoo	Schedule 1	Vulnerable	+	+
Calyptorhynchus baudinii	Baudin's Black Cockatoo	Schedule 1	Vulnerable	+	+
Calyptorhynchus latirostris	Carnaby's Black Cockatoo	Schedule 1	Endangered	+	+
Botaurus poiciloptilus	Australasian Bittern	Schedule 1	Endangered	+	
Falco peregrinus macropus	Peregrine Falcon	Schedule 4			+
Tyto novaehollandiae novaehollandiae	Masked Owl (SW pop.)	Priority 3			+
Ixobrychus flavicollis australis	Black Bittern	Priority 3			+
Mammals					
Dasyurus geoffroii	Chuditch	Schedule 1	Vulnerable	+	+
Setonix brachyurus	Quokka	Schedule 1	Vulnerable	+	
Pseudocheirus occidentalis	Western Ringtail Possum	Schedule 1	Vulnerable	+	+
Phascogale tapoatafa tapoatafa	Southern Brush-tailed Phascogale	Schedule 1	Vulnerable	+	

Species	Common Name	Listing under WC Act or DEC Priority List	Listing under EPBC Act	Source of Information	
				EPBC Act Protected Matters Search	NatureMap
Isoodon obesulus fusciventer	Southern Brown Bandicoot	Priority 5		+	
Hydromys chrysogaster	Water Rat	Priority 4		+	
Macropus irma	Western Brush Wallaby	Priority 4			+
Amphibia					
Geocrinia alba	White bellied Frog	Schedule 1	Endangered	+	
Crustaceans					
Cherax tenuimanus	Margaret River (Hairy) Marron	Schedule 1	Critically Endangered	+	+
Fishes					
Geotria australis	Pouched Lamprey	Priority 1			+
Nannatherina balstoni	Balston's Pygmy Perch	Schedule 1	Vulnerable	+	
Migratory Birds					
Haliaeetus leucogaster	White-bellied Sea-Eagle		Migratory	+	
Apus pacificus	Fork-tailed Swift		Migratory	+	
Merops ornatus	Rainbow Bee-eater		Migratory	+	+
Ardea alba	Great Egret		Migratory	+	+
Ardea ibis	Cattle Egret		Migratory	+	

Given that large parts of the study area have been cleared for agriculture and grazing, with a minimal amount of habitat suitable for native fauna, it is unlikely that all of these species would be present within the study area. An assessment of the likelihood of occurrence of the threatened and priority listed species listed has been prepared and is provided in Appendix E. The likelihood of occurrence has been assessed based on the known locations and distributions of the species, habitat requirements and observations made during the field assessment.

4. Field Survey Results

4.1 Flora and Vegetation

4.1.1 Vegetation Types

Six vegetation types were identified within the study area, including cleared farmland, pine plantations, and previously cleared/highly degraded or planted vegetation. Remnant vegetation remaining within the study area consisted predominantly of Jarrah/Marri Forest with emergent Peppermint trees in gullies and along the river and creek lines.

The vegetation types identified within the study area are described in detail in Table 7 and mapped on Figure 2, Appendix A.

Table 7 Vegetation types recorded within the study area

Broad Vegetation Type	Vegetation Description	Vegetation Condition	Representative Survey Sites	Photograph
Jarrah-Marri Open Forest	Open Forest of *Eucalyptus marginata* (Jarrah) and *Corymbia calophylla* (Marri) over Scattered *Banksia grandis* over Shrubland of *Hovea trisperma*, *Xanthorrhoea preissii* and *Acacia saligna* over Open Low Heath of *Hibbertia hypericoides*, *Hakea* spp., and *Leucopogon* spp. over Open Herbland of *Patersonia umbrosa* var. *xanthina*, *Opercularia hispidula* and *Lindsaea linearis* and Very Open Sedgeland of *Desmocladus flexuosus*, and *Lepidosperma gracile* on undulating slopes with granite basement rock.	Very Good (3) History of logging	Q1, Q2, Q3	
Jarrah-Marri-Peppermint Forest	Open Forest of *Eucalyptus marginata* (Jarrah) and *Corymbia calophylla* (Marri) over Low Open Forest of *Agonis flexuosa* (Peppermint), *Callistachys lanceolata* and *Taxandria linearifolia* over Mixed Shrubland over Open Herbland of *Pteridium esculentum*, *Johnsonia lupulina* and *Agrostocrinum hirsutum* over Sedgeland of *Lepidosperma tetraquetrum, L. gracile* and *L. effusum* in valleys, river banks and creeklines.	Very Good (3) to Good (4) Disturbances include introduced species/weeds, clearing and logging.	R2, walking transects	

Broad Vegetation Type	Vegetation Description	Vegetation Condition	Representative Survey Sites	Photograph
Closed Scrub	Closed Tall Scrub of *Melaleuca incana* subsp. *incana*, *Taxandria linearifolia* and *Agonis flexuosa* over Herbland of *Pteridium esculentum* over Sedgeland of *Juncus* spp., *Gahnia decomposita* and *Lepidosperma squamatum* along winter-wet depressions/minor creek lines.	Very Good (3) Disturbances include weeds and pedestrian tracks.	R1, walking transect	
Cleared Farmland	Area is generally 'parkland cleared' with flora comprising of weed or crop species with some isolated stands or larger patches of native trees (Jarrah and Marri).	Completely Degraded (6) Predominantly cleared, vegetation structure no longer intact.	-	

Broad Vegetation Type	Vegetation Description	Vegetation Condition	Representative Survey Sites	Photograph
Pine Plantation	Planted *Pinus* spp.	Completely Degraded (6) Predominantly cleared, vegetation structure no longer intact.	-	
Highly Disturbed/ Planted	Area has previously been cleared and/or consists of predominantly planted/introduced species.	Completely Degraded (6) Predominantly cleared, vegetation structure no longer intact.	-	

4.1.2 Threatened and Priority Ecological Communities

The field survey did not identify any potential TECs or PECs within the study area.

4.1.3 Vegetation Condition

The condition of the vegetation within the study area ranged from *Very Good* (3) to *Completely Degraded* (6). The majority of the study area was considered to be *Completely Degraded*. Some two thirds of the study area traverses cleared agricultural land used for predominantly crops, sheep and cattle grazing and viticulture. The alignment also traverses pine plantations, native bushland, conservation reserve, and existing roads and private properties. The remaining one third of the study area consists of native vegetation of predominantly Jarrah/Marri Forest and riparian vegetation. The Jarrah/Marri Forest has been historically logged

The area of remnant vegetation between the pine plantations and Margaret River is generally in very good condition however it has been historically logged and has had a fire within the last 10-15 years. This vegetation is considered to be in *Very Good* condition.

The vegetation condition of the study area is mapped in Figure 3, Appendix A.

4.1.4 Flora Diversity

A total of 168 plant taxa (including subspecies and varieties), representing 52 plant families and 116 genera, was recorded from the study area. This total is comprised of 134 native species and 34 introduced (exotic) species.

Dominant families recorded from the study area included:

- Fabaceae 27 taxa;
- Poaceae 14 taxa;
- Myrtaceae 13 taxa; and
- Proteaceae 9 taxa.

Nine of the collections could not be identified to species level, and two species to genus due to the absence of adequate material including flowering parts and/or fruiting bodies.

A full list of flora species present in the study area is provided in Table 11, Appendix D.

4.1.5 Introduced Flora

Remaining areas of native vegetation within the study area are generally in very good condition and contained minimal, non-aggressive, weed species. However a large proportion of the study area has been cleared and/or disturbed and is dominated by introduced pasture grasses and herb species. A number of introduced trees and shrubs have also been planted along road verges and private properties. Not all of these species were collected and recorded from the study area.

A total of 34 introduced/weed species were recorded within the study area. Of these, two species, **Lantana camara* (Lantana) and **Hypericum perforatum* (St. John's wort) are listed as Declared Plants under Section 37 of the *Agricultural and Related Resources Protection Act 1976*.

Lantana is listed as a P1; for the whole of the State which prohibits movement of plants or their seeds within the State. Lanatana is also listed as a Weed of National Significance (WONS) by the Australian Government. In WA, lantana invades areas along rivers and near wetlands, usually when birds spread the seeds. One plant (which appeared planted) was recorded in a disturbed area adjacent to the Margaret River DEC office.

St John's wort is a perennial plant that reproduces from seed and from creeping underground rhizomes. The plants do not flower in their first year, but flower and seed prolifically in later years. Seeds may survive in the soil for up to six years before germination (DAFWA, 2011). This species can densely infest grazing land, particularly when pastures get denuded. This species was recorded along a track near the DEC office. St John's wort is not listed Declared within the Shire of Augusta-Margaret River.

4.1.6 Threatened and Priority Flora

No Threatened flora was recorded from the study area during the field survey. One Priority Flora species was recorded from the study area:

- *Gastrolobium formosum* (Priority 3)

Gastrolobium formosum is a small, trailing shrub, to 1 m high. Flowers are red, flowering in November. This species occurs in clay loam along river banks or in swamps. A population of approximately 20 individuals of *G. formosum* was recorded along the northern bank of Margaret River within the western alignment option.

Plate 1 *Gastrolobium formosum*

The locations of the Priority flora recorded within the study area are mapped on Figure 2, Appendix A.

It is recommended that a targeted search *G. formosum* be undertaken once the road design has been finalised and the known impact area is defined. This would include recording the location and population size of *G. formosum* within the alignment for the purpose of identifying the extent of impact the proposal may have on this species.

4.2 Fauna

4.2.1 Fauna Diversity

During the survey, 82 species comprised of 56 birds, 9 reptiles, 3 amphibians and 14 mammals were recorded within the project area. Of these, four introduced/pest species were recorded.

Fauna recorded during the survey area listed in Appendix D.

4.2.2 Conservation Significant Fauna

Four fauna species listed as Vulnerable under the EPBC Act and Schedule 1 under the WC Act were recorded during the field survey. The following conservation significant species were observed during the field assessment.

Baudin's Black Cockatoo (*Calyptorhynchus baudinii*) Schedule 1, Vulnerable

Baudin's Black 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*) (DSEWPaC, 2011). 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 trees throughout its range as this species is its principal food source. Baudin's Black Cockatoo has been listed as Vulnerable under the EPBC Act and as Schedule 1 under the WC Act.

Observations: A pair of Baudin's Black Cockatoo's was observed feeding (on Marri) in Lot 2150 and had one juvenile present. This individual was observed begging for food, suggesting it was this season's young and that the pair had bred in the area. Several individual birds were feeding close by, also on Marri. Due to the amount of feeding trees (and feeding observations) available in the remnant vegetation areas and treed areas within paddocks this species is considered to be endemic and to utilise the area opportunistically for feeding. The same areas had trees suitable for breeding and combined with the above observations it is likely that the area is potentially used for breeding.

Within the study area there are 123 potential Black Cockatoo breeding trees. The locations of these trees are mapped in blue on Figure 5, Appendix A. These trees are Jarrah, Marri or eucalyptus stags and contain nesting hollows suitable for Black Cockatoo breeding. A further 445 trees were identified as a size suitable for the development of nesting hollows (>500 mm at DBH) within the next 100 years. These trees are mapped in yellow on Figure 5, Appendix A. The total area of Black Cockatoo

feeding habitat within the study area is approximately 14.6 ha. Cockatoo feeding habitat is mapped on Figure 4, Appendix A.

Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) Schedule 1, Vulnerable

The Forest Red-tailed Black Cockatoo species is essentially a cockatoo of the Jarrah forest (*Eucalyptus marginata*) but also uses Marri (*Corymbia calophylla*) and woodlands for foraging, with Marri seeds (along with Jarrah) being its principal food source (DSEWPaC, 2011). This species is also known to feed on *Allocasuarina* spp. and introduced species (DSEWPaC, 2011). The Forest Red-tailed Black Cockatoo has reduced in range due to habitat loss and now persists in the Jarrah forest of the South West.

Observations: This species was observed and heard several times during the field assessment. In remnant vegetation and stands of trees in paddocks observations of feeding on Jarrah and Marri nuts were made. Like the Baudin's Black Cockatoo the Forest Red-tailed Black Cockatoo would utilise the area for both feeding and breeding as required. Areas calculated are the same as for the Baudin's Black Cockatoo.

Western Ringtail Possum (*Pseudocheirus occidentalis*) Schedule 1, Vulnerable

Western Ringtail Possums occur only in the south west region of Western Australia where they feed upon Peppermint (*Agonis flexuosa*) and Eucalyptus trees. Around urban environments the species is known to feed on introduced species favouring fruit trees, roses and *Ficus* species. The species is now restricted to wetter coastal areas of the south west; with smaller populations occurring inland in Jarrah, Wandoo and Marri forests (Menkhorst, 2004).

Observations: During the field survey three active individuals were observed at night along riparian vegetation in the northern section of the alignment. Two dreys (resting platforms in trees) were also recorded in this area and their locations are presented in Figure 4, Appendix A. Droppings were also recorded along Margaret River in the riparian vegetation and in the valley of Lot 2150. One hundred and twenty-three large Eucalypts were recorded within the alignment which had hollows suitable for this species. The area of core habitat that Western Ringtail Possums may utilise is approximately 1.71 ha.

Note: Common Brush-tailed Possums were also recorded throughout the alignment via sightings and droppings. This is a common species and can live along-side Western Ringtail Possums.

Plate 2 Western Ringtail Possum in riparian vegetation

Plate 3 Droppings of both Common Brushtail Possum (large ones) and Western Ringtail Possum on a large log.

Southern Brush-tailed Phascogale (*Phascogale tapoatafa tapoatafa*) Schedule 1, Vulnerable

The Southern Brush-tailed Phascogale (SBTP) is observed in dry sclerophyll forests and open woodlands with a generally sparse understorey. This species' habitat requirements also include hollow-bearing trees, rotted stumps or tree cavities which they use as nest sites (Van Dyck and Strahan, 2008). Tree hollows that have a small and secure entrance with a large internal cavity are highly favoured by breeding SBTPs. Southern Brush-tailed Phascogale will also use existing bird's nests as their small size and weight allows them to use such existing nests successfully (Van Dyck and Strahan, 2008).

Habitat clearing and fragmentation as a result of agriculture and land development; and habitat alteration from logging and mining have reduced the availability of trees with hollows required for this species to nest and breed. Another cause for decline of

this species is predation by foxes and cats. What suitable habitat remains is often fragmented, isolating populations and impeding genetic exchange.

Observations: No sightings of the species were recorded during the field survey; however a dropping was recorded on a log in Lot 2150 that is thought to be of a SBTP. The remnant areas of habitat in the project area including Lot 2150 have suitable trees with hollows and excellent ground coverage of logs. It is likely that SBTP would be in the project area within the remnant areas of vegetation.

Plate 4 SBTP dropping from Lot 2150.

4.2.3 Fauna Habitats

The project area contains three broad fauna habitat types based on predominant landforms, soil and vegetation structure in the area. Habitat types within the project area closely correspond with the broad vegetation types described previously. These habitat types are described as follows:

- Riparian
- Riverine
- Jarrah/Marri Forest

The location of these habitat types is the same as mapped for the Vegetation Types (Figure 2), described in section 4.1.1 and listed in Table 8.

Table 8 Significant fauna habitats types within the alignment

Habitat Type	Vegetation Community	Potential Species Use	Image of Typical Habitat
Riparian	Jarrah-Marri-Peppermint Open Forest with dense understorey of sedges with logs. Some sections have *Melaleuca* spp. present.	Western Ringtail Possum Quokka Chuditch Southern Brush-tailed Phascogale Southern Brown Bandicoot Western Brush Wallaby	
Riverine	No vegetation community but associated riparian vegetation and fallen logs and branches in the water all provide habitat.	Hairy Marron Water Rat Both Bitterns Pouched Lamprey Great Egret White-breasted Sea Eagle Peregrine Falcon	
Jarrah/ Marri Forest	Marri/Jarrah Forest with logs and granite outcropping.	All Black Cockatoos Chuditch Southern Brush-tailed Phascogale Brush Wallaby Australian Masked Owl Peregrine Falcon	

The majority of the project area was disturbed and contained minimal native vegetation which would offer suitable habitat for native fauna. However, all of the habitat types listed above would offer value as habitat for native fauna including some conservation significant species. These species are discussed further in the Likelihood of Occurrence table in Appendix E.

4.3 Potential Offset Lot 2150

Lot 2150 is approximately 36 ha in size and is positioned on the eastern side of Margaret River, west of the proposed alignment. The Lot is not fenced and is divided

into two by a transmission line corridor. The vegetation of the Lot is primarily Marri/Jarrah Forest but does get some emergent Peppermint in the valley, close to Darch Brook. Historically the area has been logged, but does contain some large stags and mature Marri and Jarrah with hollows. The ground has good cover of litter and in particular large logs for species to hide in. There are some weed effects on the edges of the block due to grazing on the site and lack of fencing for livestock, however the vegetation condition improves from around 10-20 m in from the edge. Three threatened fauna species were observed on the site, including Baudin's Black Cockatoo, Southern Brush-tailed Phascogale and Western Ringtail Possum.

The Lot could be considered as a good site to use as an offset for threatened fauna of the area. The Lot can also be considered significant as an area of remnant vegetation/fauna refuge adjacent to the existing north-south habitat corridor along Darch Brook.

5. Assessment against the 10 Clearing Principles

Any clearing of native vegetation will require a permit under Part V Division 2 of the *Environmental Protection Act 1986* (EP Act), except where an exemption applies under Schedule 6 of the Act or is prescribed by regulation in the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*, and it is not in an Environmentally Sensitive Area (ESA).

Table 9 provides an assessment of the proposed project against the "10 Clearing Principles" as outlined in Schedule 5 of the Environmental Protection Amendment Act 2003 to determine whether it is at variance to the Principles. These Principles aim to ensure that all potential impacts resulting from removal of native vegetation can be assessed in an integrated way.

An assessment of the proposed project has identified that the project is at variance with Principles (b) and (f), may be at variance with Principles (a), (g), (h), and (i) and is unlikely to be at variance with Principles (c), (d), (e), and (j).

Table 9 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 majority of the proposed alignment traverses through cleared agricultural land which contains some individual stands and patches of mature Jarrah and Marri trees. The alignment also traverses through pine plantations, native bushland, conservation reserve, and existing roads and private properties. Only a small section of the alignment adjacent to the Margaret River contains remnant vegetation in very good condition. The dominant vegetation community within the project area is Jarrah (*Eucalyptus marginata*) and Marri (*Corymbia calophylla*) Open Forest with Peppermint (*Agonis flexuosa*) dominant along rivers and drainage lines. No Priority Ecological Communities (PECs) have been recorded within the project area. No Priority listed fauna were recorded in the study area during the field survey. However five Priority fauna species have previously been recorded within 5 km of the project area (NatureMap, 2011). One Priority flora species *Gastrolobium formosum* (P3) was recorded within the project area. A population of *G. formosum* (approximately 20 individuals) was recorded along the northern bank of the Margaret River within the western alignment option. It is recommended that a targeted search for *G. formosum* be undertaken once the road design has been finalised and the known impact area is defined. This would include recording the location and population size of *G. formosum* within the alignment for the purpose of identifying the extent of impact the proposal may have on this species. Vegetation within the project area is considered to represent moderate species diversity, with a total of 168 taxa from 52 families recorded, of which 34 are introduced species. The vegetation has had a combination of previous disturbances including large-scale clearing, roads/tracks and logging. Given the relatively small size of the project area and the availability of similar vegetation in the surrounding area, the loss of vegetation within the project area is unlikely to significantly reduce the biodiversity of the local area.	The proposal may be at variance to the principle.

Principle Number	Principle	Assessment	Outcome
(b)	Native vegetation should not be cleared if it comprises the whole or part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous Western Australia.	The desktop queries identified twelve EPBC Act and WC Act threatened species and a further five marine and/or migratory bird species as potentially occurring within the study area. Six additional DEC listed Priority fauna species have been recorded within 5 km of the study area. Three fauna species listed as Vulnerable under the EPBC Act and Schedule 1 under the WC Act were recorded within the project area during the field survey, including Baudin's Black Cockatoo, Western Ringtail Possum and Forest Red-tailed Black Cockatoo. Additionally, the Southern Brush-tailed Phascogale which is also listed as Vulnerable and Schedule 1 was recorded in the nearby Lot 2150 (potential offset area). There is potential that this species also occurs within remnant vegetation within the alignment. Potential feeding and breeding habitat for Black Cockatoos within the project area includes Jarrah, Marri and *Banksia grandis*. Within the project area there is a total of 14.6 ha of Black Cockatoo feeding habitat (includes both alignment options). There are 123 trees (Jarrah/Marri/eucalypt stags) within the study area which contain nesting hollows suitable for Black Cockatoo breeding. A further 445 trees were identified as a size suitable for the development of nesting hollows (>500 mm DBH) within the next 100 years. During the field survey three Western Ringtail Possums were observed active at night along riparian vegetation in the northern section of the alignment. Two dreys (resting platforms in trees) were also recorded in this area. Droppings were also recorded along Margaret River in the riparian vegetation and in the valley of Lot 2150. One hundred and twenty-three large Eucalypts were recorded within the alignment with hollows suitable for this species. The area of core habitat that Western Ringtail Possums may utilise is approximately 1.7 ha.	The proposal is at variance to the principle.
(c)	Native vegetation should not be cleared if it includes, or is necessary for the continued existence of, rare flora.	No Threatened flora species listed under the WC Act or EPBC Act have been recorded within the project area.	The proposal is unlikely to be at variance with the principle.

Principle Number	Principle	Assessment	Outcome
(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.	There are no known Threatened Ecological Communities (TECs) within 10 km of the project area. No TECs were recorded within the project area during the field survey.	The proposal is unlikely to be 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 vegetation within the study area is described as Beard vegetation association 1 and 3 and Mattiske vegetation complexes Cowaramup (C1), Cowaramup (CW1) and Wilyabrub (W1). The extent of the vegetation complexes C1 and CW1 are considered to be *Depleted*, i.e. between 30% and 50% of pre-European extent remaining. The extent of the vegetation complex W1 and Beard vegetation associations 1 and 3 are considered of *Least Concern*, i.e. intact, with over 50% of the pre-European extents remaining. The Beard and Mattiske vegetation associations and complexes present in the study area all retain more than the threshold level (30%) recommended in the National Objectives Targets for Biodiveristy Conservation, below which species loss appears to accelerate exponentially at an ecosystem level (Commonwealth of Western Australia, 2001). Furthermore, the study area does not occur within an extensively cleared landscape as approximately 67% of pre-European vegetation extent remains in the Shire of Augusta-Margaret River. The vegetation within the project area is described as predominantly Beard vegetation association 3, with a small section in the north of the project area described as Beard vegetation association 1. Main Roads have proposed to offset the loss of vegetation as a result of the proposed project.	The proposal is unlikely to be at variance with the Principle.

Principle Number	Principle	Assessment	Outcome
(f)	Native vegetation should not be cleared if it is growing in or in association with a watercourse or wetland.	There are no listed significant wetlands or watercourses within the project area. However, the proposed project area traverses a section of the Margaret River and two of its tributaries (including Darch Brook). Vegetation associated with these waterways includes Jarrah-Marri-Peppermint Forest and Closed Scrub of *Melaleuca* spp. over mixed Sedgeland. Water flow within these waterways should be maintained and where possible no diversion of watercourses be carried out. Direct impact on riparian vegetation and associated habitat should be avoided wherever possible. Vegetation retention within drainage lines will help prevent erosion and flooding and prevent potential deleterious impacts on downstream areas.	The proposal is 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.	The soils within the project area consist of loamy gravels, duplex sandy gravels, semi-wet soils and grey deep sand duplexes with some granite outcropping. Soil erosion and water erosion may occur on these soils, particularly along the river and creeklines. The clearing of native vegetation may cause some alterations to the health of adjacent lands including the introduction/spread of dieback, soil erosion and runoff and weed dispersal. To reduce the potential impacts of clearing within the project area, in particular the area within and/or adjacent to the National Park, specific management plans will be required for the management of dieback, runoff and erosion, invasive species (weeds) and fire.	The proposal may be at variance with the Principle.

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.	There are no Environmentally Sensitive Areas (ESAs) within or in close proximity to the study area. North of the Margaret River crossing, the western alignment traverses through the Bramley National Park, Keenan State Forest and a small section of timber reserve. The eastern alignment only traverses through the Keenan State Forest and timber reserve and lies adjacent to the Bramley National Park. This section of the alignment was excluded from the National Park by request from Main Roads and the Shire of Augusta-Margaret River. The proposal may potentially seek to excise a section of the National Park dependent on the final road design and defined impact area. The proposed road will create a barrier for fauna movement between the western and eastern boundaries of the alignment within the National Park. However Main Roads have proposed to create wildlife corridors along the alignment to facilitate the movement of fauna between conservation areas. To reduce potential impacts, clearing within the section of remnant vegetation within and/or adjacent to the Bramley National Park, will require specific plans for the management of flora and fauna, dieback, erosion and invasive species (weeds) and fire. The extent of potential impacts to the National Park is dependent on which of the two road alignments is selected.	The proposal may be 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.	The proposed project area traverses the Margaret River and two of its tributaries (including Darch Brook). There is a risk of runoff with additional sediment entering these waterways during the clearing and construction of the proposed project. A management plan will be required to assess and manage these potential impacts. The groundwater salinity in the area is low and given the scale of the proposed clearing, it is unlikely deterioration of underground water quality will result.	The proposal may be at variance with the Principle

Principle Number	Principle	Assessment	Outcome
(j)	Native vegetation should not be cleared if the clearing of the vegetation is likely to cause, or exacerbate, the intensity of flooding.	A large proportion of the project area is presently cleared for agricultural purposes or consists of planted/introduced species. Given the nature of the soil within the project area and the scale and linear nature of the proposed clearing, it is not considered likely to cause, or exacerbate, the intensity of flooding. Any potential impacts can be mitigated through the use of appropriate management actions/plans.	The proposal is unlikely to be at variance with the Principle.

6. Environmental Impacts and Approvals

6.1 Commonwealth Approvals

6.1.1 Referral to the Department of Sustainability, Environment, Water, Populations and Communities (DSEWPaC)

Referral to DSEWPaC under the EPBC Act is triggered if a proposed action has/or potentially has a significant impact on Matters of National Environmental Significance (MNES). An assessment against each of these issues is shown in Table 10.

Table 10 Assessment of the proposal against Matters of National Environmental Significance

Matters of National Environmental Significance	Present	Impact
World Heritage Places	No	None
National Heritage Places	No	None
Ramsar Wetlands	No	None
Threatened species and ecological communities	Yes – Potential black cockatoo feeding and breeding habitat and Western Ringtail Possum habitat.	Removal of up to 14.6 ha of potential black cockatoo feeding/breeding habitat (includes both alignment options). Removal of up to 1.7 ha of core Western Ringtail habitat.
Listed Migratory Species	May be present	No significant impacts
Commonwealth marine areas	No	None
Nuclear Actions	No	None

DSEWPaC considers that an action is likely to have a significant impact on one or more of the three black cockatoo species if there is a real chance or possibility that it will result in one or more of the following:

- Any clearing of breeding habitat in woodland stands of 0.5 ha or more that contains 3 or more breeding trees of suitable size (i.e. a DBH greater than 500 mm);
- Any clearing of known breeding trees of suitable size (i.e. a DBH greater than 500 mm);
- Clearing of more than 1 ha of foraging habitat;

- Creation of a new gap of more than 4 km between patches of black cockatoo habitat;
- Clearing of a known roosting site (including individual trees used for roosting);
- Shooting of birds or taking of eggs or chicks from the wild;
- Introduction of invasive species such as honey bees that creates competition for hollows;
- Spreading of known plant diseases such as *Phytophthora*; or
- Altering hydrology or fire regimes so that black cockatoo habitat of more than 1 ha would become degraded or destroyed.

The field survey recorded 123 potential Black Cockatoo breeding trees (Jarrah, Marri and eucalypt stags) with suitable nesting hollows. A further 445 trees were identified as a size suitable for the development of nesting hollows (>500 mm at DBH) within the next 100 years. The total area of Black Cockatoo feeding habitat within the study area is approximately 14.6 ha. However these calculations are based on the current study area which includes two alignment options north of the Margaret River. The proposed project is considered likely to result in a number of criteria listed above and as such, referral of the project under the EPBC Act is likely to be required.

Western Ringtail Possums were also assessed by habitat usage. Within the alignment, approximately 1.7 ha was identified as being core habitat for the Western Ringtail Possum. Referral may be required based on the loss of habitat and impacts on this species.

The clearing area required for the proposed project is currently unknown as the design of the alignment is only at the preliminary stages and is not yet finalised. A further assessment will be necessary of the potential impacts to significant fauna habitat once the alignment has been finalised and a clearing boundary identified.

6.2 State Approvals

6.2.1 Referral to the Environmental Protection Agency (EPA)

Projects may require referral to the EPA under Part IV of the EP Act, if the project will have significant impacts on any of the following matters:

- Native remnant vegetation;
- Rare flora and fauna species and threatened communities;
- Wetlands;
- Watercourses and rivers;
- Estuaries and inlets;
- Coastlines and near shore marine areas;
- Catchments with special requirements;
- Contaminated soils;

- Noise and vibration;
- Public Drinking Water Source Areas – groundwater and surface water;
- Aboriginal heritage;
- European heritage; or
- Adjacent land uses.

The proposed project is likely to have an impact on two of the above matters, rare fauna species and rivers and watercourses. However the significance level of these impacts cannot be assessed accurately until the alignment has been finalised and a clearing boundary identified.

The proposed project may require referral to the EPA.

6.2.2 Department of Environment and Conservation

The clearing of vegetation in Western Australia is governed under the EP Act.

Main Roads has been granted a statewide vegetation clearing permit (Purpose Permit CPS 818-5), granted under section 51E of the EP Act, from the DEC. The Purpose Permit allows Main Roads to clear native vegetation for road realignment projects and associated construction activities (including preconstruction 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; or
- Those project activities are incorporated in any proposal that is referred to and assessed under Part IV of the EP Act by the EPA.

On the basis of this assessment, the project is considered to be at variance to Principles (b) and (f), may be at variance to Principles (a), (g), (h), and (i) and is unlikely to be at variance to Principles (c), (d), (e), and (j) of the Ten Clearing Principles.

Should the proposal be formally assessed under s38 of the EP Act, Main Roads would not be required to obtain a clearing permit to undertake clearing activities associated with the proposal. However, exemptions under Schedule 6 of the EP Act do not apply in the case that the EPA decides not to assess a proposal. As such, if the proposal was 'not assessed' under Part IV of the EP Act, Main Roads would be required to obtain a permit to clear native vegetation.

If the proposal is not formally assessed, clearing may be considered possible in accordance with Main Roads State-wide purpose "Clearing Permit" (CPS 818-5).

The main conditions of the Permit are:

- avoiding and minimising clearing impacts;
- not exceeding any of the annual regional clearing limits;

- preparing a Preliminary Environmental Impact Assessment (PEIA) (assessing clearing impacts against the Ten Clearing Principles);
- undertaking stakeholder consultation (where variance with the Ten Clearing Principles occurs);
- provision of offsets (where variance with the Ten Clearing Principles occurs);
- preparing an Environmental Impact Assessment (EIA) (may be done instead of PEIA) (where variance occurs);
- preparing an Environmental Management Plan (EMP) (where variance occurs);
- preparing a revegetation plan for temporary clearing (and submit to DEC if temporary clearing is >0.5 ha);
- implementing weed and dieback management;
- recording;
- auditing and/or reporting; and/or
- upholding regional limits on the amount of clearing.

6.2.3 Department of Water

The *Rights in Water and Irrigation Act 1914* covers the regulation, management, use and protection of water resources and irrigation in Western Australia. A Permit to Interfere with Bed and Banks will be required for this project to licence the construction works on the bridge over the Margaret River and its associated tributaries.

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7. References

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Appendix A

Figures

322,000 324,000 326,000

6,244,000 6,242,000 6,240,000 6,238,000

NOZZLE RD

BACK RD

OLD ROSA BROOK RD

Locality Map

GRACETOWN

TREETON

Indian Ocean

BORANUP

LEGEND

Threatened Flora

- (T) Threatened Flora - Extant Taxa
- Priority 1 - Poorly Known Taxa
- Priority 2 - Poorly Known Taxa
- Priority 3 - Poorly Known Taxa
- Priority 4 - Rare Taxa

- Roads
- Hydrology
- Study Area

DEC Estate

- National Park
- State Forest
- Timber Reserve

1: 20,000 (at A3)

0 100 200 400 600 800 1,000

Metres

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

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CLIENTS | PEOPLE | PERFORMANCE

Main Roads Western Australia
Margaret River Bypass

Job Number	61-27189
Revision	0
Date	08 Dec 2011

Locality and Environmental Constraints

Figure 1

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

Data source: MRWA: Roads - 20091028; GHD; Study Area - 20111207; Landgate: Bussleton 2010 Mosaic -20111206, Hydrology - 20111207; DEC: DEC Estate - 20111207, Threatened Flora - 20111104; GA: 250K Topographic Series - 2006. Created by: cagilbert

322,000 324,000 326,000

6,244,000 6,242,000 6,240,000 6,238,000

NOZZLE RD

BACK RD

R2

Q3

Q1

Q2

Gastrolobium formosum

R1

OLD ROSA BROOK RD

Locality Map

BRAMLEY

DALEEP

MARGARET RIVER

LEGEND

- Quadrat
- Releve

GHD Declared Rare & Priority Species

- (T) Threatened Flora - Extant Taxa
- Priority 1 - Poorly Known Taxa
- Priority 2 - Poorly Known Taxa
- Priority 3 - Poorly Known Taxa
- Priority 4 - Rare Taxa

- Roads
- Study Area

Vegetation Type

- Cleared Farmland
- Closed Scrub
- Highly Disturbed/Planted
- Jarrah Marri Forest
- Jarrah Marri Peppermint Forest
- Pine Plantation
- Water Body

1: 20,000 (at A3)

0 100 200 400 600 800 1,000

Metres

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

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GHD

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mainroads WESTERN AUSTRALIA

powered by SLIP ENABLER

Main Roads Western Australia
Margaret River Bypass

Job Number	61-27189
Revision	0
Date	09 Mar 2012

Vegetation Communities

Figure 2

G:\61\27189\GIS\Maps\MXD\6127189_G002_Rev0.mxd

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

Data source: MRWA: Roads - 20091028; GHD; Study Area - 20111207, Vegetation Type - 20111207, GHD Declared Rare & Priority Species - 20111207, Quadrat - 20111207, Releve - 20111207; Landgate: Bussleton 2010 Mosaic -20111206; GA: 250K Topographic Series - 2006. Created by: cagilbert

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6,244,000 6,242,000 6,240,000 6,238,000

NOZZLE RD

BACK RD

OLD ROSA BROOK RD

Locality Map

BRAMLEY

DALEEP

MARGARET RIVER

LEGEND

Roads

Study Area

Vegetation Condition

1. Pristine or Nearly So
2. Excellent
3. Very Good
4. Good
5. Degraded
6. Completely Degraded

1: 20,000 (at A3)

0 100 200 400 600 800 1,000

Metres

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

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Main Roads Western Australia
Margaret River Bypass

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Vegetation Condition

Figure 3

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

Data source: MRWA: Roads - 20091028; GHD; Study Area - 20111206, Vegetation Condition - 20111206; Landgate: Bussleton 2010 Mosaic -20111206; GA: 250K Topographic Series - 2006. Created by: cagilbert

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NOZZLE RD

BACK RD

OLD ROSA BROOK RD

Locality Map

BRAMLEY

DALEEP

MARGARET RIVER

LEGEND

Roads

Study Area

Significant Fauna Habitat

Black Cockatoo Feeding Habitat

Western Ringtail Possum Habitat

Western Ringtail Possum and Cockatoo Habitat

1: 20,000 (at A3)

0 100 200 400 600 800 1,000

Metres

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

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Main Roads Western Australia
Margaret River Bypass

Job Number	61-27189
Revision	0
Date	08 Dec 2011

Significant Fauna Habitat

Figure 4

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Data source: MRWA: Roads - 20091028; GHD; Study Area - 20111207, Significant Fauna Habitat - 20111207; Landgate: Bussleton 2010 Mosaic -20111206;GA: 250K Topographic Series - 2006. Created by: cagilbert

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6,244,000 6,242,000 6,240,000 6,238,000

NOZZLE RD

BACK RD

OLD ROSA BROOK RD

Locality Map

BRAMLEY

DALEEP

MARGARET RIVER

LEGEND

Potential Cockatoo Breeding Trees

- Trees > 500mm DBH
- Possible Black Cockatoo Breeding Areas (Large tree with Hollows)
- Roads
- Study Area

1: 20,000 (at A3)

0 100 200 400 600 800 1,000

Metres

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

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Main Roads Western Australia
Margaret River Bypass

Job Number	61-27189
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Date	08 Dec 2011

Potential Cockatoo Breeding Trees

Figure 5

G:\61\27189\GIS\Maps\MXD\6127189_G005_Rev0.mxd
239 Adelaide Terrace Perth WA 6004 Australia T 61 8 6222 8222 F 61 8 6222 8555 E permail@ghd.com.au W www.ghd.com.au

Data source: MRWA: Roads - 20091028; GHD; Study Area - 20111207, Potential Cockatoo Breeding Habitat- 20111207; Landgate: Bussleton 2010 Mosaic -20111206; GA: 250K Topographic Series - 2006. Created by: cagilbert

Appendix B

Conservation Codes

EPBC Act Fauna Conservation Categories

Listed threatened species and ecological communities

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

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

Critically endangered and endangered species

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

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

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

Vulnerable species

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

- lead to a long-term decrease in the size of an important population of a species, or
- reduce the area of occupancy of an important population, or
- fragment an existing important population into two or more populations, or
- adversely affect habitat critical to the survival of a species, or
- disrupt the breeding cycle of an important population, or
- modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline, or

- result in invasive species that are harmful a vulnerable species becoming established in the vulnerable species' habitat*, or
- interferes substantially with the recovery of the species.

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

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

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

Listed migratory species

The EPBC Act protects lands and migratory species that are listed under International Agreements.

- Appendices to the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animals) for which Australia is a Range State under the Convention;
- The Agreement between the Government of Australia and the Government of the Peoples Republic of China for the Protection of Migratory Birds and their Environment (CAMBA);
- The Agreement between the Government of Japan and the Government of Australia for the Protection of Migratory Birds and Birds in Danger of Extinction and their Environment (JAMBA); and
- The Agreement between the Government of Australia and the Government of the Republic of Korea on the Protection of Migratory Birds (ROKAMBA).
- other international agreements approved by the Commonwealth Environment Minister.

An action will require approval from the Environment Minister if the action has, will have, or is likely to have a significant impact on a listed migratory species. Note that some migratory species are also listed as threatened species.

The criteria below are relevant to migratory species that are not threatened.

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

- substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat of the migratory species, or
- result in invasive species that is harmful to the migratory species becoming established* in an area of important habitat of the migratory species, or

- seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of the species.

An area of important habitat is:

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

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

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

Conservation categories and definitions for *Environment Protection and Biodiversity Conservation Act 1999* listed flora and fauna species

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

Conservation codes for Western Australian Flora and Fauna listed under the *Wildlife Conservation Act 1950* and the DEC.

Code	Conservation Category	Description
T	Schedule 1 under the WC Act	**Threatened Fauna** (Fauna that is rare or is likely to become extinct **Threatened Flora** (Declared Rare Flora – Extant) Taxa that 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. **CR:** Critically Endangered – considered to be facing an extremely high risk of extinction in the wild. **EN:** Endangered – considered to be facing a very high risk of extinction in the wild. **VU**: Vulnerable – considered to be facing a high risk of extinction in the wild.
X	Schedule 2 under the WC Act	**Presumed Extinct Fauna** **Presumed Extinct Flora** (Declared rare Flora – Extinct) Taxa which have been adequately searched for and there is no reasonable doubt that the last individual has died, and have been gazetted as such.
IA	Schedule 3 under the WC Act	**Birds protected under an international agreement** Birds that are subject to an agreement between governments of Australia and Japan relating to the protection of migratory birds and birds in danger of extinction.
S	Schedule 4 under the WC Act	**Other specially protected fauna** Fauna that is in need of special protection, otherwise than for the reasons mentioned in the above schedules.
1	Priority One: Poorly-known taxa	Taxa that are known from one or a few collections or sight records (generally less than five), all on

Code	Conservation Category	Description
		lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, Shire, Westrail and Main Roads WA road, gravel and soil reserves, and active mineral leases and under threat of habitat destruction or degradation. Taxa may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes.
2	Priority Two: Poorly-known taxa	Taxa that are known from one or a few collections or sight records, some of which are on lands not under imminent threat of habitat destruction or degradation, e.g. national parks, conservation parks, nature reserves, State forest, vacant Crown land, water reserves, etc. Taxa may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes.
3	Priority Three: Poorly-known taxa	Taxa that are known from collections or sight records from several localities not under imminent threat, or from few but widespread localities with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Taxa may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and known threatening processes exist that could affect them.
4	Priority Four: Rare, Near Threatened and other taxa in need of monitoring	**(a**) **Rare**. Taxa that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These taxa are usually represented on conservation lands. **(b) Near Threatened**. Taxa that are considered to have been adequately surveyed and that do

Code	Conservation Category	Description
		not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable. **(c)** Taxa that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.
5	Priority 5: Conservation Dependent taxa	Taxa that are not threatened but are subject to a specific conservation program, the cessation of which would result in the taxon becoming threatened within five years.

Appendix C

Desktop Search Results

Australian Government
Department of Sustainability, Environment, Water, Population and Communities

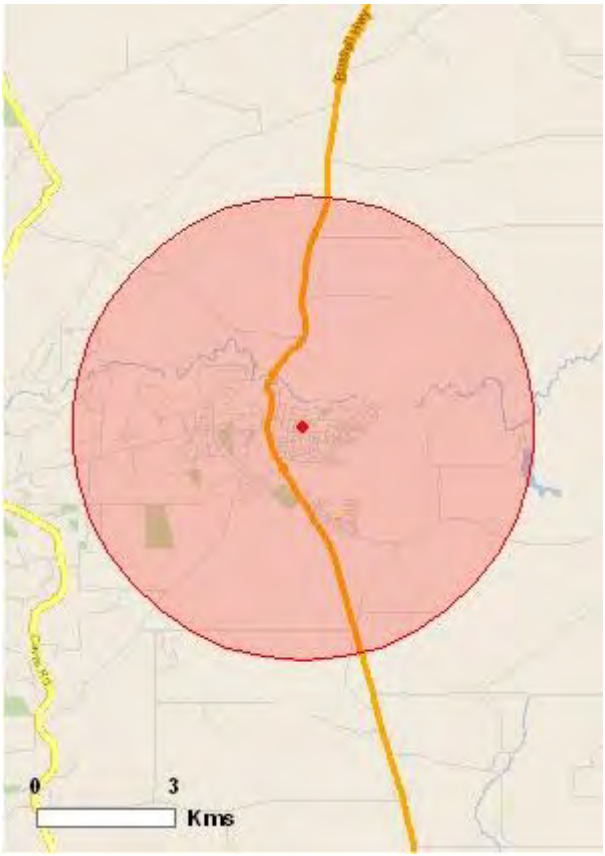
EPBC Act Protected Matters Report: Coordinates

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information about the EPBC Act including significance guidelines, forms and application process details can be found at http://www.environment.gov.au/epbc/assessmentsapprovals/index.html

Report created: 30/08/11 12:01:17



Coordinates
Buffer: 5.0Km

Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance - see http://www.environment.gov.au/epbc/assessmentsapprovals/guidelines/index.html.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Significance (Ramsar Wetlands):	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Areas:	None
Threatened Ecological Communitites:	None
Threatened Species:	14
Migratory Species:	7

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place and the heritage values of a place on the Register of the National Estate. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage/index.html

Please note that the current dataset on Commonwealth land is not complete. Further information on Commonwealth land would need to be obtained from relevant sources including Commonwealth agencies, local agencies, and land tenure maps.

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species. Information on EPBC Act permit requirements and application forms can be found at http://www.environment.gov.au/epbc/permits/index.html.

Commonwealth Lands:	1
Commonwealth Heritage Places:	None
Listed Marine Species:	5
Whales and Other Cetaceans:	None

Critical Habitats:	None
Commonwealth Reserves:	None

Report Summary for Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

Place on the RNE:	2
State and Territory Reserves:	1
Regional Forest Agreements:	1
Invasive Species:	11
Nationally Important Wetlands:	None

Details

Matters of National Environmental Significance

Threatened Species **[Resource Information]**

Name	Status	Type of Presence
BIRDS		
Botaurus poiciloptilus		
Australasian Bittern [1001]	Endangered	Species or species habitat may occur within area
Calyptorhynchus banksii naso		
Forest Red-tailed Black-Cockatoo [67034]	Vulnerable	Species or species habitat may occur within area
Calyptorhynchus baudinii		
Baudin's Black-Cockatoo, Long-billed Black-Cockatoo [769]	Vulnerable	Breeding known to occur within area
Calyptorhynchus latirostris		
Carnaby's Black-Cockatoo, Short-billed Black-Cockatoo [59523]	Endangered	Species or species habitat likely to occur within area
CRUSTACEANS		
Cherax tenuimanus		
Hairy Marron, Margaret River Hairy Marron, Margaret River Marron [78931]	Critically Endangered	Species or species habitat known to occur within area
FISH		
Nannatherina balstoni		
Balston's Pygmy Perch [66698]	Vulnerable	Species or species habitat may occur within area
FROGS		
Geocrinia alba		
White-bellied Frog, Creek Frog [26181]	Endangered	Species or species habitat likely to occur within area
MAMMALS		
Dasyurus geoffroii		
Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat likely to occur within area
Pseudocheirus occidentalis		

Western Ringtail Possum [25911]	Vulnerable	Species or species habitat likely to occur within area
PLANTS		
Caladenia excelsa		
Giant Spider-orchid [56717]	Endangered	Species or species habitat likely to occur within area
Caladenia hoffmanii		
Hoffman's Spider-orchid [56719]	Endangered	Species or species habitat may occur within area
Caladenia winfieldii		
Majestic Spider-orchid [64504]	Endangered	Species or species habitat may occur within area
Centrolepis caespitosa		
[6393]	Endangered	Species or species habitat likely to occur within area
Sphenotoma drummondii		
[21160]	Endangered	Species or species habitat may occur within area

Migratory Species [Resource Information]

Name	Status	Type of Presence
Migratory Marine Birds		
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat may occur within area
Ardea alba		
Great Egret, White Egret [59541]		Species or species habitat may occur within area
Ardea ibis		
Cattle Egret [59542]		Species or species habitat may occur within area
Migratory Terrestrial Species		
Haliaeetus leucogaster		
White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Merops ornatus		
Rainbow Bee-eater [670]		Species or species habitat may occur within area
Migratory Wetlands Species		
Ardea alba		
Great Egret, White Egret [59541]		Species or species habitat may occur within area
Ardea ibis		
Cattle Egret [59542]		Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Commonwealth Lands [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Commonwealth Land -

Listed Marine Species [Resource Information]

Name	Status	Type of Presence
Birds		
Apus pacificus		

Fork-tailed Swift [678]	Species or species habitat may occur within area
Ardea alba	
Great Egret, White Egret [59541]	Species or species habitat may occur within area
Ardea ibis	
Cattle Egret [59542]	Species or species habitat may occur within area
Haliaeetus leucogaster	
White-bellied Sea-Eagle [943]	Species or species habitat likely to occur within area
Merops ornatus	
Rainbow Bee-eater [670]	Species or species habitat may occur within area

Extra Information

Places on the RNE [Resource Information]

Note that not all Indigenous sites may be listed.

Name	Status
Historic	
St Thomas More Catholic Church WA	Indicative Place
Basildene Farmhouse (former) WA	Registered

State and Territory Reserves [Resource Information]

Bramley, WA

Regional Forest Agreements [Resource Information]

Note that all areas with completed RFAs have been included.

South West WA RFA, Western Australia

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Mammals		
Felis catus		
Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Oryctolagus cuniculus		
Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Sus scrofa		
Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes		
Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Asparagus asparagoides		
Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area

[Cenchrus ciliaris](#) Buffel-grass, Black Buffel-grass [20213]	Species or species habitat may occur within area
[Genista sp. X Genista monspessulana](#) Broom [67538]	Species or species habitat may occur within area
[Lycium ferocissimum](#) African Boxthorn, Boxthorn [19235]	Species or species habitat may occur within area
[Pinus radiata](#) Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]	Species or species habitat may occur within area
[Rubus fruticosus aggregate](#) Blackberry, European Blackberry [68406]	Species or species habitat likely to occur within area
[Tamarix aphylla](#) Athel Pine, Athel Tree, Tamarisk, Athel Tamarisk, Athel Tamarix, Desert Tamarisk, Flowering Cypress, Salt Cedar [16018]	Species or species habitat likely to occur within area

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World Heritage and Register of National Estate properties, Wetlands of International Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

For species where the distributions are well known, maps are digitised from sources such as recovery plans and detailed habitat studies. Where appropriate, core breeding, foraging and roosting areas are indicated under 'type of presence'. For species whose distributions are less well known, point locations are collated from government wildlife authorities, museums, and non-government organisations; bioclimatic distribution models are generated and these validated by experts. In some cases, the distribution maps are based solely on expert knowledge.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports

produced from this database:
- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers.

The following groups have been mapped, but may not cover the complete distribution of the species:
- non-threatened seabirds which have only been mapped for recorded breeding sites;
- seals which have only been mapped for breeding sites near the Australian continent.

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-33.9531 115.08059

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Department of Environment, Climate Change and Water, New South Wales
-Department of Sustainability and Environment, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment and Natural Resources, South Australia
-Parks and Wildlife Service NT, NT Dept of Natural Resources, Environment and the Arts
-Environmental and Resource Management, Queensland
-Department of Environment and Conservation, Western Australia
-Department of the Environment, Climate Change, Energy and Water
-Birds Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-SA Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Atherton and Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
-State Forests of NSW
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

Last updated: Thursday, 16-Sep-2010 09:13:25 EST

Department of Sustainability, Environment, Water, Population and Communities
GPO Box 787
Canberra ACT 2601 Australia
+61 2 6274 1111 ABN

NatureMap Species Report

Created By Guest user on 30/08/2011

Kingdom Animalia
Method 'By Circle'
Centre 115°04' 46" E,33°57' 07" S
Buffer 5km

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
1.	24260	*Acanthiza apicalis (Broad-tailed Thornbill)*			
2.	24261	*Acanthiza chrysorrhoa (Yellow-rumped Thornbill)*			
3.	24262	*Acanthiza inornata (Western Thornbill)*			
4.	24560	*Acanthorhynchus superciliosus (Western Spinebill)*			
5.	25536	*Accipiter fasciatus (Brown Goshawk)*			
6.	24312	*Anas gracilis (Grey Teal)*			
7.	24313	*Anas platyrhynchos (Mallard)*			
8.	-450	*Anas sp.*			
9.	24316	*Anas superciliosa (Pacific Black Duck)*			
10.	-375	*Anhinga novaehollandiae*			
11.		*Anisynta sphenosema*			
12.		*Anobium punctatum*			
13.	24561	*Anthochaera carunculata (Red Wattlebird)*			
14.	24562	*Anthochaera lunulata (Western Little Wattlebird)*			
15.	-396	*Anthus novaeseelandiae*			
16.	24285	*Aquila audax (Wedge-tailed Eagle)*			
17.	24341	*Ardea pacifica (White-necked Heron)*			
18.	25566	*Artamus cinereus (Black-faced Woodswallow)*			
19.	24353	*Artamus cyanopterus (Dusky Woodswallow)*			
20.	24357	*Artamus superciliosus (White-browed Woodswallow)*			
21.		*Atractocerus kreuslerae*			
22.		*Austrogomphus lateralis*			
23.		*Austronysius sericus*			Y
24.	-326	*Barnardius zonarius*			
25.	24319	*Biziura lobata (Musk Duck)*			
26.	25713	*Cacatua galerita (Sulphur-crested Cockatoo)*			
27.	25598	*Cacomantis flabelliformis (Fan-tailed Cuckoo)*			
28.	24427	*Cacomantis flabelliformis subsp. flabelliformis*			
29.	-374	*Cacomantis pallidus*			
30.	24788	*Calidris ruficollis (Red-necked Stint)*			
31.	25717	*Calyptorhynchus banksii (Red-tailed Black-Cockatoo)*			
32.	24733	*Calyptorhynchus baudinii (Baudin's Cockatoo)*		T	
33.	24734	*Calyptorhynchus latirostris (Carnaby's Cockatoo)*		T	
34.	-453	*Calyptorhynchus sp.*			
35.	24086	*Cercartetus concinnus (Western Pygmy-possum)*			
36.	-365	*Chalcites lucidus*			
37.	24377	*Charadrius ruficapillus (Red-capped Plover)*			
38.	24321	*Chenonetta jubata (Australian Wood Duck)*			
39.	33940	*Cherax tenuimanus (Margaret River Marron)*		T	
40.		*Chloromerus maculifemur*			Y
41.	24980	*Christinus marmoratus (Marbled Gecko)*			
42.	-330	*Chroicocephalus novaehollandiae*			
43.	24432	*Chrysococcyx lucidus subsp. plagosus*			
44.	24288	*Circus approximans (Swamp Harrier)*			
45.	24396	*Climacteris rufa (Rufous Treecreeper)*			
46.	25675	*Colluricincla harmonica (Grey Shrike-thrush)*			
47.	25568	*Coracina novaehollandiae (Black-faced Cuckoo-shrike)*			
48.	25592	*Corvus coronoides (Australian Raven)*			
49.	24417	*Corvus coronoides subsp. perplexus*			
50.	24671	*Coturnix pectoralis (Stubble Quail)*			
51.	25701	*Coturnix ypsilophora (Brown Quail)*			
52.	25595	*Cracticus tibicen (Australian Magpie)*			
53.	25596	*Cracticus torquatus (Grey Butcherbird)*			
54.	25398	*Crinia georgiana (Quacking Frog)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
55.	25399	*Crinia glauerti (Clicking Frog)*			
56.	25401	*Crinia pseudinsignifera (Bleating Froglet)*			
57.	30893	*Cryptoblepharus buchananii*			
58.	25047	*Ctenotus impar*			
59.	25049	*Ctenotus labillardieri*			
60.	24322	*Cygnus atratus (Black Swan)*			
61.	30901	*Dacelo novaeguineae (Laughing Kookaburra)*			
62.	25673	*Daphoenositta chrysoptera (Varied Sittella)*			
63.	24092	*Dasyurus geoffroii (Western Quoll)*		T	
64.	25607	*Dicaeum hirundinaceum (Mistletoebird)*			
65.	24470	*Dromaius novaehollandiae (Emu)*			
66.	25251	*Echiopsis curta (Bardick)*			
67.	25096	*Egernia kingii (King's Skink)*			
68.	25100	*Egernia napoleonis*			
69.	-361	*Egretta novaehollandiae*			
70.	-384	*Elanus axillaris*			
71.	-357	*Elseyornis melanops*			
72.	-353	*Eolophus roseicapillus*			
73.	24651	*Eopsaltria australis subsp. griseogularis (Western Yellow Robin)*			
74.	24652	*Eopsaltria georgiana (White-breasted Robin)*			
75.	-322	*Eopsaltria griseogularis*			
76.		*Ephydrella acrostichalis*			Y
77.	24567	*Epthianura albifrons (White-fronted Chat)*			
78.		*Euomus insculptus*			Y
79.	25621	*Falco berigora (Brown Falcon)*			
80.	25622	*Falco cenchroides (Australian Kestrel)*			
81.	25624	*Falco peregrinus (Peregrine Falcon)*		S	
82.	24475	*Falco peregrinus subsp. macropus*		S	
83.	25677	*Falcunculus frontatus (Crested Shrike-tit)*			
84.	25727	*Fulica atra (Eurasian Coot)*			
85.	25729	*Gallinula tenebrosa (Dusky Moorhen)*			
86.	25730	*Gallirallus philippensis (Buff-banded Rail)*			
87.	25404	*Geocrinia leai (Ticking Frog)*			
88.	34030	*Geotria australis (Pouched Lamprey)*		P1	
89.	25530	*Gerygone fusca (Western Gerygone)*			
90.	24735	*Glossopsitta porphyrocephala (Purple-crowned Lorikeet)*			
91.	-380	*Glyciphila melanops*			
92.	24443	*Grallina cyanoleuca (Magpie-lark)*			
93.	25627	*Haematopus fuliginosus (Sooty Oystercatcher)*			
94.	24295	*Haliastur sphenurus (Whistling Kite)*			
95.	25410	*Heleioporus eyrei (Moaning Frog)*			
96.	25118	*Hemiergis peronii subsp. tridactyla*			
97.		*Hensaussurea sheardi*			
98.	-385	*Hieraaetus morphnoides*			
99.	25734	*Himantopus himantopus (Black-winged Stilt)*			
100.	24491	*Hirundo neoxena (Welcome Swallow)*			
101.		*Homalictus urbanus*			Y
102.	24215	*Hydromys chrysogaster (Water-rat)*		P4	
103.	-335	*Hydroprogne caspia*			
104.	24153	*Isoodon obesulus subsp. fusciventer (Southern Brown Bandicoot)*		P5	
105.	24347	*Ixobrychus flavicollis subsp. australis*		P3	
106.	-334	*Lalage sueurii*			
107.	24511	*Larus novaehollandiae subsp. novaehollandiae*			
108.		*Lectrides parilis*			
109.	25131	*Lerista distinguenda*			
110.	25133	*Lerista elegans*			
111.	25154	*Lerista microtis subsp. microtis*			
112.	25005	*Lialis burtonis*			
113.	24581	*Lichenostomus virescens (Singing Honeyeater)*			
114.	25661	*Lichmera indistincta (Brown Honeyeater)*			
115.	25415	*Limnodynastes dorsalis (Western Banjo Frog)*			
116.	25388	*Litoria moorei (Motorbike Frog)*			
117.	-400	*Lophoictinia isura*			
118.		*Lophyrotoma analis*			Y
119.	24133	*Macropus irma (Western Brush Wallaby)*		P4	
120.	25650	*Malurus elegans (Red-winged Fairy-wren)*			
121.	25654	*Malurus splendens (Splendid Fairy-wren)*			
122.	-354	*Melanodryas cucullata*			
123.	25663	*Melithreptus brevirostris (Brown-headed Honeyeater)*			
124.	-342	*Melithreptus lunatus*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
125.	25184	*Menetia greyii*			
126.	24598	*Merops ornatus (Rainbow Bee-eater)*			
127.	-329	*Microcarbo melanoleucos*			
128.	25693	*Microeca fascinans (Jacky Winter)*			
129.	25191	*Morethia lineoocellata*			
130.	25192	*Morethia obscura*			
131.	25610	*Myiagra inquieta (Restless Flycatcher)*			
132.	24738	*Neophema elegans (Elegant Parrot)*			
133.		*Neotemnopteryx fulva*			
134.	25748	*Ninox novaeseelandiae (Boobook Owl)*			
135.	24820	*Ninox novaeseelandiae subsp. boobook*			
136.	24196	*Nyctophilus timoriensis subsp. timoriensis (Greater Long-eared Bat)*			
137.	24407	*Ocyphaps lophotes (Crested Pigeon)*			
138.		*Opilo congruus*			
139.	25679	*Pachycephala pectoralis (Golden Whistler)*			
140.	25680	*Pachycephala rufiventris (Rufous Whistler)*			
141.		*Paleonura rosacea*			Y
142.	24299	*Pandion haliaetus subsp. cristatus*			
143.	25681	*Pardalotus punctatus (Spotted Pardalote)*			
144.	25682	*Pardalotus striatus (Striated Pardalote)*			
145.	24648	*Pelecanus conspicillatus (Australian Pelican)*			
146.		*Perga sp.*			
147.	-333	*Petrochelidon nigricans*			
148.	-343	*Petroica boodang*			
149.	25697	*Phalacrocorax carbo (Great Cormorant)*			
150.	24667	*Phalacrocorax sulcirostris (Little Black Cormorant)*			
151.	25699	*Phalacrocorax varius (Pied Cormorant)*			
152.	24409	*Phaps chalcoptera (Common Bronzewing)*			
153.	25587	*Phaps elegans (Brush Bronzewing)*			
154.	34045	*Phascogale tapoatafa subsp. ssp. (WAM M434) (Brush-tailed Phascogale)*		T	
155.	24099	*Phascogale tapoatafa subsp. tapoatafa (Southern Brush-tailed Phascogale)*			
156.	24596	*Phylidonyris novaehollandiae (New Holland Honeyeater)*			
157.	25720	*Platycercus icterotis (Western Rosella)*			
158.	24681	*Poliocephalus poliocephalus (Hoary-headed Grebe)*			
159.	25731	*Porphyrio porphyrio (Purple Swamphen)*			
160.	24771	*Porzana tabuensis (Spotless Crake)*			
161.	24164	*Potorous platyops (Broad-faced Potoroo)*		X	
162.	24166	*Pseudocheirus occidentalis (Western Ringtail Possum)*		T	
163.	25259	*Pseudonaja affinis subsp. affinis (Dugite)*			
164.	-364	*Purpureicephalus spurius*			
165.	25008	*Pygopus lepidopodus (Common Scaly Foot)*			
166.	25271	*Ramphotyphlops australis*			
167.	24243	*Rattus fuscipes (Western Bush Rat)*			
168.	24245	*Rattus rattus (Black Rat)*			
169.	-347	*Rhipidura albiscapa*			
170.	25614	*Rhipidura leucophrys (Willie Wagtail)*			
171.	25534	*Sericornis frontalis (White-browed Scrubwren)*			
172.	24279	*Sericornis frontalis subsp. maculatus*			
173.	24145	*Setonix brachyurus (Quokka)*		T	
174.	24109	*Sminthopsis dolichura (Little long-tailed Dunnart)*			
175.	24111	*Sminthopsis gilberti (Gilbert's Dunnart)*			
176.	24113	*Sminthopsis griseoventer subsp. griseoventer (Grey-bellied Dunnart)*			
177.		*Spathoptila cyclophora*			Y
178.	24645	*Stagonopleura oculata (Red-eared Firetail)*			
179.		*Stenoderus suturalis*			
180.	24522	*Sterna bergii (Crested Tern)*			
181.	-383	*Sternula nereis*			
182.	24329	*Stictonetta naevosa (Freckled Duck)*			
183.		*Stigmodera cancellata*			
184.	24554	*Stipiturus malachurus subsp. westernensis*			
185.	25597	*Strepera versicolor (Grey Currawong)*			
186.	25590	*Streptopelia senegalensis (Laughing Turtle-Dove)*			
187.	25705	*Tachybaptus novaehollandiae (Australasian Grebe)*			
188.	24331	*Tadorna tadornoides (Australian Shelduck)*			
189.		*Techimorphus westraliensis*			Y
190.	-406	*Thalasseus bergii*			
191.	-405	*Thinornis rubricollis*			
192.		*Thoracolopha pissonephra*			Y
193.	24845	*Threskiornis spinicollis (Straw-necked Ibis)*			
194.	25549	*Todiramphus sanctus (Sacred Kingfisher)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
195.	24158	*Trichosurus vulpecula subsp. vulpecula (Common Brushtail Possum)*			
196.	-410	*Tyto javanica*			
197.	24855	*Tyto novaehollandiae subsp. novaehollandiae*		P3	
198.	24386	*Vanellus tricolor (Banded Lapwing)*			
199.	25225	*Varanus rosenbergi (Heath Monitor)*			
200.	24206	*Vespadelus regulus (Southern Forest Bat)*			
201.		*Xylopsocus rubidus*			
202.		*Xylopsocus sp.*			
203.	25765	*Zosterops lateralis (Grey-breasted White-eye)*			

Conservation Codes
T - Rare or likely to become extinct
X - Presumed extinct
IA - Protected under international agreement
S - Other specially protected fauna
1 - Priority 1
2 - Priority 2
3 - Priority 3
4 - Priority 4
5 - Priority 5

[1] For NatureMap's purposes, species flagged as endemic are those whose records are wholely contained within the search area. Note that only those records complying with the search criterion are included in the calculation. For example, if you limit records to those from a specific datasource, only records from that datasource are used to determine if a species is restricted to the query area.

NatureMap Species Report

Created By Guest user on 30/08/2011

Kingdom Plantae
Method 'By Circle'
Centre 115°04' 51" E,33°56' 59" S
Buffer 5km

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
1.	18285	*Acacia baileyana*	Y		
2.	3233	*Acacia barbinervis*			
3.	3247	*Acacia browniana*			
4.	11731	*Acacia browniana var. browniana*			
5.	3307	*Acacia divergens*			
6.	3347	*Acacia gilbertii*			
7.	3386	*Acacia inops*		P3	
8.	3410	*Acacia lateriticola*			
9.	3424	*Acacia littorea*			
10.	3448	*Acacia mooreana*			
11.	3453	*Acacia myrtifolia*			
12.	3454	*Acacia nervosa (Rib Wattle)*			
13.	15481	*Acacia pulchella var. glaberrima*			
14.	30036	*Acacia saligna subsp. stolonifera*			
15.	3591	*Acacia urophylla*			
16.	15487	*Acacia varia var. varia*			
17.	17774	*Acetosella vulgaris*	Y		
18.	1573	*Acianthus reniformis (Mosquito Orchid)*			
19.	25	*Adiantum aethiopicum (Common Maidenhair)*			
20.	5316	*Agonis flexuosa (Peppermint)*			
21.	17202	*Agonis flexuosa var. flexuosa*			
22.	23474	*Agrostocrinum hirsutum*			
23.	184	*Aira caryophyllea (Silvery Hairgrass)*	Y		
24.	1489	*Amaryllis belladonna (Belladonna Lily)*	Y		
25.	13101	*Amperea simulans*			
26.	1063	*Anarthria scabra*			
27.	6317	*Andersonia micrantha*			
28.	1407	*Anigozanthos flavidus (Tall Kangaroo Paw)*			
29.	1409	*Anigozanthos humilis (Catspaw)*			
30.	202	*Anthoxanthum odoratum (Sweet Vernal Grass)*	Y		
31.	3686	*Aotus cordifolia*			
32.	11399	*Apium prostratum var. filiforme*			
33.	8779	*Asparagus asparagoides (Bridal Creeper)*	Y		
34.	20249	*Astartea leptophylla*			
35.	7851	*Asteridea pulverulenta (Common Bristle Daisy)*			
36.	17950	*Austrodanthonia caespitosa*			
37.	17949	*Austrodanthonia occidentalis*			
38.	18279	*Babiana angustifolia*	Y		
39.	32616	*Banksia dallanneyi subsp. sylvestris*			
40.	1819	*Banksia grandis (Bull Banksia)*			
41.	1837	*Banksia occidentalis (Red Swamp Banksia)*			
42.	1848	*Banksia seminuda (River Banksia)*			
43.	743	*Baumea juncea (Bare Twigrush)*			
44.	3157	*Billardiera floribunda (White-flowered Billardiera)*			
45.	25798	*Billardiera fusiformis (Australian Bluebell)*			
46.	3159	*Billardiera laxiflora*			
47.	3165	*Billardiera variifolia*			
48.	4403	*Boronia alata (Winged Boronia)*			
49.	29274	*Boronia crenulata subsp. crenulata*			
50.	17653	*Boronia crenulata subsp. pubescens*			
51.	11503	*Boronia crenulata var. crenulata*			
52.	4415	*Boronia defoliata*			
53.	4417	*Boronia dichotoma*			
54.	4422	*Boronia gracilipes (Karri Boronia)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
55.	4428	*Boronia megastigma (Scented Boronia)*			
56.	4429	*Boronia molloyae (Tall Boronia)*			
57.	20392	*Boronia tenuior*			
58.	1267	*Borya constricta*			
59.	3708	*Bossiaea disticha*		P3	
60.	3713	*Bossiaea linophylla*			
61.	3714	*Bossiaea ornata (Broad Leaved Brown Pea)*			
62.	244	*Briza maxima (Blowfly Grass)*	Y		
63.	245	*Briza minor (Shivery Grass)*	Y		
64.	249	*Bromus diandrus (Great Brome)*	Y		
65.	12770	*Burchardia congesta*			
66.	1385	*Burchardia multiflora (Dwarf Burchardia)*			
67.	1276	*Caesia micrantha (Pale Grass-lily)*			
68.	1277	*Caesia occidentalis*			
69.	13853	*Caladenia arrecta*			
70.	15332	*Caladenia attingens subsp. attingens*			
71.	15341	*Caladenia citrina*			
72.	1581	*Caladenia corynephora*			
73.	13619	*Caladenia excelsa*		T	
74.	1590	*Caladenia ferruginea (Rusty Spider Orchid)*			
75.	1592	*Caladenia flava (Cowslip Orchid)*			
76.	15348	*Caladenia flava subsp. flava*			
77.	1596	*Caladenia huegelii (Grand Spider Orchid)*		T	
78.	1597	*Caladenia infundibularis*			
79.	18037	*Caladenia lodgeana*		T	
80.	15365	*Caladenia longicauda subsp. longicauda*			
81.	15366	*Caladenia longicauda subsp. merrittii*			
82.	1604	*Caladenia macrostylis (Leaping Spider Orchid)*			
83.	1608	*Caladenia nana (Pink Fan Orchid)*			
84.	-12183	*Caladenia paludosa x serotina*			
85.	18033	*Caladenia pholcoidea subsp. pholcoidea*			
86.	1613	*Caladenia reptans (Little Pink Fairy Orchid)*			
87.	1616	*Caladenia sericea (Silky Blue Orchid)*			
88.	10861	*Callistachys lanceolata (Wonnich)*			
89.	757	*Carex preissii*			
90.	2952	*Cassytha glabella (Tangled Dodder Laurel)*			
91.	11799	*Cassytha racemosa forma racemosa*			
92.	18156	*Chamaecytisus palmensis (Tagasaste)*	Y		
93.	1513	*Chasmanthe floribunda (African Cornflag)*	Y		
94.	31	*Cheilanthes austrotenuifolia*			
95.	4448	*Chorilaena quercifolia (Chorilaena)*			
96.	3754	*Chorizema diversifolium*			
97.	12765	*Chorizema nanum*			
98.	3761	*Chorizema rhombeum*			
99.	2929	*Clematis pubescens (Common Clematis)*			
100.	4550	*Comesperma calymega (Blue-spike Milkwort)*			
101.	4552	*Comesperma confertum*			
102.	4564	*Comesperma virgatum (Milkwort)*			
103.	1862	*Conospermum caeruleum (Blue Brother)*			
104.	16854	*Conospermum capitatum subsp. capitatum*			
105.	1418	*Conostylis aculeata (Prickly Conostylis)*			
106.	11826	*Conostylis aculeata subsp. aculeata*			
107.	20074	*Conyza sumatrensis*	Y		
108.	277	*Cortaderia selloana (Pampas Grass)*	Y		
109.	17104	*Corymbia calophylla (Marri)*			
110.	18319	*Cotoneaster glaucophyllus*	Y		
111.	7952	*Crepis capillaris (Smooth Hawksbeard)*	Y		
112.	13484	*Cryptandra arbutiflora var. tubulosa*			
113.	15404	*Cyanicula sericea*			
114.	51	*Cyathea cooperi*	Y		
115.	783	*Cyperus congestus (Dense Flat-sedge)*	Y		
116.	792	*Cyperus eragrostis (Umbrella Sedge)*	Y		
117.	10964	*Cyrtostylis robusta*			
118.	287	*Dactylis glomerata (Cocksfoot)*	Y		
119.	7420	*Dampiera alata (Winged-stem Dampiera)*			
120.	7444	*Dampiera hederacea (Karri Dampiera)*			
121.	7454	*Dampiera linearis (Common Dampiera)*			
122.	7484	*Dampiera trigona (Angled-stem Dampiera)*			
123.	1219	*Dasypogon hookeri (Pineapple Bush)*			
124.	6964	*Datura stramonium (Common Thornapple)*	Y		

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125.	6218	*Daucus glochidiatus (Australian Carrot)*			
126.	3799	*Daviesia cordata (Bookleaf)*			
127.	3815	*Daviesia horrida (Prickly Bitter-pea)*			
128.	3817	*Daviesia inflata*			
129.	17691	*Desmocladus fasciculatus*			
130.	16595	*Desmocladus flexuosus*			
131.	299	*Deyeuxia quadriseta (Reed Bentgrass)*			
132.	7487	*Diaspasis filifolia (Thread-leaved Diaspasis)*			
133.	306	*Dichelachne crinita (Longhair Plumegrass)*			
134.	3011	*Diplotaxis muralis (Wall Rocket)*	Y		
135.	3867	*Dipogon lignosus (Dolichos Pea)*	Y		
136.	4757	*Dodonaea ceratocarpa*			
137.	1640	*Drakaea glyptodon (King-in-his-carriage)*			
138.	11853	*Drosera menziesii subsp. menziesii*			
139.	11105	*Echinochloa crus-galli (Barnyard Grass)*	Y		
140.	6681	*Echium plantagineum (Paterson's Curse)*	Y		
141.	348	*Ehrharta erecta (Panic Veldt Grass)*	Y		
142.	351	*Ehrharta villosa (Pyp Grass)*	Y		
143.	1643	*Elythranthera brunonis (Purple Enamel Orchid)*			
144.	7968	*Erigeron karvinskianus*	Y		
145.	15412	*Eriochilus dilatatus subsp. multiflorus*			
146.	15415	*Eriochilus scaber subsp. scaber*			
147.	5625	*Eucalyptus diversicolor (Karri)*			
148.	18602	*Eucalyptus microcorys*	Y		
149.	5739	*Eucalyptus patens (Swan River Blackbutt)*			
150.	-4851	*Eucalyptus sp.*			
151.	3876	*Eutaxia epacridoides*			
152.	430	*Festuca arundinacea (Tall Fescue)*	Y		
153.	7974	*Filago gallica*	Y		
154.	6221	*Foeniculum vulgare (Fennel)*	Y		
155.	1945	*Franklandia triaristata (Lanoline Bush)*		P4	
156.	18392	*Freesia alba x leichtlinii*	Y		
157.	31532	*Fumaria muralis subsp. muralis*	Y		
158.	32370	*Funaria hygrometrica*			
159.	900	*Gahnia aristata*			
160.	17744	*Gahnia sclerioides*		P3	
161.	20475	*Gastrolobium capitatum*			
162.	19190	*Gastrolobium cuneatum*			
163.	20504	*Gastrolobium formosum*		P3	
164.	3936	*Genista linifolia (Flaxleaf Broom)*	Y		
165.	18143	*Genista monspessulana*	Y		
166.	1518	*Gladiolus angustus (Long Tubed Painted Lady)*	Y		
167.	10909	*Gompholobium confertum*			
168.	3951	*Gompholobium marginatum*			
169.	3953	*Gompholobium ovatum*			
170.	3955	*Gompholobium preissii*			
171.	11083	*Gompholobium scabrum*			
172.	16746	*Gonocarpus benthamii subsp. benthamii*			
173.	-4248	*Goodenia sp.*			
174.	7064	*Gratiola peruviana (Austral Brooklime)*			
175.	13427	*Grevillea manglesioides subsp. manglesioides*			
176.	19494	*Grevillea manglesioides subsp. metaxa*			
177.	2080	*Grevillea quercifolia (Oak-leaf Grevillea)*			
178.	2137	*Hakea ceratophylla (Horned Leaf Hakea)*			
179.	2170	*Hakea lasianthoides*			
180.	2174	*Hakea linearis*			
181.	2175	*Hakea lissocarpha (Honey Bush)*			
182.	2203	*Hakea ruscifolia (Candle Hakea)*			
183.	2214	*Hakea trifurcata (Two-leaf Hakea)*			
184.	3961	*Hardenbergia comptoniana (Native Wisteria)*			
185.	18297	*Hedera helix*	Y		
186.	6868	*Hemigenia rigida*		P1	
187.	5109	*Hibbertia amplexicaulis*			
188.	5114	*Hibbertia commutata*			
189.	5117	*Hibbertia cuneiformis (Cutleaf Hibbertia)*			
190.	5118	*Hibbertia cunninghamii*			
191.	20051	*Hibbertia diamesogenos*			
192.	5126	*Hibbertia furfuracea*			
193.	5132	*Hibbertia grossulariifolia*			
194.	5135	*Hibbertia hypericoides (Yellow Buttercups)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
195.	444	*Holcus lanatus (Yorkshire Fog)*	Y		
196.	3965	*Hovea elliptica (Tree Hovea)*			
197.	3968	*Hovea trisperma (Common Hovea)*			
198.	5218	*Hybanthus debilissimus*			
199.	6231	*Hydrocotyle hirta (Hairy Pennywort)*			
200.	452	*Hyparrhenia hirta (Tambookie Grass)*	Y		
201.	31234	*Hypericum perforatum subsp. veronense (St John's Wort)*	Y		
202.	8086	*Hypochaeris glabra (Smooth Catsear)*	Y		
203.	9352	*Hypochaeris radicata (Flat Weed)*	Y		
204.	1532	*Ixia maculata (Yellow Ixia)*	Y		
205.	1297	*Johnsonia lupulina (Hooded Lily)*			
206.	1177	*Juncus articulatus (Jointed Rush)*	Y		
207.	1185	*Juncus kraussii (Sea Rush)*			
208.	14631	*Juncus meianthus*		P2	
209.	1186	*Juncus microcephalus*	Y		
210.	1188	*Juncus pallidus (Pale Rush)*			
211.	1189	*Juncus pauciflorus (Loose Flower Rush)*			
212.	4037	*Kennedia coccinea (Coral Vine)*			
213.	15674	*Kunzea ciliata*			
214.	18585	*Lagenophora huegelii*			
215.	5033	*Lasiopetalum floribundum (Free Flowering Lasiopetalum)*			
216.	4047	*Lathyrus tingitanus (Tangier Pea)*	Y		
217.	932	*Lepidosperma effusum (Spreading Sword-sedge)*			
218.	937	*Lepidosperma longitudinale (Pithy Sword-sedge)*			
219.	-11263	*Lepidosperma sp.*			
220.	945	*Lepidosperma squamatum*			
221.	1653	*Leporella fimbriata (Hare Orchid)*			
222.	2342	*Leptomeria cunninghamii*			
223.	2355	*Leptomeria squarrulosa*			
224.	6358	*Leucopogon assimilis*			
225.	6360	*Leucopogon australis (Spiked Beard-heath)*			
226.	6367	*Leucopogon capitellatus*			
227.	6428	*Leucopogon pendulus*			
228.	6454	*Leucopogon verticillatus (Tassel Flower)*			
229.	36180	*Liparophyllum latifolium*			
230.	9289	*Lobelia anceps (Angled Lobelia)*			
231.	7408	*Lobelia tenuior (Slender Lobelia)*			
232.	14551	*Logania serpyllifolia subsp. serpyllifolia*			
233.	6515	*Logania vaginalis (White Spray)*			
234.	11073	*Lolium x hybridum*	Y		
235.	1223	*Lomandra caespitosa (Tufted Mat Rush)*			
236.	1234	*Lomandra nigricans*			
237.	1238	*Lomandra pauciflora*			
238.	7365	*Lonicera japonica (Japanese Honeysuckle)*	Y		
239.	35321	*Lonicera x italica*	Y		
240.	4059	*Lotus angustissimus (Narrowleaf Trefoil)*	Y		
241.	8564	*Lotus subbiflorus*	Y		
242.	1655	*Lyperanthus nigricans (Red Beak Orchid)*			
243.	36375	*Lysimachia arvensis (Pimpernel)*	Y		
244.	6456	*Lysinema ciliatum (Curry Flower)*			
245.	6457	*Lysinema conspicuum*			
246.	17637	*Marianthus candidus (White Marianthus)*			
247.	17694	*Meeboldina scariosa*			
248.	20297	*Melaleuca osullivanii*			
249.	6883	*Mentha pulegium (Pennyroyal)*	Y		
250.	957	*Mesomelaena tetragona (Semaphore Sedge)*			
251.	4090	*Mirbelia dilatata (Holly-leaved Mirbelia)*			
252.	4963	*Modiola caroliniana*	Y		
253.	6185	*Myriophyllum aquaticum (Brazilian Water Milfoil)*	Y		
254.	492	*Neurachne alopecuroidea (Foxtail Mulga Grass)*			
255.	6970	*Nicandra physalodes (Apple of Peru)*	Y		
256.	2923	*Nymphaea odorata (Fragrant Waterlily)*	Y		
257.	-6755	*Nymphaea sp.*			
258.	8143	*Olearia paucidentata (Autumn Scrub Daisy)*			
259.	8149	*Olearia rudis (Rough Daisybush)*			
260.	7346	*Opercularia echinocephala (Bristly Headed Stink Weed)*			
261.	7354	*Opercularia volubilis (Twining Stinkweed)*			
262.	1537	*Orthrosanthus laxus (Morning Iris)*			
263.	1540	*Orthrosanthus polystachyus (Many Spike Orthrosanthus)*			
264.	4349	*Oxalis corniculata (Yellow Wood Sorrel)*	Y		

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265.	4350	*Oxalis corymbosa (Pink Shamrock)*	Y		
266.	4354	*Oxalis incarnata*	Y		
267.	4356	*Oxalis pes-caprae (Soursob)*	Y		
268.	13135	*Ozothamnus ramosus*			
269.	3618	*Paraserianthes lophantha (Albizia)*			
270.	17114	*Paraserianthes lophantha subsp. lophantha*			
271.	7089	*Parentucellia latifolia (Common Bartsia)*	Y		
272.	11550	*Patersonia umbrosa var. xanthina (Yellow Flags)*			
273.	536	*Pennisetum clandestinum (Kikuyu Grass)*	Y		
274.	6245	*Pentapeltis peltigera*			
275.	2267	*Persoonia longifolia (Snottygobble)*			
276.	2273	*Persoonia saccata (Snottygobble)*			
277.	2293	*Petrophile diversifolia*			
278.	20460	*Pheladenia deformis*			
279.	1478	*Phlebocarya ciliata*			
280.	4675	*Phyllanthus calycinus (False Boronia)*			
281.	11928	*Pimelea ciliata subsp. ciliata*			
282.	5239	*Pimelea clavata*			
283.	5249	*Pimelea hispida (Bristly Pimelea)*			
284.	18117	*Pimelea rosea subsp. rosea*			
285.	5264	*Pimelea spectabilis (Bunjong)*			
286.	12041	*Pimelea suaveolens subsp. suaveolens*			
287.	5269	*Pimelea sylvestris*			
288.	88	*Pinus radiata (Radiata Pine)*	Y		
289.	16322	*Pittosporum undulatum*	Y		
290.	7303	*Plantago lanceolata (Ribwort Plantain)*	Y		
291.	6249	*Platysace compressa (Tapeworm Plant)*			
292.	6259	*Platysace tenuissima*			
293.	17016	*Podalyria sericea*	Y		
294.	86	*Podocarpus drouynianus (Wild Plum)*			
295.	8395	*Polygala myrtifolia (Myrtleleaf Milkwort)*	Y		
296.	15424	*Praecoxanthus aphyllus*			
297.	1680	*Prasophyllum parvifolium (Autumn Leek Orchid)*			
298.	-12789	*Prasophyllum sp.*			
299.	1683	*Prasophyllum triangulare (Dark Leek Orchid)*			
300.	1698	*Pterostylis vittata (Banded Greenhood)*			
301.	2742	*Ptilotus manglesii (Pom Poms)*			
302.	20195	*Pultenaea brachytropis*			
303.	4179	*Pultenaea pinifolia*		P3	
304.	32480	*Racopilum cuspidigerum var. convolutaceum*			
305.	2932	*Ranunculus colonorum (Common Buttercup)*			
306.	2933	*Ranunculus muricatus (Sharp Buttercup)*	Y		
307.	13300	*Rhodanthe citrina*			
308.	4695	*Ricinocarpos glaucus*			
309.	32425	*Rosulabryum billarderi*			
310.	20506	*Rubus anglocandicans*	Y		
311.	20496	*Rubus laudatus*	Y		
312.	2430	*Rumex brownii (Swamp Dock)*	Y		
313.	7602	*Scaevola calliptera*			
314.	7613	*Scaevola glandulifera (Viscid Hand-flower)*			
315.	7624	*Scaevola microphylla (Small-leaved Scaevola)*			
316.	32433	*Sematophyllum homomallum*			
317.	-9761	*Senecio sp.*			
318.	11803	*Silene gallica var. quinquevulnera*	Y		
319.	2911	*Silene vulgaris (Bladder Campion)*	Y		
320.	7022	*Solanum nigrum (Black Berry Nightshade)*	Y		
321.	8231	*Sonchus oleraceus (Common Sowthistle)*	Y		
322.	17551	*Sphaerolobium drummondii*			
323.	4207	*Sphaerolobium medium*			
324.	31952	*Sphenotoma gracilis (Swamp Paper-heath)*			
325.	4828	*Spyridium globulosum (Basket Bush)*			
326.	7696	*Stylidium calcaratum (Book Triggerplant)*			
327.	7708	*Stylidium crassifolium (Thick-leaved Triggerplant)*			
328.	7713	*Stylidium dichotomum (Pins-and-needles)*			
329.	7719	*Stylidium ecorne (Foot Triggerplant)*			
330.	19251	*Stylidium eriopodum*			
331.	12590	*Stylidium lowrieanum*			
332.	7787	*Stylidium rhynchocarpum (Black-beaked Triggerplant)*			
333.	-12389	*Stylidium sp.*			
334.	7799	*Stylidium spathulatum (Creamy Triggerplant)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
335.	7802	*Stylidium squamosotuberosum (Fleshy-rhizomed Trigger Plant)*			
336.	1260	*Stypandra glauca (Blind Grass)*			
337.	15827	*Taraxis grossa*			
338.	667	*Tetrarrhena laevis (Forrest Ricegrass)*			
339.	1704	*Thelymitra cornicina (Lilac Sun Orchid)*			
340.	1705	*Thelymitra crinita (Blue Lady Orchid)*			
341.	1708	*Thelymitra fuscolutea (Leopard Orchid)*			
342.	1711	*Thelymitra nuda (Scented Sun Orchid)*			
343.	5080	*Thomasia foliosa*			
344.	32486	*Thuidium sparsum var. hastatum*			
345.	1319	*Thysanotus arenarius*			
346.	8248	*Tolpis barbata (Yellow Hawkweed)*	Y		
347.	6280	*Trachymene pilosa (Native Parsnip)*			
348.	4547	*Tremandra diffusa*			
349.	4548	*Tremandra stelligera*			
350.	4302	*Trifolium ligusticum (Ligurian Clover)*	Y		
351.	35016	*Trihaloragis hexandra subsp. integrifolia*			
352.	34965	*Trihaloragis hexandra subsp. serrata*			
353.	1561	*Tritonia crocata*	Y		
354.	38401	*Tritonia gladiolaris (Lined Tritonia)*	Y		
355.	4360	*Tropaeolum majus (Garden Nasturtium)*	Y		
356.	13479	*Trymalium ledifolium var. rosmarinifolium*			
357.	33438	*Trymalium odoratissimum subsp. trifidum*			
358.	17680	*Tyrbastes glaucescens*			
359.	33537	*Vallisneria australis*	Y		
360.	7665	*Velleia trinervis*			
361.	7108	*Veronica arvensis (Wall Speedwell)*	Y		
362.	4322	*Vicia sativa (Common Vetch)*	Y		
363.	4325	*Viminaria juncea (Swishbush)*			
364.	6575	*Vinca major (Blue Periwinkle)*	Y		
365.	5223	*Viola odorata (Common Violet)*	Y		
366.	7388	*Wahlenbergia multicaulis*			
367.	13103	*Watsonia borbonica*	Y		
368.	1565	*Watsonia leipoldtii (Watsonia)*	Y		Y
369.	18108	*Watsonia meriana var. bulbillifera*	Y		
370.	18118	*Watsonia meriana var. meriana*	Y		
371.	1569	*Watsonia versfeldii*	Y		
372.	11712	*Watsonia versfeldii var. alba*	Y		
373.	1570	*Watsonia wordsworthiana*	Y		
374.	20737	*X Cyanthera glossodioides*			
375.	6283	*Xanthosia atkinsoniana*			
376.	19330	*Xanthosia tasmanica*			
377.	1149	*Xyris lacera*			
378.	1049	*Zantedeschia aethiopica (Arum Lily)*	Y		
379.	36218	*Zygodon menziesii*			

Conservation Codes
T - Rare or likely to become extinct
X - Presumed extinct
IA - Protected under international agreement
S - Other specially protected fauna
1 - Priority 1
2 - Priority 2
3 - Priority 3
4 - Priority 4
5 - Priority 5

[1] For NatureMap's purposes, species flagged as endemic are those whose records are wholely contained within the search area. Note that only those records complying with the search criterion are included in the calculation. For example, if you limit records to those from a specific datasource, only records from that datasource are used to determine if a species is restricted to the query area.

Appendix D

Field Survey Results

Table 11 Flora species recorded within the study area

Family	Genus	Species	Status
Anarthriaceae	*Anarthria*	*laevis*	
Anarthriaceae	*Anarthria*	*prolifera*	
Apiaceae	*Pentapeltis*	*peltigera*	
Apiaceae	*Platysace*	*tenuissima*	
Apocynaceae	*Vinca*	*major*	*
Araliaceae	*Hedera*	*helix*	*
Asparagaceae	*Lomandra*	*pauciflora*	
Asparagaceae	*Lomandra*	*purpurea*	
Asparagaceae	*Lomandra*	sp.	
Asparagaceae	*Thysanotus*	*manglesianus*	
Asparagaceae	*Thysanotus*	*multiflorus*	
Asteraceae	*Arctotheca*	*calendula*	*
Asteraceae	*Hypochaeris*	*glabra*	*
Asteraceae	*Hypochaeris*	*radicata*	*
Asteraceae	*Lagenophora*	*huegellii*	
Asteraceae	*Rhodanthe*	*citrina*	
Asteraceae	*Sonchus*	*asper*	*
Asteraceae	*Taraxacum*	*officinale*	*
Asteraceae	*Ursinia*	*anthemoides*	*
Caryophyllaceae	*Petrorhagia*	*dubia*	*
Celastraceae	*Tripterococcus*	*brunonis*	
Colchicaceae	*Burchardia*	*congesta*	
Crassulaceae	*Crassula*	*alata*	*
Crassulaceae	*Crassula*	*glomerata*	*
Cyperaceae	*Cyathochaeta*	*avenacea*	
Cyperaceae	*Gahnia*	*decomposita*	
Cyperaceae	*Lepidosperma*	*effusum*	
Cyperaceae	*Lepidosperma*	*gracile*	
Cyperaceae	*Lepidosperma*	*squamatum*	

Family	Genus	Species	Status
Cyperaceae	*Lepidosperma*	*tetraquetrum*	
Cyperaceae	*Mesomelaena*	*graciliceps*	
Cyperaceae	*Mesomelaena*	*tetragona*	
Dennstaedtiaceae	*Pteridium*	*esculentum*	
Dilleniaceae	*Hibbertia*	*cunninghamii*	
Dilleniaceae	*Hibbertia*	*furfuracea*	
Dilleniaceae	*Hibbertia*	*hypericoides*	
Droseraceae	*Drosera*	*glanduligera*	
Droseraceae	*Drosera*	*pallida*	
Droseraceae	*Drosera*	sp.	
Elaeocarpaceae	*Tremandra*	*stelligera*	
Ericaceae	*Astroloma*	*ciliatum*	
Ericaceae	*Astroloma*	*pallidum*	
Ericaceae	*Leucopogon*	*propinquus*	
Ericaceae	*Leucopogon*	*verticillatus*	
Ericaceae	*Sphenotoma*	*gracilis*	
Euphorbiaceae	*Amperea*	*ericoides*	
Fabaceae	*Acacia*	*alata* var. *alata*	
Fabaceae	*Acacia*	*decurrens*	*
Fabaceae	*Acacia*	*divergens*	
Fabaceae	*Acacia*	*gilbertii*	
Fabaceae	*Acacia*	*melanoxylon*	*
Fabaceae	*Acacia*	*pulchella*	
Fabaceae	*Acacia*	*saligna*	
Fabaceae	*Bossiaea*	*eriocarpa*	
Fabaceae	*Bossiaea*	*linophylla*	
Fabaceae	*Bossiaea*	*ornata*	
Fabaceae	*Callistachys*	*lanceolata*	
Fabaceae	*Chorizema*	*rhombeum*	
Fabaceae	*Daviesia*	*decurrens*	

Family	Genus	Species	Status
Fabaceae	*Gastrolobium*	*bilobum*	
Fabaceae	*Gastrolobium*	*formosum*	Priority 3
Fabaceae	*Gompholobium*	*knightianum*	
Fabaceae	*Gompholobium*	*polymorphum*	
Fabaceae	*Gompholobium*	*preissii*	
Fabaceae	*Hovea*	*chorizemifolia*	
Fabaceae	*Hovea*	*elliptica*	
Fabaceae	*Hovea*	*trisperma*	
Fabaceae	*Kennedia*	*coccinea*	
Fabaceae	*Mirbelia*	*dilatata*	
Fabaceae	sp.		
Fabaceae	*Sphaerolobium*	*medium*	
Fabaceae	*Trifolium*	sp.	
Fabaceae	*Viminaria*	*juncea*	
Goodeniaceae	*Dampiera*	*hederacea*	
Goodeniaceae	*Dampiera*	*linearis*	
Goodeniaceae	*Dampiera*	*trigona*	
Goodeniaceae	*Scaevola*	*calliptera*	
Goodeniaceae	*Scaevola*	*microphylla*	
Haemodoraceae	*Anigonzanthos*	*flavidus*	
Haemodoraceae	*Conostylis*	*aculeata*	
Haemodoraceae	*Conostylis*	*aculeata* subsp. *aculeata*	
Haemodoraceae	*Haemodorum*	sp.	
Haemodoraceae	*Haemodorum*	*spicatum*	
Hemerocallidaceae	*Agrostocrinum*	*hirsutum*	
Hemerocallidaceae	*Dianella*	*revoluta*	
Hemerocallidaceae	*Johnsonia*	*lupulina*	
Hemerocallidaceae	*Stypandra*	*glauca*	
Hypericaceae	*Hypericum*	*perforatum*	*DP
Iridaceae	*Patersonia*	*occidentalis*	

Family	Genus	Species	Status
Iridaceae	*Patersonia*	*umbrosa* var. *xanthina*	
Iridaceae	*Watsonia*	*meriana* var. *bulbillifera*	*
Iridaceae	*Watsonia*	sp.	*
Juncaceae	*Juncus*	*pallidus*	
Juncaceae	*Juncus*	*pauciflorus*	
Juncaceae	*Juncus*	*planifolius*	
Lamiaceae	*Hemigenia*	*pritzelii*	
Lauraceae	*Cassytha*	*racemosa*	
Lindsaeaceae	*Lindsaea*	*linearis*	
Loganiaceae	*Logania*	*serpyllifolia* subsp. *angustifolia*	
Loganiaceae	*Logania*	*vaginalis*	
Menyanthaceae	*Liparophyllum*	*latifolium*	
Myrtaceae	*Agonis*	*flexuosa*	
Myrtaceae	*Astartea*	*leptophylla*	
Myrtaceae	*Corymbia*	*calophylla*	
Myrtaceae	*Eucalyptus*	*diversicolor*	
Myrtaceae	*Eucalyptus*	*lehmannii*	*Planted
Myrtaceae	*Eucalyptus*	*globulus*	*Planted
Myrtaceae	*Eucalyptus*	*marginata*	
Myrtaceae	*Eucalyptus*	sp.	*Planted
Myrtaceae	*Kunzea*	*ciliata*	
Myrtaceae	*Leptospermum*	*laevigatum*	*
Myrtaceae	*Melaleuca*	*incana* subsp. *incana*	
Myrtaceae	*Melaleuca*	sp.	*Planted
Myrtaceae	*Taxandra*	*linearifolia*	
Orchidaceae	*Caladenia*	*flava*	
Orchidaceae	*Disa*	*bracteata*	*
Orchidaceae	*Lyperanthus*	*serratus*	
Orchidaceae	*Thelymitra*	*crinita*	
Oxalidaceae	*Oxalis*	sp.	

Family	Genus	Species	Status
Phyllanthaceae	*Phyllanthus*	*calycinus*	
Pinaceae	*Pinus*	sp.	
Pittosporaceae	*Billardiera*	*variifolia*	
Pittosporaceae	sp.		
Plantaginaceae	*Plantago*	*lanceolata*	
Poaceae	*Aira*	*caryophyllea*	*
Poaceae	*Austrodanthonia*	*setacea*	
Poaceae	*Austrostipa*	*tenuifolia*	
Poaceae	*Avena*	*barbata*	*
Poaceae	*Briza*	*maxima*	*
Poaceae	*Briza*	*minor*	*
Poaceae	*Ehrharta*	*calycina*	*
Poaceae	*Eragrostis*	*curvula*	*
Poaceae	*Hordeum*	*leporinum*	*
Poaceae	*Hordeum*	*leporinum*	*
Poaceae	*Hyparrhenia*	*hirta*	*
Poaceae	*Lolium*	*rigidum*	*
Poaceae	*Neurachne*	*alopecuroidea*	
Poaceae	*Phalaris*	*paradoxa*	*
Podocarpaceae	*Podocarpus*	*drouynianus*	
Polygalaceae	*Comesperma*	*virgatum*	
Proteaceae	*Banksia*	*grandis*	
Proteaceae	*Grevillea*	*quercifolia*	
Proteaceae	*Hakea*	*amplexicaulis*	
Proteaceae	*Hakea*	*lasianthoides*	
Proteaceae	*Hakea*	*lissocarpha*	
Proteaceae	*Hakea*	*ruscifolia*	
Proteaceae	*Persoonia*	*longifolia*	
Proteaceae	*Petrophile*	*diversifolia*	
Proteaceae	*Synaphea*	*?petiolaris*	

Family	Genus	Species	Status
Ranunculaceae	*Clematis*	*pubescens*	
Restionaceae	*Desmocladus*	*fasciculatus*	
Restionaceae	*Desmocladus*	*flexuosus*	
Restionaceae	*Loxocarya*	*cinerea*	
Restionaceae	*Meeboldina*	*?coangustata*	
Restionaceae	*Meeboldina*	*scariosa*	
Restionaceae	*Taraxis*	*grossa*	
Rhamnaceae	*Trymalium*	*odoratissimum* subsp. *trifidum*	
Rubiaceae	*Opercularia*	*hispidula*	
Rutaceae	*Philotheca*	*spicata*	
Santalaceae	*Leptomeria*	*squarrulosa*	
Solanaceae	*Solanum*	*nigrum*	*
Stylidiaceae	*Stylidium*	*amoenum*	
Stylidiaceae	*Stylidium*	*calcaratum*	
Thymeleaceae	*Pimelea*	*spectablis*	
Verbenaceae	*Lantana*	*camara*	*DP, WONS
Xanthorrhoeaceae	*Xanthorrhoea*	*gracillis*	
Xanthorrhoeaceae	*Xanthorrhoea*	*preissii*	
Zamiaceae	*Macrozamia*	*riedlei*	

*	Introduced / weed species
DP	Declared Plant
WONS	Weeds of National Significance

Quadrat Data

Quadrat	1								
Location	E:	323976	N:	6242018					
Habitat	Jarrah/Marri Forest								
Topography/Aspect	SW		Slope		Gentle-moderate				
Geology	Granite								
Soil	Dark brown sand								
%Bare Ground	0	%Logs	10-30	%Twigs	30-70	%Leaves	>70		
Hydrology	Good drainage								
Landform	Mid-slope								
Vegetation Condition	Very Good (3)								
Disturbance	Selective logging								
Age Since Fire	Old (5-20 yr)								

Layer	Cover Class	Family	Genus	Species
Trees 10-30 m	10-30%	Myrtaceae	*Corymbia*	*calophylla*
		Myrtaceae	*Eucalyptus*	*marginata*
Shrubs >2 m	10-30%	Fabaceae	*Hovea*	*trisperma*
		Fabaceae	*Acacia*	*saligna*
		Xanthorrhoeaceae	*Xanthorrhoea*	*preissii*
Shrubs <1m	30-70%	Dilleniaceae	*Hibbertia*	*hypericoides*
		Proteaceae	*Hakea*	*lissocarpha*
		Proteaceae	*Hakea*	*amplexicaulis*
		Zamiaceae	*Macrozamia*	*riedlei*
		Ericaceae	*Leucopogon*	*propinquus*
		Proteaceae	*Hakea*	*ruscifolia*
		Fabaceae	*Gompholobium*	*polymorphum*
Grasses	<2%	Poaceae	**Lolium*	*rigidum*
Herbs	10-30%	Pittosporaceae	*sp.*	

Layer	Cover Class	Family	Genus	Species
		Rubiaceae	*Opercularia*	*hispidula*
		Lauraceae	*Cassytha*	*racemosa*
		Iridaceae	*Patersonia*	*umbrosa var. xanthina*
		Goodeniaceae	*Scaevola*	*calliptera*
		Hemerocallidaceae	*Agrostocrinum*	*hirsutum*
		Apiaceae	*Platysace*	*tenuissima*
		Asteraceae	*Lagenophora*	*huegellii*
		Droseraceae	*Drosera*	*pallida*
		Stylidiaceae	*Stylidium*	*amoenum*
		Lindsaeaceae	*Lindsaea*	*linearis*
Sedges	2-10%	Cyperaceae	*Lepidosperma*	*gracile*
		Restionaceae	*Desmocladus*	*fasciculatus*

Quadrat	2
Location	E: 324055 N: 6241911
Habitat	Jarrah/Marri Forest
Topography/Aspect	SE Slope Moderate
Geology	Granite
Soil	Dark brown sand
%Bare Ground	<2 %Logs 2-10 %Twigs 30-70 %Leaves >70
Hydrology	Good drainage
Landform	Lower slope
Vegetation Condition	Very Good (3)
Disturbance	Selective logging
Age Since Fire	Old (5-20 yr)

Layer	Cover Class	Family	Genus	Species
Trees <10 m	30-70	Myrtaceae	*Corymbia*	*calophylla*
		Myrtaceae	*Eucalyptus*	*marginata*
Shrubs 1-2 m	30-70	Fabaceae	*Hovea*	*trisperma*
		Fabaceae	*Acacia*	*saligna*
		Xanthorrhoeaceae	*Xanthorrhoea*	*preissii*
		Proteaceae	*Hakea*	*amplexicaulis*
		Proteaceae	*Petrophile*	*diversifolia*
Shrubs <1 m	30-70	Elaeocarpaceae	*Tremandra*	*stelligera*
		Ericaceae	*Leucopogon*	*verticillatus*
		Zamiaceae	*Macrozamia*	*riedlei*
		Dilleniaceae	*Hibbertia*	*hypericoides*
		Rutaceae	*Philotheca*	*spicata*
		Dilleniaceae	*Hibbertia*	*furfuracea*
		Fabaceae	*Bossiaea*	*ornata*
		Proteaceae	*Persoonia*	*longifolia*
		Ericaceae	*Leucopogon*	*propinquus*
		Fabaceae	*Hovea*	*elliptica*

Layer	Cover Class	Family	Genus	Species
Grasses	<2	Poaceae	*Neurachne*	*alopecuroidea*
Herbs	10-30	Thymeleaceae	*Pimelea*	*spectablis*
		Hemerocallidaceae	*Agrostocrinum*	*hirsutum*
		Apiaceae	*Platysace*	*tenuissima*
		Iridaceae	*Patersonia*	*umbrosa var. xanthina*
		Dilleniaceae	*Hibbertia*	*cunninghamii*
		Rubiaceae	*Opercularia*	*hispidula*
		Stylidiaceae	*Stylidium*	*amoenum*
		Pittosporaceae	sp.	
		Asteraceae	*Lagenophora*	*huegellii*
		Asparagaceae	*Lomandra*	sp.
		Orchidaceae	*Lyperanthus*	*serratus*
		Orchidaceae	*Thelymitra*	*crinita*
		Lindsaeaceae	*Lindsaea*	*linearis*
		Haemodoraceae	*Haemodorum*	sp.
		Anarthriaceae	*Anarthria*	*prolifera*
		Proteaceae	*Synaphea*	*?petiolaris*
		Asparagaceae	*Lomandra*	*pauciflora*
		Hemerocallidaceae	*Johnsonia*	*lupulina*
		Apiaceae	*Platysace*	*tenuissima*
Sedges	10-30	Cyperaceae	*Lepidosperma*	*gracile*
		Restionaceae	*Desmocladus*	*fasciculatus*
		Cyperaceae	*Mesomelaena*	*graciliceps*

Quadrat	3						
Location	E:	323964	N:	6242124			
Habitat	Jarrah/Marri Forest						
Topography/Aspect	W		Slope	Gentle			
Geology	Granite						
Soil	Dark orange/brown sand						
%Bare Ground	<2	%Logs	2-10	%Twigs	10-30	%Leaves	>70
Hydrology	Good drainage						
Landform	Mid-slope						
Vegetation Condition	Very Good (3)						
Disturbance	Selective logging						
Age Since Fire	Old (5-20 yr)						

Layer	Cover Class	Family	Genus	Species
Trees 10-30 m	30-70	Myrtaceae	*Eucalyptus*	*marginata*
Shrubs 1-2 m	30-70	Fabaceae	*Hovea*	*trisperma*
		Proteaceae	*Hakea*	*ruscifolia*
		Fabaceae	*Hovea*	*elliptica*
		Xanthorrhoeaceae	*Xanthorrhoea*	*preissii*
		Fabaceae	*Acacia*	*divergens*
		Proteaceae	*Hakea*	*amplexicaulis*
		Ericaceae	*Leucopogon*	*verticillatus*
		Podocarpaceae	*Podocarpus*	*drouynianus*
Shrubs <1 m	30-70	Dilleniaceae	*Hibbertia*	*hypericoides*
		Rutaceae	*Philotheca*	*spicata*
		Zamiaceae	*Macrozamia*	*riedlei*
		Fabaceae	*Hovea*	*chorizemifolia*
		Fabaceae	*Sphaerolobium*	*medium*
Herbs	10-30	Hemerocallidaceae	*Agrostocrinum*	*hirsutum*
		Lindsaeaceae	*Lindsaea*	*linearis*
		Lauraceae	*Cassytha*	*racemosa*

Layer	Cover Class	Family	Genus	Species
		Iridaceae	*Patersonia*	*umbrosa* var. *xanthina*
		Apiaceae	*Pentapeltis*	*peltigera*
		Apiaceae	*Platysace*	*tenuissima*
		Stylidiaceae	*Stylidium*	*amoenum*
Sedges	<2	Cyperaceae	*Lepidosperma*	*gracile*

Releve	1
Location	E: 323485 N: 6240564
Habitat	Jarrah-Marri Forest/Drainage line
Topography/Aspect	East Slope Gentle
Soil	Dark brown loam/sand
%Bare Ground	<2 %Logs 10-30 %Twigs 30-70 %Leaves >70
Hydrology	Good drainage
Landform	Bank of drainage line
Vegetation Condition	Very Good (3)
Disturbance	Weeds and tracks
Age Since Fire	Old (5-20 yr)

Layer	Cover Class	Family	Genus	Species
Trees 10-30 m	30-70	Myrtaceae	*Eucalyptus*	*marginata*
		Myrtaceae	*Corymbia*	*calophylla*
Trees <10 m	10-30	Myrtaceae	*Agonis*	*flexuosa*
Shrubs >2 m	10-30	Proteaceae	*Banksia*	*grandis*
		Myrtaceae	*Melaleuca*	*incana* subsp. *incana*
		Myrtaceae	*Taxandra*	*linearifolia*
Shrubs 1-2 m	10-30	Fabaceae	*Mirbelia*	*dilatata*
		Fabaceae	*Hovea*	*trisperma*
		Fabaceae	*Hovea*	*elliptica*
Shrubs <1 m	30-70	Dilleniaceae	*Hibbertia*	*hypericoides*
		Fabaceae	*Acacia*	*alata* var. *alata*
		Haemodoraceae	*Conostylis*	*aculeata subsp. aculeata*
Grasses	2-10	Poaceae	*Hordeum*	*leporinum*
		Poaceae	**Phalaris*	*paradoxa*
		Poaceae	*Briza*	*maxima*
		Poaceae	*Avena*	*barbata*

Layer	Cover Class	Family	Genus	Species
Herbs	10-30	Dennstaedtiaceae	*Pteridium*	*esculentum*
		Restionaceae	*Loxocarya*	*cinerea*
		Hemerocallidaceae	*Agrostocrinum*	*hirsutum*
		Fabaceae	**Trifolium*	*sp.*
		Oxalidaceae	*Oxalis*	*sp.*
		Droseraceae	*Drosera*	*sp.*
		Asteraceae	**Hypochaeris*	*radicata*
		Asparagaceae	*Thysanotus*	*manglesianus*
		Juncaceae	*Juncus*	*pauciflorus*
		Goodeniaceae	*Dampiera*	*trigona*
Sedges	10-30	Restionaceae	*Desmocladus*	*flexuosus*
		Cyperaceae	*Lepidosperma*	*squamatum*
		Cyperaceae	*Gahnia*	*decomposita*
		Restionaceae	*Meeboldina*	*?coangustata*
		Juncaceae	*Juncus*	*planifolius*
		Juncaceae	*Juncus*	*pallidus*

Releve	2
Location	E: 323817 N: 6242116
Habitat	Jarrah-Marri-Peppermint Forest
Topography/Aspect	n/a
Soil	Dark brown loamy/sandy
%Bare Ground	0 %Logs 2-10 %Twigs 30-70 %Leaves >70
Hydrology	Seasonally wet
Landform	Drainage depression
Vegetation Condition	Very Good (3)
Disturbance	Weeds and tracks
Age Since Fire	Old (5-20 yr)

Layer	Cover Class	Family	Genus	Species
Trees 10-30 m	10-30	Myrtaceae	*Eucalyptus*	*marginata*
		Myrtaceae	*Corymbia*	*calophylla*
Trees <10 m	30-70	Myrtaceae	*Agonis*	*flexuosa*
		Fabaceae	*Callistachys*	*lanceolata*
		Myrtaceae	*Taxandria*	*linearifolia*
Shrubs 1-2 m	10-30	Fabaceae	*Hovea*	*trisperma*
		Xanthorrhoeaceae	*Xanthorrhoea*	*preissii*
		Proteaceae	*Hakea*	*amplexicaulis*
		Ericaceae	*Leucopogon*	*verticillatus*
		Fabaceae	*Mirbelia*	*dilatata*
		Rhamnaceae	*Trymalium*	*odoratissimum subsp. trifidum*
		Loganiaceae	*Logania*	*vaginalis*
		Thymeleaceae	*Pimelea*	*spectablis*
		Fabaceae	*Bossiaea*	*linophylla*
Shrubs <1 m	10-30	Elaeocarpaceae	*Tremandra*	*stelligera*
		Dilleniaceae	*Hibbertia*	*hypericoides*

Layer	Cover Class	Family	Genus	Species
		Zamiaceae	*Macrozamia*	*riedlei*
		Fabaceae	*Acacia*	*gilbertii*
		Goodeniaceae	*Scaevola*	*microphylla*
Grasses	<2	Poaceae	**Lolium*	*rigidum*
		Poaceae	*Briza*	*maxima*
Herbs	10-30	Dennstaedtiaceae	*Pteridium*	*esculentum*
		Goodeniaceae	*Dampiera*	*hederacea*
		Lauraceae	*Cassytha*	*racemosa*
		Ranunculaceae	*Clematis*	*pubescens*
		Iridaceae	*Patersonia*	*umbrosa* var. *xanthina*
		Orchidaceae	*Lyperanthus*	*serratus*
		Menyanthaceae	*Liparophyllum*	*latifolium*
		Hemerocallidaceae	*Johnsonia*	*lupulina*
		Hemerocallidaceae	*Agrostocrinum*	*hirsutum*
		Stylidiaceae	*Stylidium*	*amoenum*
		Goodeniaceae	*Scaevola*	*calliptera*
		Droseraceae	*Drosera*	*pallida*
		Polygalaceae	*Comesperma*	*virgatum*
		Asparagaceae	*Lomandra*	*pauciflora*
Sedges	30-70	Cyperaceae	*Lepidosperma*	*tetraquetrum*
		Restionaceae	*Taraxis*	*grossa*
		Cyperaceae	*Lepidosperma*	*gracile*
		Cyperaceae	*Lepidosperma*	*effusum*

Table 12 Fauna Species Identified From Desktop and Field Assessment

Family	Genus	Species	Common Name	Nature Maps data search	EPBC data search	GHD (2011)	Species Listing or introduced
Birds							
Acanthizidae	*Acanthiza*	*apicalis*	Inland Thornbill	X			
Acanthizidae	*Acanthiza*	*chrysorrhoa*	Yellow-rumped Thornbill	X		X	
Acanthizidae	*Acanthiza*	*inornata*	Western Thornbill	X			
Acanthizidae	*Sericornis*	*frontalis maculatus*	White-browed Scrubwren	X		X	
Acanthizidae	*Smicrornis*	*brevirostris occidentalis*	Weebill			X	
Acanthizidae	*Gerygone*	*fusca*	Western Gerygone	X		X	
Accipitridae	*Aquila*	*audax*	Wedge-tailed Eagle	X			
Accipitridae	*Accipiter*	*cirrocephalus cirrocephalus*	Collared Sparrowhawk			X	
Accipitridae	*Accipiter*	*fasciatus fasciatus*	Brown Goshawk	X			
Accipitridae	*Circus*	*approximans*	Swamp Harrier	X			
Accipitridae	*Elanus*	*axillaris*	Black-shouldered Kite	X			
Accipitridae	*Haliastur*	*sphenurus*	Whistling Kite	X			
Accipitridae	*Haliaeetus*	*leucogaster*	White-bellied Sea-eagle		X		Mi
Accipitridae	*Hieraaetus*	*morphnoides*	Little Eagle	X			
Accipitridae	*Lophoictinia*	*isura*	Square-tailed Kite			X	
Accipitridae	*Pandion*	*haliaetus cristatus*	Osprey	X			

Family	Genus	Species	Common Name	Nature Maps data search	EPBC data search	GHD (2011)	Species Listing or introduced
Anatidae	*Anas*	*gracilis*	Grey Teal	X		X	
Anatidae	*Anas*	*platyrhynchos*	Mallard	X			#
Anatidae	*Anas*	*superciliosa*	Pacific Black Duck	X		X	
Anatidae	*Biziura*	*lobata*	Musk Duck	X			
Anatidae	*Chenonetta*	*jubata*	Australian Wood Duck	X		X	
Anatidae	*Cygnus*	*atratus*	Black Swan	X			
Anatidae	*Strictonetta*	*naevosa*	Freckled Duck	X			
Anatidae	*Tadorna*	*tadornoides*	Australian Shelduck	X		X	
Ardeidae	*Apus*	*pacificus*	Fork-tailed Swift		X		Ma,Mi
Ardeidae	*Ardea*	*modesta*	Great Egret		X		Ma,Mi
Ardeidae	*Ardea*	*ibis*	Cattle Egret		X		Ma,Mi
Ardeidae	*Ardea*	*pacifica*	White-necked Heron	X			
Ardeidae	*Botaurus*	*poiciloptilus*	Australasian Bittern		X		En,S1
Ardeidae	*Egretta*	*novaehollandiae*	White-faced Heron	X		X	
Ardeidae	*Ixobrychus*	*flavicollis australis*	Black Bittern	X			P3
Anhingidae	*Anhinga*	*novaehollandiae*	Australasian Darter	X			
Artamidae	*Artamus*	*cinereus*	Black-faced Woodswallow	X		X	
Artamidae	*Artamus*	*cyanopterus*	Dusky Woodswallow	X		X	
Artamidae	*Artamus*	*superciliosus*	White-browed Woodswallow	X			

Family	Genus	Species	Common Name	Nature Maps data search	EPBC data search	GHD (2011)	Species Listing or introduced
Artamidae	*Cracticus*	*tiibicen dorsalis*	Australian Magpie	X		X	
Artamidae	*Cracticus*	*torquatus leucopterus*	Grey Butcherbird	X		X	
Artamidae	*Strepera*	*versicolor*	Grey Currawong	X			
Cacatuidae	*Cacatua*	*galerita*	Sulphur-crested Cockatoo	X			#
Cacatuidae	*Cacatua*	*sanguinea*	Little Corella			X	
Cacatuidae	*Calyptorhynchus*	*banksii naso*	Forest Red-tailed Black Cockatoo	X	X	X	Vu, S1
Cacatuidae	*Calyptorhynchus*	*baudinii*	Baudin's Black Cockatoo	X	X	X	Vu, S1
Cacatuidae	*Calyptorhynchus*	*latirostris*	Carnaby's Black Cockatoo	X	X		En, S1
Cacatuidae	*Eolophus*	*roseicapilla*	Pink and Grey Galah	X		X	
Campephagidae	*Coracina*	*novaehollandiae*	Black-faced Cuckoo-shrike	X		X	
Campephagidae	*Lalage*	*sueurii*	White-winged Triller	X			
Casuariidae	*Dromaius*	*novaehollandiae*	Emu	X		X	
Charadriidae	*Charadrius*	*ruficapillus*	Red-capped Plover	X			
Charadriidae	*Thinornis*	*rubricollis*	Hooded Plover	X			
Charadriidae	*Elseyornis*	*melanops*	Black-fronted Dotterel	X			
Charadriidae	*Vanellus*	*tricolor*	Banded Lapwing	X			
Climacteridae	*Climacteris*	*rufa*	Rufous Treecreeper	X			
Columbidae	*Ocyphaps*	*lophotes*	Crested Pigeon	X			
Columbidae	*Phaps*	*chalcoptera*	Common Bronzewing	X		X	

Family	Genus	Species	Common Name	Nature Maps data search	EPBC data search	GHD (2011)	Species Listing or introduced
Columbidae	*Phaps*	*elegans*	Brush Bronzewing	X			
Columbidae	*Streptopelia*	*senegalensis*	Laughing Turtle Dove	X			#
Corvidae	*Corvus*	*coronoides perplexus*	Australian Raven	X		X	
Cuculidae	*Cacomantis*	*pallidus*	Pallid Cuckoo	X			
Cuculidae	*Cacomantis*	*flabelliformis*	Fan-tailed Cuckoo	X			
Cuculidae	*Chalcites*	*lucidus plagosus*	Shining-bronze Cuckoo	X			
Estrildidae	*Stagonopleura*	*oculata*	Red-eared Firetail	X			
Falconidae	*Falco*	*berigora*	Brown Falcon	X			
Falconidae	*Falco*	*cenchroides cenchroides*	Nankeen Kestrel	X		X	
Falconidae	*Falco*	*peregrinus macropus*	Peregrine Falcon	X			S4
Haematopodidae	*Haematopus*	*fuliginosus*	Sooty Oystercatcher	X			
Halcyonidae	*Dacelo*	*novaeguineae*	Laughing Kookaburra	X		X	#
Hirundinidae	*Hirundo*	*neoxena*	Welcome Swallow	X		X	
Hirundinidae	*Petrochelidon*	*nigricans*	Tree Martin	X		X	
Hirundinidae	*Petrochelidon*	*ariel*	Fairy Martin			X	
Laridae	*Hydroprogne*	*caspia*	Caspian Tern	X			
Laridae	*Chroicocephalus*	*novaehollandiae*	Silver Gull	X			
Laridae	*Sternula*	*nereis*	Fairy Tern	X			
Laridae	*Thalasseus*	*bergii*	Crested Tern	X			

Family	Genus	Species	Common Name	Nature Maps data search	EPBC data search	GHD (2011)	Species Listing or introduced
Maluridae	*Malurus*	*elegans*	Red-winged Fairy-wren	X		X	
Maluridae	*Malurus*	*splendens*	Splendid Fairy-wren	X		X	
Maluridae	*Stipiturus*	*malachurus westernensis*	Southern Emu-wren	X			
Meliphagidae	*Acanthorhynchus*	*superciliosus*	Western Spinebill	X			
Meliphagidae	*Anthochaera*	*lunulata*	Western Wattlebird	X		X	
Meliphagidae	*Anthochaera*	*carunculata*	Red Wattlebird	X		X	
Meliphagidae	*Epthianura*	*albifrons*	White-fronted Chat	X			
Meliphagidae	*Glyciphila*	*melanops*	Tawny-crowned Honeyeater	X			
Meliphagidae	*Lichenostomus*	*virescens virescens*	Singing Honeyeater	X		X	
Meliphagidae	*Lichmera*	*indistincta*	Brown Honeyeater	X		X	
Meliphagidae	*Melithreptus*	*brevirostris*	Brown-headed Honeyeater	X			
Meliphagidae	*Phylidonyris*	*novaehollandiae*	New Holland Honeyeater	X		X	
Meropidae	*Merops*	*ornatus*	Rainbow Bee-eater	X	X		Ma,Mi
Monarchidae	*Grallina*	*cyanoleuca*	Magpie-lark	X		X	
Monarchidae	*Myiagra*	*inquieta*	Restless Flycatcher	X			
Motacillidae	*Anthus*	*novaeseelandiae*	Australian Pipit	X			
Nectariniidae	*Dicaeum*	*hirundinaceum*	Mistletoebird	X			
Neosittidae	*Daphoenositta*	*chrysoptera*	Varied Sittella	X		X	
Pachycephalidae	*Colluricincla*	*harmonica rufiventris*	Grey Shrike-thrush	X		X	

Family	Genus	Species	Common Name	Nature Maps data search	EPBC data search	GHD (2011)	Species Listing or introduced
Pachycephalidae	*Falcunculus*	*frontatus*	Crested Shrike-tit	X			
Pachycephalidae	*Pachycephala*	*pectoralis*	Golden Whistler	X		X	
Pachycephalidae	*Pachycephala*	*rufiventris rufiventris*	Rufous Whistler	X		X	
Pardalotidae	*Pardalotus*	*punctatus*	Spotted Pardalote	X			
Pardalotidae	*Pardalotus*	*striatus*	Striated Pardalote	X		X	
Pelecanidae	*Pelecanus*	*conspicillatus*	Australian Pelican	X			
Petroicidae	*Petroica*	*boodang*	Scarlet Robin	X		X	
Petroicidae	*Eopsaltria*	*griseogularis*	Western Yellow Robin	X		X	
Petroicidae	*Eopsaltria*	*georgiana*	White-breasted Robin	X			
Petroicidae	*Melanodryas*	*cucullata*	Hooded Robin	X			
Petroicidae	*Microeca*	*fascinans*	Jacky Winter	X		X	
Phalacrocoracidae	*Microcarbo*	*melanoleucos*	Little Pied Cormorant	X			
Phalacrocoracidae	*Phalacrocorax*	*carbo*	Great Cormorant	X			
Phalacrocoracidae	*Phalacrocorax*	*sulcirostris*	Little Black Cormorant	X		X	
Phalacrocoracidae	*Phalacrocorax*	*varius*	Pied Cormorant	X			
Phasianidae	*Coturnix*	*pectoralis*	Stubble Quail	X			
Phasianidae	*Coturnix*	*ypsilophora*	Brown Quail	X			
Podicipedidae	*Poliocephalus*	*poliocephalus*	Hoary-headed Grebe	X			
Podicipedidae	*Tachybaptus*	*novarhollandiae*	Australasian Grebe	X		X	

Family	Genus	Species	Common Name	Nature Maps data search	EPBC data search	GHD (2011)	Species Listing or introduced
Psittacidae	*Barnardius*	*zonarius*	Australian Ringneck	X		X	
Psittacidae	*Glossopsitta*	*porphyrocephala*	Purple-crowned Lorikeet	X		X	
Psittacidae	*Platycercus*	*icterotis*	Western Rosella	X		X	
Psittacidae	*Purpureicephalus*	*spurius*	Red-capped Parrot	X		X	
Psittacidae	*Neophema*	*elegans*	Elegant Parrot	X		X	
Rallidae	*Fulica*	*atra*	Eurasian Coot	X		X	
Rallidae	*Gallinula*	*tenebrosa*	Dusky Moorhen	X			
Rallidae	*Gallirallus*	*philippensis*	Buff-banded Rail	X			
Rallidae	*Porphyrio*	*porphyrio*	Purple Swamphen	X			
Rallidae	*Porzana*	*tabuensis*	Spotless Crake	X			
Recurvirostridae	*Himantopus*	*himantopus*	Black-winged Stilt	X			
Rhipiduridae	*Rhipidura*	*albicauda*	Grey Fantail	X		X	
Rhipiduridae	*Rhipidura*	*leucophrys*	Willie Wagtail	X		X	
Scolopacidae	*Calidris*	*ruficollis*	Red-necked Stint	X			
Strigidae	*Ninox*	*novaeseelandiae boobook*	Boobook Owl	X			
Threskiornithidae	*Threskiornis*	*spinicollis*	Straw-necked Ibis	X		X	
Timaliidae	*Zosterops*	*lateralis*	Silvereye	X		X	
Tytonidae	*Tyto*	*Javanica*	Eastern Barn Owl	X			
Tytonidae	*Tyto*	*novaehollandiae*	Masked Owl (Southwest)	X			P3

Family	Genus	Species	Common Name	Nature Maps data search	EPBC data search	GHD (2011)	Species Listing or introduced
		novaehollandiae					
Reptiles							
Elapidae	*Echiopsis*	*curta*	Bardick	X			
Elapidae	*Notechis*	*scutatus*	Tiger Snake			X	
Elapidae	*Pseudonaja*	*affinis affinis*	Dugite	X			
Gekkonidae	*Christinus*	*marmoratus*	Marbled Gecko	X			
Scincidae	*Acritoscincus*	*trilineatum*	Cool Skink			X	
Scincidae	*Ctenotus*	*impar*	Odd-striped Ctenotus	X			
Scincidae	*Ctenotus*	*labillardieri*	Red-legged skink	X			
Scincidae	*Cryptoblephorus*	*buchanani*	Buchanan's Snake-eyed Skink	X		X	
Scincidae	*Egernia*	*kingii*	King Skink	X		X	
Scincidae	*Egernia*	*napoleonis*	Napoleon Skink	X			
Scincidae	*Hemiergis*	*peronii tridactyla*	Three-toed Earless Skink	X		X	
Scincidae	*Lerista*	*distinguenda*	South-west Four-toed Lerista	X			
Scincidae	*Lerista*	*elegans*	West Coast Four-toed Lerista	X			
Scincidae	*Lerista*	*microtis microtis*	Micro Lerista	X			
Scincidae	*Menetia*	*greyii*	Common Dwarf Skink	X		X	
Scincidae	*Morethia*	*lineocellata*	Western Pale-flecked Skink	X			
Scincidae	*Morethia*	*obscura*	Southern Pale-flecked Morethia	X		X	

Family	Genus	Species	Common Name	Nature Maps data search	EPBC data search	GHD (2011)	Species Listing or introduced
Scincidae	*Tiliqua*	*rugosa rugosa*	Bobtail			X	
Pygopodidae	*Lialis*	*burtonis*	Burton's Legless Lizard	X			
Pygopodidae	*Pygopus*	*lepidopodus*	Common Scaly Foot	X			
Typhlopidae	*Ramphotyphlops*	*australis*	Common Blindsnake	X			
Varanidae	*Varanus*	*rosenbergi*	Heath Monitor	X		X	
Amphibians							
Hylidae	*Litoria*	*adelaidensis*	Slender Tree Frog			X	
Hylidae	*Litoria*	*moorei*	Motorbike Frog	X		X	
Limnodynastidae	*Heleioporus*	*eyrei*	Moaning Frog	X			
Limnodynastidae	*Limnodynastes*	*dorsalis*	Pobblebonk	X			
Myobatrachidae	*Crinia*	*georgiana*	Quacking Frog	X			
Myobatrachidae	*Crinia*	*glauerti*	Gleuert's Froglet	X		X	
Myobatrachidae	*Crinia*	*pseudinsignifera*	Bleating Froglet	X			
Myobatrachidae	*Geocrinia*	*alba*	White-bellied Frog		X		En, CR, S1
Myobatrachidae	*Geocrinia*	*leai*	Ticking Frog	X			
Mammals							
Burramyidae	*Cercartetus*	*concinnus*	Western Pigmy Possum	X			
Canidae	*Vulpes*	*vulpes*	Fox			X	#
Dasyuridae	*Dasyurus*	*geoffroii*	Chuditch	X	X		Vu,S1

Family	Genus	Species	Common Name	Nature Maps data search	EPBC data search	GHD (2011)	Species Listing or introduced
Dasyuridae	*Phascogale*	*tapoatafa tapoatafa*	Southern Brush-tailed Phascogale	X		X	Vu,S1
Dasyuridae	*Sminthopsis*	*dolichura*	Little Long-tailed Dunnart	X			
Dasyuridae	*Sminthopsis*	*gilberti*	Gilbert's Dunnart	X			
Dasyuridae	*Sminthopsis*	*griseoventer griseoventer*	Grey-bellied Dunnart	X			
Felidae	*Felis*	*catus*	Cat			X	#
Leporidae	*Oryctolagus*	*cuniculus*	European Rabbit			X	#
Macropodidae	*Macropus*	*fuliginosus*	Western Grey Kangaroo			X	
Macropodidae	*Macropus*	*irma*	Western Brush Wallaby	X			P4
Macropodidae	*Setonix*	*brachyurus*	Quokka	X			Vu, S1
Molossidae	*Mormopterus*	sp. 4 (ex M. planiceps, SW form)				X	
Molossidae	*Tadarida*	*australis*	White-striped Freetail Bat			X	
Muridae	*Hydromys*	*chrysogaster*	Water-rat	X			P4
Muridae	*Rattus*	*fuscipes*	Western Bush Rat	X			
Muridae	*Rattus*	*rattus*	Black Rat	X			#
Peremelidae	*Isoodon*	*obesulus*	Southern Brown Bandicoot	X		X	P5
Phalangeridae	*Trichosaurus*	*vulpecula vulpecula*	Common Brushtail Possum	X		X	
Potoroidae	*Potorous*	*platyops*	Broad-faced Potoroo	X			Extinct
Pseudocheiridae	*Pseudocheirus*	*occidentalis*	Western Ringtail Possum	X		X	Vu, S1

Family	Genus	Species	Common Name	Nature Maps data search	EPBC data search	GHD (2011)	Species Listing or introduced
Tachyglossidae	*Tachyglossus*	*aculeatus*	Echidna			X	
Vespertilionidae	*Chalinolobus*	*gouldii*	Gould's Wattle Bat			X	
Vespertilionidae	*Chalinolobus*	*morio*	Chocolate Wattled Bat			X	
Vespertilionidae	*Nyctophilus*	*timoriensis timoriensis*	Greater Long-eared Bat	X			
Vespertilionidae	*Vespadelus*	*regulus*	Southern Forest Bat	X		X	
Fish							
Percichthyidae	*Nannatherina*	*balstoni*	Balston's Pygmy Perch		X		Vu, S1
Petromyzontidae	*Geotria*	*australis*	Pouched Lamprey	X			P1
Crustaceans							
Parastacidae	*Cherax*	*tenuimanus*	Margaret River Marron	X	X		Cr, En, S1
Invertebrates							
Chloropidae	*Chloromerus*	*maculifemur*		X			
Hesperiidae	*Anisynta*	*sphenosema*	Wedge Grass-skipper	X			
Anobiidae	*Anobium*	*punctatum*	Common Furniture Beetle	X			#
Lymexylidae	*Atractocerus*	*kreuslerae*	Eucalypt Pinworm	X			
Gomphidae	*Austrogomphus*	*lateralis*	Lilac Hunter (Dragonfly)	X			
Lygaeidae	*Austronysius*	*sericus*		X			
Bostrichidae	*Xylopsocus*	*rubidus*	Powderpost Beetle	X			
Ephydridae	*Ephydrella*	*acrostichalis*		X			

Family	Genus	Species	Common Name	Nature Maps data search	EPBC data search	GHD (2011)	Species Listing or introduced
Curculionidae	*Euomus*	*insculptus*		X			
Blattellidae	*Hensaussurea*	*sheardi*		X			
Pentatomidae	*Homalictus*	*urbanus*	Emerald Homalictus Bee	X			
Leptoceridae	*Lectrides*	*parilis*	Long-horn Caddisflies	X			
Pergidae	*Lophyrotoma*	*analis*	Ironbark Sawfly	X			

X Species observed or identified

Introduced Species

Cr Critically Endangered – EPBC Act

En Endangered– EPBC Act

Vu Vulnerable– EPBC Act

S1 Schedule 1 – WC Act

S4 Schedule 4 – WC Act

P1 to 5 Priority Fauna Species – DEC

Appendix E

Likelihood of Occurrence

Table 13 Likelihood of occurrence assessment for Threatened and Priority Flora species with potential to occur within the study area.

Species	Details and Habitat	EPBC Conservation Code	DEC Conservation Code	Likelihood
Caladenia excelsa Giant Spider-orchid	Giant Spider-orchid is distributed along the Leeuwin Naturaliste Ridge between Yallingup and Karridale, Western Australia. The species occurs within the South West Natural Resource Management Region. The total known population size is 257 plants across 26 small fragmented sub-populations. Grows on hilltops, slopes, swales and low plains in deep pale yellow, white, grey sandy soils and is found among low shrubs in Banksia, Jarrah and Marri woodlands.	Endangered	Threatened	**May Occur** Suitable habitat present
Caladenia lodgeana	Tuberous, perennial, herb. Fl. white, Oct. Black loam. Distribution: South-west. WAR.	Endangered	Threatened	**May Occur** Suitable habitat and previously recorded in the region
Caladenia hoffmanii Hoffman's Spider-orchid	Hoffman's Spider-orchid is endemic to Western Australia and is known from 10 populations within the Narrogin District and the Geraldton–Kalbarri District. There is also a disjunct occurrence of this species some 600 km to the south-east where it occurs in the Pingaring area, growing around large granite outcrops under tall shrubs with low heath and in woodlands. Associated species included Jam (*Acacia acuminata*), Large-flowered Melaleuca (*Melaleuca megacephala*), Pine Grevillea (*Grevillea pinaster*) and	Endangered	Threatened	**Unlikely** No suitable habitat and not known to occur in the region

Species	Details and Habitat	EPBC Conservation Code	DEC Conservation Code	Likelihood
	thryptomenes (*Thryptomene* spp.) This species occurs within the Northern Agricultural (Western Australia) Natural Resource Management Region.			
Caladenia winfieldii Majestic Spider-orchid	*Caladenia winfieldii* grows in grey sandy loam, rich in humus, along seasonal creeks. The associated vegetation is low woodland, comprising *Eucalyptus rudis*, *Melaleuca preissiana* and *Banksia littoralis* over scrub and herbs. The species is often found growing at the base of and in the skirts of *Xanthorrhoea preissii*. *Caladenia winfieldii* is known from just one population (two subpopulations) south-east of Manjimup in DEC's Donnelly District.	Endangered	Threatened	**Unlikely** No suitable habitat and not known to occur in the region
Centrolepis caespitosa Matted Centrolepis	*Centrolepis caespitosa* occurs in winter-wet clay pans dominated by low shrubs and sedges. Very little is known about it as it is very small and inconspicuous and, being an annual herb, dies over summer. Eight populations are known over a large geographical range from the South Coast near Denmark, north to the Swan Coastal Plain and east to Meckering. Due to its inconspicuous nature, the taxon is difficult to locate and the possibility of finding more populations is highly unlikely unless the species is specifically targeted for survey.	Endangered	Priority 4	**Unlikely** Not known to occur within 5 km of the study area
Sphenotoma drummondii Mountain paper-heath	Known from scattered populations in WA's Albany District. Grows on skeletal peat soil and on shallow soil over schist quartzite and granite. It is frequently found in pockets of soil on cliff faces or under cliff overhangs, and is associated with Mountain Kunzea (*Kunzea montana*) and Thick-stemmed Bottlebrush (*Calothamnus crassus*). This species occurs within	Endangered	Threatened	**Unlikely** Not known to occur within 5 km of the study area

Species	Details and Habitat	EPBC Conservation Code	DEC Conservation Code	Likelihood
	the South Coast (Western Australia) Natural Resource Management Region.			
Drakaea micrantha	Tuberous, perennial, herb. Flowers red and yellow between September and October. Occurs in white-grey sand.	Vulnerable	Threatened	**Unlikely** No known to occur within 5 km of the study area
Acacia inops	Weak, scrambling, pungent shrub, 0.4-1.1 m high. Fl. white-cream, Sep to Nov. Black peaty sand, clay. Swamps, creeks. Distribution: South-west. JF and WAR.		Priority 3	**May Occur** Suitable habitat present
Acacia lateriticola glabrous variant	Shrub, flowers yellow, Aug or Oct. Occurs on lateritic soils. JF and WAR.		Priority 3	**May Occur** Suitable habitat present
Acacia subracemosa	Spreading shrub, flowers cream-white/yellow, September to November. Flowers red or yellow sand over limestone.		Priority 3	**Unlikely** No suitable habitat present
Acacia tayloriana	Prostrate shrub, cream-white flowers in January. Occurs in grey or yellow/orange sandy soils, lateritic gravel, clay loam in winter-wet areas.		Priority 4	**May Occur** Suitable habitat present
Astroloma sp. Nannup	Erect shrub, flowers red-orange, January to April. Occurs in sandy and gravelly lateritic soils. JF and WAR.		Priority 4	**May Occur** Suitable habitat present

Species	Details and Habitat	EPBC Conservation Code	DEC Conservation Code	Likelihood
Boronia anceps	Perennial herb, lacking lignotuber, stem flattened and ancipitous when young. Flowers pink/pink-purple, September to December or January. Occurs on white sand, gravelly laterite on seasonally swampy heaths. JF and WAR.		Priority 3	**Unlikely** Suitable habitat limited
Boronia capitata gracilis	Slender shrub, branches pilose. Flowers pink between June to November. Occurs in white/grey or black sand in winter-wet swamps, hillslopes.		Priority 3	**May Occur** Suitable habitat present
Boronia tetragona	Perennial, herb, leaves sessile, entire, with papillate margins, branches quadrangular, sepals ciliate. Flowers pink and red, October to December. Occurs in black/white sand, laterite, brown sandy loam in winter-wet flats, swamps and open woodland. JF and SWA.		Priority 3	**May Occur** Suitable habitat present
Bossiaea disticha	Erect or straggly to spreading shrub, 0.1-1.5 m high. Fl. yellow & brown/red, Sep to Nov. Sandy soils over limestone. Distribution: South-west. WAR.		Priority 3	**Unlikely** No suitable habitat present
Caladenia abbreviata	Tuberous, perennial, herb. Flowers yellow and brown November to December. Occurs in sand on sand dunes.		Priority 3	**Unlikely** No suitable habitat present
Conospermum paniculatum	Spreading, open shrub, flowers blue-white in July-November. Occurs in sandy or clayey soils in swampy areas, plains and slopes. JF, SWA and WAR.		Priority 3	**May Occur** Suitable habitat present

Species	Details and Habitat	EPBC Conservation Code	DEC Conservation Code	Likelihood
Dampiera heteroptera	Erect to semi-prostrate perennial, herb or shrub. Flowers blue, September to october. Occurs on sandy soils in swampy areas. JF and WAR.		Priority 3	**May Occur** Suitable habitat present
Franklandia triaristata Lanoline bush	Erect, lignotuberous shrub, 0.2-1 m high. Fl. white-cream-yellow/brown-purple, Aug to Oct. White or grey sand. Distribution: South-west. JF, SWA and WAR.		Priority 4	**May Occur** Suitable habitat present and known to occur in the area
Gahnia sclerioides	A slender rhizomatous, perennial, grass-like or herb (sedge), 0.3-0.9 m high. Loam, sandy soils. Moist shaded situations. Distribution: South-west. JF and WAR.		Priority 3	**May Occur** Suitable habitat present and known to occur in the area
Galium leptogonium	No information available.		Priority 3	**Present** No known records within the immediate region
Gastrolobium formosum	Small, trailing shrub, to 1 m high. Fl. red, Nov. Clay loam. Along river banks or in swamps. Distribution: South-west. JF and WAR.		Priority 3	**Present** Along the banks of Margaret River
Grevillea brachystylis brachystylis	Much-branched, prostrate or decumbent, non-lignotuberous shrub. Flowers red August to November. Occurs in black sand, sandy clay in swampy situations.		Priority 3	**May Occur** Suitable habitat present
Grevillea bronwenae	Slender, erect shrub. Flowers red, June to December. Occurs in		Priority 3	**Unlikely**

Species	Details and Habitat	EPBC Conservation Code	DEC Conservation Code	Likelihood
	grey sand over laterite, lateritic loam on hillslopes amongst tall (sclerophyll) shrubland, or low (sclerophyll) shrubland; in sand; occupying heathlands. SWA and JF.			No suitable habitat present
Hemigenia rigida	Very poorly known. Prostrate shrub, leaves flat/open, pedicles longer then in *H. pritzelii* (10 mm or more), bracyeoles large, lanceolate and wrapping around calyx, calyx relatively large and strongly 2-lipped but lobes relatively long and acute. Only known from two collections near Wagin.		Priority 1	**Unlikely** Not known from the region
Hybanthus volubilis	Twining perennial, herb. Flowers blue-purple-white, September to December. Occurs in clay or sand clay on river banks. JF and WAR.		Priority 2	**May Occur** Suitable habitat present
Hypocalymma cordifolium minus	Slender, decumbent shrub forming entangled masses. Flowers white/pink from September to December. Occurs in peaty sand, grey sand, damp sites and swamps. JF and WAR.		Priority 4	**May Occur** Suitable habitat present
Juncus meianthus	Tufted perennial, herb, 0.05-0.2 m high, to 0.4 m wide. Fl. brown, Nov to Dec or Jan. Black sand, sandy clay. Creeks, seepage areas. Distribution: South-west. JF and WAR.		Priority 2	**May Occur** Suitable habitat present
Lambertia rariflora rariflora	Small tree or shrub to 7 m tall. Flowers green/yellow-green February to March or May. Occurs in red-brown clay soils, black organic loam, laterite, near intermittent streams. JF and WAR.		Priority 4	**May Occur** Suitable habitat present
Leptomeria furtiva	Lax, sprawling shrub, flowers orange/brown, Agust to october. Occurs in grey or black peaty sand in winter-wet flats. JF, SWA and WAR.		Priority 2	**May Occur** Suitable habitat present

Species	Details and Habitat	EPBC Conservation Code	DEC Conservation Code	Likelihood
Meeboldina thysanantha	Rhizomatous, perennial, herb (rush-like), 0.4-1 m high. Flowers brown, December. Occurs in sand in swamps. JF, SWA, WAR.		Priority 3	**May Occur** Suitable habitat present
Pimelea cilata longituba	Erect shrub, flowers pink October to December. Occurs in grey sand over clay, loam. JF, SWA and WAR.		Priority 3	**May Occur** Suitable habitat present
Pultenaea pinifolia	Erect, slender shrub, 1-3 m high. Fl. yellow-orange, Oct to Nov. Loam or clay. Floodplains, swampy areas. Distribution: South-west. JF, SWA and WAR.		Priority 3	**May Occur** Suitable habitat present
Thomasia laxiflora	Shrub, flowers pink-purple in October to November. Occurs on gravelly soils. JF and SWA.		Priority 3	**May Occur** Suitable habitat present
Tripteroccus brachylobus	Perennial herb to 1 m. Flowers yellow/yellow-green, November to December or February. Occurs in grey sand, red clay, laterite, often moist in low-lying flats. JF, SWA and WAR		Priority 4	**Unlikely** No known records within 5 km of the study area.
Xyris maxima	Robust, erect, tufted perennial, herb. Flowers yellow in November to December or January. Occurs in black peaty sand in drainage flats. JF.		Priority 2	**Unlikely** Suitable habitat limited

Table 14 Likelihood of occurrence assessment for conservation significant fauna species.

Species	Details and Habitat	EPBC Conservation Code	DEC Conservation Code	Likelihood
Botaurus poiciloptilus Australasian Bittern	Favours permanent freshwater wetlands with tall, dense vegetation, particularly bullrushes (*Typha* spp.) and spikerushes (*Eleoacharis* spp.). The species hides during the day amongst dense reeds or rushes and feed mainly at night on frogs, fish, yabbies, spiders, insects and snails. Feeding platforms may be constructed over deeper water from reeds trampled by the bird; platforms are often littered with prey remains.	Endangered	Schedule 1	**Potential** This species has been recorded in the region.
Calyptorhynchus banksii naso Forest Red-tailed Black Cockatoo	Inhabits the dense *Eucalyptus marginata* (Jarrah), *E. diversicolor* (Karri) and *Corymbia calophylla* (Marri) forests receiving more than 600 mm of annual average rainfall. Nests in the large hollows of Marri, Jarrah and Karri.	Vulnerable	Schedule	**Known** Species observed in the project area
Calyptorhynchus baudinii Baudin's Black Cockatoo	Nests in the hollows of mature Marri *Corymbia calophylla*, Karri *Eucalyptus diversicolour* and Jarrah *E. marginata* in the lower south-west. Mainly feeds on the seeds and flowers of Marri in the forested regions of the south-west, the seeds of the Proteaceous *Banksia grandis*, *B. littoralis, B. ilicifolia, Hakea undulata, H. prostrata, H. trifurcata*, and *Dryandra* spp., as well as *Erodium botrys*, Jarrah and insect larvae. Also feeds on apple and pear seeds in orchards.	Vulnerable	Schedule 1	**Known** Species observed in the project area

Species	Details and Habitat	EPBC Conservation Code	DEC Conservation Code	Likelihood
Calyptorhynchus latirostris Carnaby's Black Cockatoo	Any patch of woodland or forest that contains live or dead trees of salmon gum, wandoo, tuart, jarrah, flooded gum, york gum, karri or marri, with either a diameter at breast height greater than 500 mm, or presence of suitable nest hollow. The birds feed on Proteaceous plant species such as *Banksia grandis, B. littoralis, B. ilicifolia, Hakea sp*, and *Grevillea spp*	Endangered	Schedule 1	**Potential** The species may forage in the region but has not been recorded breeding.
Geocrinia alba White-bellied Frog	This frog lives in dense vegetation in damp or swampy areas in areas kept moist into spring and summer by seepage along creek lines. The size of the geographic area over which the taxon is distributed: 101-1000 km².	Endangered	Schedule 1	**Unlikely** The species is only known from the Witchcliffe area.
Pseudocheirus occidentalis Western Ringtail Possum	The species occurs in the South West of Western Australia, but has a scattered broken distribution. Bunbury, Busselton and Albany are known to have the highest densities and occurs in habitats with dense, relatively lush vegetation, usually associated with vegetation lines and canopy connectivity. Where protection from introduced predators is provided, a wide range of nest sites on or near the ground has been recorded, including low shrub thickets, sedges, rushes, and grass trees. In suburbia house cavities and rooves are utilised, tree hollows and dreys in tree canopies are usually used. The species is generally associated with Peppermint trees (*Agonis fluxuosa*).	Vulnerable	Schedule 1	**Known** The species was observed

Species	Details and Habitat	EPBC Conservation Code	DEC Conservation Code	Likelihood
Dasyurus geoffroii Chuditch, Western Quoll	Chuditch previously occupied habitat in a variety of climatic zones across Australia. Chuditch are now restricted to the south-west of Western Australia. The former range of Chuditch suggests that the species utilised a wide variety of habitats including dry schlerophyll forests, beaches and deserts. Chuditch currently inhabit most kinds of wooded habitat within its current range including eucalypt forest (especially Jarrah, *Eucalyptus marginata*), dry woodland and mallee shrublands. In Jarrah forest, Chuditch populations occur in both moist, densely vegetated, steeply sloping forest and drier, open, gently sloping forest. The densest populations of Chuditch have been found in riparian forest. Chuditch have never been recorded in pure Karri (*Eucalyptus diversicolor*) forest. Prior to the initiation of the European Red Fox (*Vulpes vulpes*) control program, highest densities of Chuditch were found in riparian (areas adjacent to lakes, rivers and wetlands) vegetation where food supply is better or more reliable, and the dense undergrowth may provide protection from predators. With the implementation of the Western Sheild (baiting), some Chuditch populations have recovered.	Vulnerable	Schedule 1	**Potential** Habitat is present in the area to support a population of Chuditch
Cherax tenuimanus Margaret River Marron	Only occurs in the Margaret River in the south west of Western Australia. The species requires relatively good quality water and a diversity of habitat structure (e.g. they generally prefer sandy areas, particularly where organic matter accumulates and access to shelter and refuge sites) and may struggle to persist in disturbed habitats.	Critically Endangered	Schedule 1	**Unlikely** Although the species is found in Margaret River, records indicate it is only found in inland reaches beyond Cane Break Pool.

Species	Details and Habitat	EPBC Conservation Code	DEC Conservation Code	Likelihood
Falco peregrinus macropus Peregrine Falcon	Falcon not confined to a specific habitat. Found everywhere from woodlands to open grasslands and coastal cliffs – though less frequently in desert regions – it feeds almost entirely on other birds. It also eats rabbits and other moderate sized mammals, bats and reptiles. The Peregrine Falcon is very territorial during breeding season, the male courting the female with an impressive display of aerobatics.		Schedule 4	**Possible** Species may utilise the area as required.
Geotria australis Pouched Lamprey	Occurs in mud burrows in upper reaches of coastal streams for the first four years of life until metamorphosis and subsequent downstream migration to the sea. Adults inhabit the sea for an undetermined period and are parasitic on other fishes. Migrate upstream which may last for 16 months and spawn in freshwater. Adults are often found below weirs and dams during their spawning migration which may take them 60 km or more upstream of the coast.		Priority 1	**Likely** The species has been recorded in the Margaret River, however is migratory.
Hydromys chrysogaster Water-rat	The Water-rat generally occurs in permanent fresh or brackish water, although it can also be found in marine environments. The species occupies a wide variety of freshwater habitats, from subalpine streams and other inland waterways to lakes, swamps, and farm dams. Populations may be abundant in drainage swamps, although the Water-rat seems to be much less common along river channels.		Priority 4	**Possible** Habitat is present for this species.
Isoodon obesulus subsp. *fusciventer* Southern Brown Bandicoot	Occurs in South-west Western Australia. Dense scrubby, often swampy, vegetation with dense cover up to one metre high, often feeds in adjacent forest and woodland that is burnt on a regular basis and in areas of pasture and cropland lying close to dense cover.		Priority 5	**Likely** The dense riparian areas provide good habitat for this species.

Species	Details and Habitat	EPBC Conservation Code	DEC Conservation Code	Likelihood
Ixobrychus flavicollis subsp. *australis* Black Bittern	The Black Bittern is a shy species that inhabits terrestrial wetlands, estuaries and littoral zones of still or flowing areas. The species has declined over much of it range and is estimated to be around 20,000 birds remaining.		Priority 3	**Possible** Habitat is present for this species.
Macropus irma Western Brush Wallaby	Only occurs in south-west of Western Australia. The western brush wallaby's optimum habitat is open forest or woodland, particularly favouring open, seasonally wet flats with low grasses and open scrubby thickets. It is also found in some areas of mallee and heathland, and is uncommon in karri forest.		Priority 4	**Likely** Habitat is present for this species.
Phascogale tapoatafa tapoatafa Southern Brush-tailed Phascogale	The southern sub-species *Phascogale tapoatafa tapoatafa* occurs from Rockhampton in Queensland to the Mt Lofty Ranges in South Australia and in an isolated population in southern Western Australia. The preferred habitat of the Brush-tailed Phascogale is dry sclerophyll open forest, with a sparse ground cover of herbs, grasses, scleromorphic shrubs or leaf litter. However, individuals may also inhabit heathland, swamps, rainforest and wet sclerophyll forest. The species occurs primarily where the annual rainfall exceeds 500 mm.	Vulnerable	Schedule 1	**Known**
Potorous platyops Broad-faced Potoroo	Listed as extinct. Appropriate, targeted surveys have not recorded this species since 1875.	Extinct	Extinct	**Unlikely**

Species	Details and Habitat	EPBC Conservation Code	DEC Conservation Code	Likelihood
Setonix brachyurus Quokka	The mainland quokka lives in the Darling Range and south-west regions of Western Australia, mostly inhabiting densely vegetated swamps and sometimes tea-tree thickets on sandy soils along creek systems and dense heath on slopes.	Vulnerable	Schedule 1	**Unlikely** Although some habitat is present it is not extensive
Tyto novaehollandiae novaehollandiae Australian Masked Owl	The Masked Owl inhabits forests, woodlands, timbered waterways and open country on the fringe of these areas. The main requirements are tall trees with suitable hollows for nesting and roosting and adjacent areas for foraging. Masked Owls are territorial, and pairs remain in or near the territory all year round.		Priority 3	**Possible** Habitat is present for this species.
Nannatherina balstoni Balston's Pygmy Perch	Balston's Pygmy Perch is known from a small area of coastal peat flats in south-western Western Australia that extends from Margaret River to Two Peoples Bay. Two additional populations have recently been found to the north of this area in the Collie River and the Moore River. In winter and spring Balston's Pygmy Perch is typically found among inundated riparian vegetation where it presumably feeds and spawns. Larvae of Balston's Pygmy Perch feed predominantly on cladocerans, while terrestrial fauna (arachnids, adult hymenopterans, coleopterans and dipterans) are the main prey item of adult fish. In summer, Balston's Pygmy Perch has been found to be moderately abundant in pools and creeks that often dry up, such as those found between Windy Harbour and Walpole.	Vulnerable	Schedule 1	**Unlikely** The species is known to persist in Margaret River but in the upper reaches

GHD

GHD House, 239 Adelaide Tce. Perth, WA 6004
P.O. Box 3106, Perth WA 6832
T: 61 8 6222 8222 F: 61 8 6222 8555 E: permail@ghd.com.au

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0	G. Gaikhorst/ E. Lynch	Anna Napier		Anna Napier		
1	E Lynch	Anna Napier	A. C. Napier	Anna Napier	A. C. Napier	12/2/12

Site visit results

18 September 2012

Neil McCarthy
Project Environmental Officer
Main Roads WA
Robertson Drive
BUNBURY WA 6230

Our ref: 61/27189/00/125588
Your ref:

Dear Neil

Margaret River Perimeter Road
Priority Flora and Environmental Assessment

Main Roads Western Australia proposes to construct a 7 km Perimeter Road, to the east of the Margaret River town site, as part of the Bussell Highway. The Perimeter Road will improve safety within the town site, by enabling traffic, including heavy vehicles, to drive around as opposed to through the town centre.

A flora and fauna assessment was conducted in March 2012 by GHD, during which a Priority Three flora species, *Gastrolobium formosum*, was identified within the project area. The population (approximately 20 individuals) was recorded along the northern bank of the Margaret River and as such the report recommended that a targeted search for *G. formosum* be undertaken once the road design had been finalised and the known impact area defined.

Following the March 2012 survey recommendation, GHD, at the request of Main Roads WA, undertook a targeted search of a section of the Margaret River, adjacent to Riverslea Drive, for the presence of *G. formosum*. The results of this targeted search are discussed below.

A broader environmental assessment of a small section of paddock adjacent to John Archibald Drive, between Woodard Avenue and Lorikeet Lane was undertaken at the same time as the *G. formosum* survey. This area is approximately within the project footprint, but was not subject to the previous survey.

Both of the surveys were undertaken on 10 September 2012.

Gastrolobium formosum Survey

The northern and southern banks of the Margaret River were surveyed for *G. formosum*. This study included the proposed project footprint and an additional 50 m on either side of the project footprint. GPS co-ordinates of the start and end of the survey along each river bank are detailed in Table 1.

Table 1 GPS co-ordinates for the start and end of the *G. formosum* survey area

Location	Start	Finish
Northern side	0323980, 6241869	0324181, 6242020
Southern side	0324091, 6241831	0324198, 6241973

GHD Pty Ltd ABN 39 008 488 373
GHD House 239 Adelaide Terrace Perth WA 6004 PO Box 3106 Perth Adelaide TCE WA 6832 Australia
T 61 8 6222 8222 **F** 61 8 6222 8555 **E** permail@ghd.com **W** www.ghd.com

A large population of >600 *G. formosum* was identified on the northern side of the river, while no individuals were identified on the southern side of the river. The *G. formosum* occurrence on the northern side of the river was restricted to a narrow band, approximately 3 to 10 metres wide, along the river bank. Plants in this band had an average cover of 70% and ranged from juvenile to mature flowering plants up to 2 metres high (Plate 1 and 2).

The proposed project footprint contained approximately 400 *G. formosum* plants, occurring with an average cover of 70% within a narrow band along the river bank. This band occurred for at least 50 m on either side of the project footprint, and contained >200 plants with an average cover of 70%.

Records held at the Western Australian Herbarium indicate the species has been previously recorded at 35 locations within Western Australia. Records held at the Herbarium give some indication of species distribution but cannot be considered comprehensive, as many records are incomplete and do not indicate the number of plants found or the location of the nearest named place. None the less, four of the records named Margaret River as the nearest named location, indicating other populations within the local area. Three records counted greater than 100 plants and a further six records described the species as common or locally abundant. Most of these records described the site as on or beside a creek or river indicating that, when present, *G. formosum* is often well represented.

Aerial photography indicates the vegetation along the river remains intact in the immediate area, which combined with the density of surveyed plants, indicates it is likely that these plants continue further along the river in the immediate area. Records from the Western Australian Herbarium also indicate the likely presence of other populations within the local area.

Although a P3 listed species, the species appears well established in the study area and Herbarium records indicate there are several populations listed as common or locally abundant in the Margaret River area.

Plate 1 *Gastrolobium formosum*

Plate 2 *Gastrolobium formosum* habitat

The area surveyed consisted of agricultural pasture, with a variety of common agricultural and weed species such as clover (*Trifolium* spp.), rye grass (*Lolium* spp.) and capeweed (*Arctotheca calendula*). Several large Marri (*Corymbia calophylla*) trees were identified within the survey area as potential feeding and breeding habitat for Black Cockatoos.

No other native vegetation was present within the survey area (Plate 3 and 4).

Plate 3 John Archibald Drive

Plate 4 John Archibald Drive

The results of this survey will be incorporated into the Margaret River Perimeter Road Environmental Impact Assessment, currently being prepared by GHD for Main Roads Western Australia.

Yours sincerely

Sean McSevich
Senior Environmental Consultant
9721 0718

2012 Naturemap and PMST database results

NatureMap
Mapping Western Australia's biodiversity

NatureMap Species Report

Created By Guest user on 13/11/2012

Kingdom Plantae
Method 'By Circle'
Centre 115°04' 50" E,33°56' 58" S
Buffer 5km

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
1.	18285	*Acacia baileyana*	Y		
2.	3233	*Acacia barbinervis*			
3.	3247	*Acacia browniana*			
4.	11731	*Acacia browniana var. browniana*			
5.	3307	*Acacia divergens*			
6.	3347	*Acacia gilbertii*			
7.	3386	*Acacia inops*		P3	
8.	3410	*Acacia lateriticola*			
9.	3424	*Acacia littorea*			
10.	3448	*Acacia mooreana*			
11.	3453	*Acacia myrtifolia*			
12.	3454	*Acacia nervosa (Rib Wattle)*			
13.	15481	*Acacia pulchella var. glaberrima*			
14.	30036	*Acacia saligna subsp. stolonifera*			
15.	3591	*Acacia urophylla*			
16.	15487	*Acacia varia var. varia*			
17.	17774	*Acetosella vulgaris*	Y		
18.	1573	*Acianthus reniformis (Mosquito Orchid)*			
19.	25	*Adiantum aethiopicum (Common Maidenhair)*			
20.	5316	*Agonis flexuosa (Peppermint)*			
21.	17202	*Agonis flexuosa var. flexuosa*			
22.	23474	*Agrostocrinum hirsutum*			
23.	184	*Aira caryophyllea (Silvery Hairgrass)*	Y		
24.	1489	*Amaryllis belladonna (Belladonna Lily)*	Y		
25.	13101	*Amperea simulans*			
26.	1063	*Anarthria scabra*			
27.	6317	*Andersonia micrantha*			
28.	1407	*Anigozanthos flavidus (Tall Kangaroo Paw)*			
29.	1409	*Anigozanthos humilis (Catspaw)*			
30.	202	*Anthoxanthum odoratum (Sweet Vernal Grass)*	Y		
31.	3686	*Aotus cordifolia*			
32.	11399	*Apium prostratum var. filiforme*			
33.	8779	*Asparagus asparagoides (Bridal Creeper)*	Y		
34.	20249	*Astartea leptophylla*			
35.	7851	*Asteridea pulverulenta (Common Bristle Daisy)*			
36.	18279	*Babiana angustifolia*	Y		
37.	32616	*Banksia dallanneyi subsp. sylvestris*			
38.	1819	*Banksia grandis (Bull Banksia)*			
39.	1837	*Banksia occidentalis (Red Swamp Banksia)*			
40.	1848	*Banksia seminuda (River Banksia)*			
41.	743	*Baumea juncea (Bare Twigrush)*			
42.	3157	*Billardiera floribunda (White-flowered Billardiera)*			
43.	25798	*Billardiera fusiformis (Australian Bluebell)*			
44.	3159	*Billardiera laxiflora*			
45.	3165	*Billardiera variifolia*			
46.	4403	*Boronia alata (Winged Boronia)*			
47.	29274	*Boronia crenulata subsp. crenulata*			
48.	17653	*Boronia crenulata subsp. pubescens*			
49.	11503	*Boronia crenulata var. crenulata*			
50.	4415	*Boronia defoliata*			
51.	4417	*Boronia dichotoma*			
52.	4422	*Boronia gracilipes (Karri Boronia)*			
53.	4428	*Boronia megastigma (Scented Boronia)*			
54.	4429	*Boronia molloyae (Tall Boronia)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
55.	20392	*Boronia tenuior*			
56.	1267	*Borya constricta*			
57.	3708	*Bossiaea disticha*		P4	
58.	3713	*Bossiaea linophylla*			
59.	3714	*Bossiaea ornata (Broad Leaved Brown Pea)*			
60.	244	*Briza maxima (Blowfly Grass)*	Y		
61.	245	*Briza minor (Shivery Grass)*	Y		
62.	249	*Bromus diandrus (Great Brome)*	Y		
63.	12770	*Burchardia congesta*			
64.	1385	*Burchardia multiflora (Dwarf Burchardia)*			
65.	1276	*Caesia micrantha (Pale Grass-lily)*			
66.	1277	*Caesia occidentalis*			
67.	13853	*Caladenia arrecta*			
68.	15332	*Caladenia attingens subsp. attingens*			
69.	15341	*Caladenia citrina*			
70.	1581	*Caladenia corynephora*			
71.	13619	*Caladenia excelsa*		T	
72.	1590	*Caladenia ferruginea (Rusty Spider Orchid)*			
73.	1592	*Caladenia flava (Cowslip Orchid)*			
74.	15348	*Caladenia flava subsp. flava*			
75.	1596	*Caladenia huegelii (Grand Spider Orchid)*		T	
76.	1597	*Caladenia infundibularis*			
77.	18037	*Caladenia lodgeana*		T	
78.	15365	*Caladenia longicauda subsp. longicauda*			
79.	15366	*Caladenia longicauda subsp. merrittii*			
80.	1604	*Caladenia macrostylis (Leaping Spider Orchid)*			
81.	1608	*Caladenia nana (Pink Fan Orchid)*			
82.	-6944	*Caladenia paludosa x serotina*			
83.	18033	*Caladenia pholcoidea subsp. pholcoidea*			
84.	1613	*Caladenia reptans (Little Pink Fairy Orchid)*			
85.	1616	*Caladenia sericea (Silky Blue Orchid)*			
86.	10861	*Callistachys lanceolata (Wonnich)*			
87.	757	*Carex preissii*			
88.	2952	*Cassytha glabella (Tangled Dodder Laurel)*			
89.	11799	*Cassytha racemosa forma racemosa*			
90.	41564	*Cenchrus clandestinus (Kikuyu Grass)*	Y		
91.	18156	*Chamaecytisus palmensis (Tagasaste)*	Y		
92.	1513	*Chasmanthe floribunda (African Cornflag)*	Y		
93.	31	*Cheilanthes austrotenuifolia*			
94.	4448	*Chorilaena quercifolia (Chorilaena)*			
95.	3754	*Chorizema diversifolium*			
96.	12765	*Chorizema nanum*			
97.	3761	*Chorizema rhombeum*			
98.	2929	*Clematis pubescens (Common Clematis)*			
99.	4550	*Comesperma calymega (Blue-spike Milkwort)*			
100.	4552	*Comesperma confertum*			
101.	4564	*Comesperma virgatum (Milkwort)*			
102.	1862	*Conospermum caeruleum (Blue Brother)*			
103.	16854	*Conospermum capitatum subsp. capitatum*			
104.	1418	*Conostylis aculeata (Prickly Conostylis)*			
105.	11826	*Conostylis aculeata subsp. aculeata*			
106.	20074	*Conyza sumatrensis*	Y		
107.	277	*Cortaderia selloana (Pampas Grass)*	Y		
108.	17104	*Corymbia calophylla (Marri)*			
109.	18319	*Cotoneaster glaucophyllus*	Y		
110.	7952	*Crepis capillaris (Smooth Hawksbeard)*	Y		
111.	13484	*Cryptandra arbutiflora var. tubulosa*			
112.	15404	*Cyanicula sericea*			
113.	51	*Cyathea cooperi*	Y		
114.	783	*Cyperus congestus (Dense Flat-sedge)*	Y		
115.	792	*Cyperus eragrostis (Umbrella Sedge)*	Y		
116.	10964	*Cyrtostylis robusta*			
117.	287	*Dactylis glomerata (Cocksfoot)*	Y		
118.	7420	*Dampiera alata (Winged-stem Dampiera)*			
119.	7444	*Dampiera hederacea (Karri Dampiera)*			
120.	7454	*Dampiera linearis (Common Dampiera)*			
121.	7484	*Dampiera trigona (Angled-stem Dampiera)*			
122.	1219	*Dasypogon hookeri (Pineapple Bush)*			
123.	6964	*Datura stramonium (Common Thornapple)*	Y		
124.	6218	*Daucus glochidiatus (Australian Carrot)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
125.	3799	*Daviesia cordata (Bookleaf)*			
126.	3815	*Daviesia horrida (Prickly Bitter-pea)*			
127.	3817	*Daviesia inflata*			
128.	17691	*Desmocladus fasciculatus*			
129.	16595	*Desmocladus flexuosus*			
130.	299	*Deyeuxia quadriseta (Reed Bentgrass)*			
131.	7487	*Diaspasis filifolia (Thread-leaved Diaspasis)*			
132.	306	*Dichelachne crinita (Longhair Plumegrass)*			
133.	3011	*Diplotaxis muralis (Wall Rocket)*	Y		
134.	3867	*Dipogon lignosus (Dolichos Pea)*	Y		
135.	4757	*Dodonaea ceratocarpa*			
136.	1640	*Drakaea glyptodon (King-in-his-carriage)*			
137.	11853	*Drosera menziesii subsp. menziesii*			
138.	11105	*Echinochloa crus-galli (Barnyard Grass)*	Y		
139.	6681	*Echium plantagineum (Paterson's Curse)*	Y		
140.	348	*Ehrharta erecta (Panic Veldt Grass)*	Y		
141.	351	*Ehrharta villosa (Pyp Grass)*	Y		
142.	1643	*Elythranthera brunonis (Purple Enamel Orchid)*			
143.	7968	*Erigeron karvinskianus*	Y		
144.	15412	*Eriochilus dilatatus subsp. multiflorus*			
145.	15415	*Eriochilus scaber subsp. scaber*			
146.	5625	*Eucalyptus diversicolor (Karri)*			
147.	18602	*Eucalyptus microcorys*	Y		
148.	5739	*Eucalyptus patens (Swan River Blackbutt)*			
149.	-5513	*Eucalyptus sp.*			
150.	3876	*Eutaxia epacridoides*			
151.	430	*Festuca arundinacea (Tall Fescue)*	Y		
152.	7974	*Filago gallica*	Y		
153.	6221	*Foeniculum vulgare (Fennel)*	Y		
154.	1945	*Franklandia triaristata (Lanoline Bush)*		P4	
155.	18392	*Freesia alba x leichtlinii*	Y		
156.	31532	*Fumaria muralis subsp. muralis*	Y		
157.	32370	*Funaria hygrometrica*			
158.	900	*Gahnia aristata*			
159.	17744	*Gahnia sclerioides*		P3	
160.	20475	*Gastrolobium capitatum*			
161.	19190	*Gastrolobium cuneatum*			
162.	20504	*Gastrolobium formosum*		P3	
163.	3936	*Genista linifolia (Flaxleaf Broom)*	Y		
164.	18143	*Genista monspessulana*	Y		
165.	1518	*Gladiolus angustus (Long Tubed Painted Lady)*	Y		
166.	10909	*Gompholobium confertum*			
167.	3951	*Gompholobium marginatum*			
168.	3953	*Gompholobium ovatum*			
169.	3955	*Gompholobium preissii*			
170.	11083	*Gompholobium scabrum*			
171.	16746	*Gonocarpus benthamii subsp. benthamii*			
172.	7064	*Gratiola peruviana (Austral Brooklime)*			
173.	13427	*Grevillea manglesioides subsp. manglesioides*			
174.	19494	*Grevillea manglesioides subsp. metaxa*			
175.	2080	*Grevillea quercifolia (Oak-leaf Grevillea)*			
176.	2137	*Hakea ceratophylla (Horned Leaf Hakea)*			
177.	2170	*Hakea lasianthoides*			
178.	2174	*Hakea linearis*			
179.	2175	*Hakea lissocarpha (Honey Bush)*			
180.	2203	*Hakea ruscifolia (Candle Hakea)*			
181.	2214	*Hakea trifurcata (Two-leaf Hakea)*			
182.	3961	*Hardenbergia comptoniana (Native Wisteria)*			
183.	18297	*Hedera helix*	Y		
184.	6868	*Hemigenia rigida*		P1	
185.	5109	*Hibbertia amplexicaulis*			
186.	5114	*Hibbertia commutata*			
187.	5117	*Hibbertia cuneiformis (Cutleaf Hibbertia)*			
188.	5118	*Hibbertia cunninghamii*			
189.	20051	*Hibbertia diamesogenos*			
190.	5126	*Hibbertia furfuracea*			
191.	5132	*Hibbertia grossulariifolia*			
192.	5135	*Hibbertia hypericoides (Yellow Buttercups)*			
193.	444	*Holcus lanatus (Yorkshire Fog)*	Y		
194.	3965	*Hovea elliptica (Tree Hovea)*			

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195.	3968	*Hovea trisperma (Common Hovea)*			
196.	5218	*Hybanthus debilissimus*			
197.	6231	*Hydrocotyle hirta (Hairy Pennywort)*			
198.	452	*Hyparrhenia hirta (Tambookie Grass)*	Y		
199.	31234	*Hypericum perforatum subsp. veronense (St John's Wort)*	Y		
200.	8086	*Hypochaeris glabra (Smooth Catsear)*	Y		
201.	9352	*Hypochaeris radicata (Flat Weed)*	Y		
202.	1532	*Ixia maculata (Yellow Ixia)*	Y		
203.	1297	*Johnsonia lupulina (Hooded Lily)*			
204.	1177	*Juncus articulatus (Jointed Rush)*	Y		
205.	1185	*Juncus kraussii (Sea Rush)*			
206.	14631	*Juncus meianthus*		P2	
207.	1186	*Juncus microcephalus*	Y		
208.	1188	*Juncus pallidus (Pale Rush)*			
209.	1189	*Juncus pauciflorus (Loose Flower Rush)*			
210.	4037	*Kennedia coccinea (Coral Vine)*			
211.	15674	*Kunzea ciliata*			
212.	18585	*Lagenophora huegelii*			
213.	5033	*Lasiopetalum floribundum (Free Flowering Lasiopetalum)*			
214.	4047	*Lathyrus tingitanus (Tangier Pea)*	Y		
215.	932	*Lepidosperma effusum (Spreading Sword-sedge)*			
216.	937	*Lepidosperma longitudinale (Pithy Sword-sedge)*			
217.	-12392	*Lepidosperma sp.*			
218.	945	*Lepidosperma squamatum*			
219.	1653	*Leporella fimbriata (Hare Orchid)*			
220.	2342	*Leptomeria cunninghamii*			
221.	2355	*Leptomeria squarrulosa*			
222.	6358	*Leucopogon assimilis*			
223.	6360	*Leucopogon australis (Spiked Beard-heath)*			
224.	6367	*Leucopogon capitellatus*			
225.	6428	*Leucopogon pendulus*			
226.	6454	*Leucopogon verticillatus (Tassel Flower)*			
227.	36180	*Liparophyllum latifolium*			
228.	9289	*Lobelia anceps (Angled Lobelia)*			
229.	7408	*Lobelia tenuior (Slender Lobelia)*			
230.	14551	*Logania serpyllifolia subsp. serpyllifolia*			
231.	6515	*Logania vaginalis (White Spray)*			
232.	11073	*Lolium x hybridum*	Y		
233.	1223	*Lomandra caespitosa (Tufted Mat Rush)*			
234.	1234	*Lomandra nigricans*			
235.	1238	*Lomandra pauciflora*			
236.	7365	*Lonicera japonica (Japanese Honeysuckle)*	Y		
237.	35321	*Lonicera x italica*	Y		
238.	4059	*Lotus angustissimus (Narrowleaf Trefoil)*	Y		
239.	8564	*Lotus subbiflorus*	Y		
240.	1655	*Lyperanthus nigricans (Red Beak Orchid)*			
241.	36375	*Lysimachia arvensis (Pimpernel)*	Y		
242.	6456	*Lysinema ciliatum (Curry Flower)*			
243.	6457	*Lysinema conspicuum*			
244.	17637	*Marianthus candidus (White Marianthus)*			
245.	17694	*Meeboldina scariosa*			
246.	20297	*Melaleuca osullivanii*			
247.	6883	*Mentha pulegium (Pennyroyal)*	Y		
248.	957	*Mesomelaena tetragona (Semaphore Sedge)*			
249.	4090	*Mirbelia dilatata (Holly-leaved Mirbelia)*			
250.	4963	*Modiola caroliniana*	Y		
251.	6185	*Myriophyllum aquaticum (Brazilian Water Milfoil)*	Y		
252.	492	*Neurachne alopecuroidea (Foxtail Mulga Grass)*			
253.	6970	*Nicandra physalodes (Apple of Peru)*	Y		
254.	2923	*Nymphaea odorata (Fragrant Waterlily)*	Y		
255.	-13011	*Nymphaea sp.*			
256.	8143	*Olearia paucidentata (Autumn Scrub Daisy)*			
257.	8149	*Olearia rudis (Rough Daisybush)*			
258.	7346	*Opercularia echinocephala (Bristly Headed Stink Weed)*			
259.	7354	*Opercularia volubilis (Twining Stinkweed)*			
260.	1537	*Orthrosanthus laxus (Morning Iris)*			
261.	1540	*Orthrosanthus polystachyus (Many Spike Orthrosanthus)*			
262.	4349	*Oxalis corniculata (Yellow Wood Sorrel)*	Y		
263.	4350	*Oxalis corymbosa (Pink Shamrock)*	Y		
264.	4354	*Oxalis incarnata*	Y		

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265.	4356	*Oxalis pes-caprae (Soursob)*	Y		
266.	13135	*Ozothamnus ramosus*			
267.	3618	*Paraserianthes lophantha (Albizia)*			
268.	17114	*Paraserianthes lophantha subsp. lophantha*			
269.	7089	*Parentucellia latifolia (Common Bartsia)*	Y		
270.	11550	*Patersonia umbrosa var. xanthina (Yellow Flags)*			
271.	6245	*Pentapeltis peltigera*			
272.	2267	*Persoonia longifolia (Snottygobble)*			
273.	2273	*Persoonia saccata (Snottygobble)*			
274.	2293	*Petrophile diversifolia*			
275.	20460	*Pheladenia deformis*			
276.	1478	*Phlebocarya ciliata*			
277.	4675	*Phyllanthus calycinus (False Boronia)*			
278.	11928	*Pimelea ciliata subsp. ciliata*			
279.	5239	*Pimelea clavata*			
280.	5249	*Pimelea hispida (Bristly Pimelea)*			
281.	18117	*Pimelea rosea subsp. rosea*			
282.	5264	*Pimelea spectabilis (Bunjong)*			
283.	12041	*Pimelea suaveolens subsp. suaveolens (Tall Mulla Mulla)*			
284.	5269	*Pimelea sylvestris*			
285.	88	*Pinus radiata (Radiata Pine)*	Y		
286.	16322	*Pittosporum undulatum*	Y		
287.	7303	*Plantago lanceolata (Ribwort Plantain)*	Y		
288.	6249	*Platysace compressa (Tapeworm Plant)*			
289.	6259	*Platysace tenuissima*			
290.	17016	*Podalyria sericea*	Y		
291.	86	*Podocarpus drouynianus (Wild Plum)*			
292.	8395	*Polygala myrtifolia (Myrtleleaf Milkwort)*	Y		
293.	15424	*Praecoxanthus aphyllus*			
294.	1680	*Prasophyllum parvifolium (Autumn Leek Orchid)*			
295.	-7537	*Prasophyllum sp.*			
296.	1683	*Prasophyllum triangulare (Dark Leek Orchid)*			
297.	1694	*Pterostylis rogersii (Curled-tongue Shell Orchid)*			
298.	1698	*Pterostylis vittata (Banded Greenhood)*			
299.	2742	*Ptilotus manglesii (Pom Poms)*			
300.	20195	*Pultenaea brachytropis*			
301.	4179	*Pultenaea pinifolia*		P3	
302.	32480	*Racopilum cuspidigerum var. convolutaceum*			
303.	2932	*Ranunculus colonorum (Common Buttercup)*			
304.	2933	*Ranunculus muricatus (Sharp Buttercup)*	Y		
305.	13300	*Rhodanthe citrina*			
306.	4695	*Ricinocarpos glaucus*			
307.	32425	*Rosulabryum billarderi*			
308.	20506	*Rubus anglocandicans*	Y		
309.	20496	*Rubus laudatus*	Y		
310.	2430	*Rumex brownii (Swamp Dock)*	Y		
311.	40425	*Rytidosperma caespitosum*			
312.	40426	*Rytidosperma occidentale*			
313.	7602	*Scaevola calliptera*			
314.	7613	*Scaevola glandulifera (Viscid Hand-flower)*			
315.	7624	*Scaevola microphylla (Small-leaved Scaevola)*			
316.	32433	*Sematophyllum homomallum*			
317.	-10902	*Senecio sp.*			
318.	11803	*Silene gallica var. quinquevulnera*	Y		
319.	2911	*Silene vulgaris (Bladder Campion)*	Y		
320.	7022	*Solanum nigrum (Black Berry Nightshade)*	Y		
321.	8231	*Sonchus oleraceus (Common Sowthistle)*	Y		
322.	17551	*Sphaerolobium drummondii*			
323.	4207	*Sphaerolobium medium*			
324.	31952	*Sphenotoma gracilis (Swamp Paper-heath)*			
325.	4828	*Spyridium globulosum (Basket Bush)*			
326.	7696	*Stylidium calcaratum (Book Triggerplant)*			
327.	7708	*Stylidium crassifolium (Thick-leaved Triggerplant)*			
328.	7713	*Stylidium dichotomum (Pins-and-needles)*			
329.	7719	*Stylidium ecorne (Foot Triggerplant)*			
330.	19251	*Stylidium eriopodum*			
331.	12590	*Stylidium lowrieanum*			
332.	7787	*Stylidium rhynchocarpum (Black-beaked Triggerplant)*			
333.	-7839	*Stylidium sp.*			
334.	7799	*Stylidium spathulatum (Creamy Triggerplant)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
335.	7802	*Stylidium squamosotuberosum (Fleshy-rhizomed Trigger Plant)*			
336.	1260	*Stypandra glauca (Blind Grass)*			
337.	15827	*Taraxis grossa*			
338.	667	*Tetrarrhena laevis (Forrest Ricegrass)*			
339.	1704	*Thelymitra cornicina (Lilac Sun Orchid)*			
340.	1705	*Thelymitra crinita (Blue Lady Orchid)*			
341.	1708	*Thelymitra fuscolutea (Leopard Orchid)*			
342.	1711	*Thelymitra nuda (Scented Sun Orchid)*			
343.	5080	*Thomasia foliosa*			
344.	32486	*Thuidium sparsum var. hastatum*			
345.	1319	*Thysanotus arenarius*			
346.	8248	*Tolpis barbata (Yellow Hawkweed)*	Y		
347.	6280	*Trachymene pilosa (Native Parsnip)*			
348.	4547	*Tremandra diffusa*			
349.	4548	*Tremandra stelligera*			
350.	4302	*Trifolium ligusticum (Ligurian Clover)*	Y		
351.	35016	*Trihaloragis hexandra subsp. integrifolia*			
352.	34965	*Trihaloragis hexandra subsp. serrata*			
353.	1561	*Tritonia crocata*	Y		
354.	38401	*Tritonia gladiolaris (Lined Tritonia)*	Y		
355.	4360	*Tropaeolum majus (Garden Nasturtium)*	Y		
356.	13479	*Trymalium ledifolium var. rosmarinifolium*			
357.	33438	*Trymalium odoratissimum subsp. trifidum*			
358.	17680	*Tyrbastes glaucescens*			
359.	33537	*Vallisneria australis*	Y		
360.	7665	*Velleia trinervis*			
361.	7108	*Veronica arvensis (Wall Speedwell)*	Y		
362.	4322	*Vicia sativa (Common Vetch)*	Y		
363.	4325	*Viminaria juncea (Swishbush)*			
364.	6575	*Vinca major (Blue Periwinkle)*	Y		
365.	5223	*Viola odorata (Common Violet)*	Y		
366.	7388	*Wahlenbergia multicaulis*			
367.	13103	*Watsonia borbonica*	Y		
368.	1565	*Watsonia leipoldtii (Watsonia)*	Y		Y
369.	18108	*Watsonia meriana var. bulbillifera*	Y		
370.	18118	*Watsonia meriana var. meriana*	Y		
371.	1569	*Watsonia versfeldii*	Y		
372.	11712	*Watsonia versfeldii var. alba*	Y		
373.	1570	*Watsonia wordsworthiana*	Y		
374.	20737	*X Cyanthera glossodioides*			
375.	6283	*Xanthosia atkinsoniana*			
376.	19330	*Xanthosia tasmanica*			
377.	1149	*Xyris lacera*			
378.	1049	*Zantedeschia aethiopica (Arum Lily)*	Y		
379.	36218	*Zygodon menziesii*			

Conservation Codes
T - Rare or likely to become extinct
X - Presumed extinct
IA - Protected under international agreement
S - Other specially protected fauna
1 - Priority 1
2 - Priority 2
3 - Priority 3
4 - Priority 4
5 - Priority 5

[1] For NatureMap's purposes, species flagged as endemic are those whose records are wholely contained within the search area. Note that only those records complying with the search criterion are included in the calculation. For example, if you limit records to those from a specific datasource, only records from that datasource are used to determine if a species is restricted to the query area.

NatureMap
Mapping Western Australia's biodiversity

NatureMap Species Report

Created By Guest user on 14/11/2012

Kingdom Animalia
Current Names Only Yes
Method 'By Circle'
Centre 115°04' 50" E,33°56' 57" S
Buffer 5km
Group By Species Group

Species Group	Species	Records
Amphibian	8	27
Bird	105	1475
Fish	1	3
Invertebrate	24	26
Mammal	15	50
Reptile	19	66
TOTAL	**172**	**1647**

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
Amphibian					
1.	25398	*Crinia georgiana (Quacking Frog)*			
2.	25399	*Crinia glauerti (Clicking Frog)*			
3.	25401	*Crinia pseudinsignifera (Bleating Froglet)*			
4.	25404	*Geocrinia leai (Ticking Frog)*			
5.	25410	*Heleioporus eyrei (Moaning Frog)*			
6.	25415	*Limnodynastes dorsalis (Western Banjo Frog)*			
7.	25378	*Litoria adelaidensis (Slender Tree Frog)*			
8.	25388	*Litoria moorei (Motorbike Frog)*			
Bird					
9.	24260	*Acanthiza apicalis (Broad-tailed Thornbill)*			
10.	24261	*Acanthiza chrysorrhoa (Yellow-rumped Thornbill)*			
11.	24262	*Acanthiza inornata (Western Thornbill)*			
12.	24560	*Acanthorhynchus superciliosus (Western Spinebill)*			
13.	25536	*Accipiter fasciatus (Brown Goshawk)*			
14.	41323	*Actitis hypoleucos (Common Sandpiper)*		IA	
15.	24312	*Anas gracilis (Grey Teal)*			
16.	24313	*Anas platyrhynchos (Mallard)*			
17.	24316	*Anas superciliosa (Pacific Black Duck)*			
18.	24561	*Anthochaera carunculata (Red Wattlebird)*			
19.	24562	*Anthochaera lunulata (Western Little Wattlebird)*			
20.	24285	*Aquila audax (Wedge-tailed Eagle)*			
21.	24341	*Ardea pacifica (White-necked Heron)*			
22.	25566	*Artamus cinereus (Black-faced Woodswallow)*			
23.	24353	*Artamus cyanopterus (Dusky Woodswallow)*			
24.	24357	*Artamus superciliosus (White-browed Woodswallow)*			
25.	24319	*Biziura lobata (Musk Duck)*			
26.	25713	*Cacatua galerita (Sulphur-crested Cockatoo)*			
27.	25598	*Cacomantis flabelliformis (Fan-tailed Cuckoo)*			
28.	24427	*Cacomantis flabelliformis subsp. flabelliformis*			
29.	24788	*Calidris ruficollis (Red-necked Stint)*		IA	
30.	25717	*Calyptorhynchus banksii (Red-tailed Black-Cockatoo)*			
31.	24733	*Calyptorhynchus baudinii (Baudin's Cockatoo (long-billed black-cockatoo))*		T	
32.	24734	*Calyptorhynchus latirostris (Carnaby's Cockatoo (short-billed black-cockatoo))*		T	
33.	24377	*Charadrius ruficapillus (Red-capped Plover)*			
34.	24321	*Chenonetta jubata (Australian Wood Duck)*			
35.	24432	*Chrysococcyx lucidus subsp. plagosus*			
36.	24288	*Circus approximans (Swamp Harrier)*			
37.	24396	*Climacteris rufa (Rufous Treecreeper)*			
38.	25675	*Colluricincla harmonica (Grey Shrike-thrush)*			
39.	25568	*Coracina novaehollandiae (Black-faced Cuckoo-shrike)*			
40.	25592	*Corvus coronoides (Australian Raven)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
41.	24417	*Corvus coronoides subsp. perplexus*			
42.	24671	*Coturnix pectoralis (Stubble Quail)*			
43.	25701	*Coturnix ypsilophora (Brown Quail)*			
44.	25595	*Cracticus tibicen (Australian Magpie)*			
45.	25596	*Cracticus torquatus (Grey Butcherbird)*			
46.	24322	*Cygnus atratus (Black Swan)*			
47.	30901	*Dacelo novaeguineae (Laughing Kookaburra)*			
48.	25673	*Daphoenositta chrysoptera (Varied Sittella)*			
49.	25607	*Dicaeum hirundinaceum (Mistletoebird)*			
50.	24470	*Dromaius novaehollandiae (Emu)*			
51.	24651	*Eopsaltria australis subsp. griseogularis (Western Yellow Robin)*			
52.	24652	*Eopsaltria georgiana (White-breasted Robin)*			
53.	24567	*Epthianura albifrons (White-fronted Chat)*			
54.	25621	*Falco berigora (Brown Falcon)*			
55.	25622	*Falco cenchroides (Australian Kestrel)*			
56.	25624	*Falco peregrinus (Peregrine Falcon)*		S	
57.	24475	*Falco peregrinus subsp. macropus (Australian Peregrine Falcon)*		S	
58.	25677	*Falcunculus frontatus (Crested Shrike-tit)*			
59.	25727	*Fulica atra (Eurasian Coot)*			
60.	25729	*Gallinula tenebrosa (Dusky Moorhen)*			
61.	25730	*Gallirallus philippensis (Buff-banded Rail)*			
62.	25530	*Gerygone fusca (Western Gerygone)*			
63.	24735	*Glossopsitta porphyrocephala (Purple-crowned Lorikeet)*			
64.	24443	*Grallina cyanoleuca (Magpie-lark)*			
65.	25627	*Haematopus fuliginosus (Sooty Oystercatcher)*			
66.	24295	*Haliastur sphenurus (Whistling Kite)*			
67.	25734	*Himantopus himantopus (Black-winged Stilt)*			
68.	24491	*Hirundo neoxena (Welcome Swallow)*			
69.	24347	*Ixobrychus flavicollis subsp. australis (Australian Black Bittern)*		P3	
70.	24511	*Larus novaehollandiae subsp. novaehollandiae*			
71.	24581	*Lichenostomus virescens (Singing Honeyeater)*			
72.	25661	*Lichmera indistincta (Brown Honeyeater)*			
73.	25650	*Malurus elegans (Red-winged Fairy-wren)*			
74.	25654	*Malurus splendens (Splendid Fairy-wren)*			
75.	25663	*Melithreptus brevirostris (Brown-headed Honeyeater)*			
76.	24598	*Merops ornatus (Rainbow Bee-eater)*		IA	
77.	25693	*Microeca fascinans (Jacky Winter)*			
78.	25610	*Myiagra inquieta (Restless Flycatcher)*			
79.	24738	*Neophema elegans (Elegant Parrot)*			
80.	25748	*Ninox novaeseelandiae (Boobook Owl)*			
81.	24820	*Ninox novaeseelandiae subsp. boobook (Boobook Owl)*			
82.	24407	*Ocyphaps lophotes (Crested Pigeon)*			
83.	25679	*Pachycephala pectoralis (Golden Whistler)*			
84.	25680	*Pachycephala rufiventris (Rufous Whistler)*			
85.	24299	*Pandion haliaetus subsp. cristatus*			
86.	25681	*Pardalotus punctatus (Spotted Pardalote)*			
87.	25682	*Pardalotus striatus (Striated Pardalote)*			
88.	24648	*Pelecanus conspicillatus (Australian Pelican)*			
89.	25697	*Phalacrocorax carbo (Great Cormorant)*			
90.	24667	*Phalacrocorax sulcirostris (Little Black Cormorant)*			
91.	25699	*Phalacrocorax varius (Pied Cormorant)*			
92.	24409	*Phaps chalcoptera (Common Bronzewing)*			
93.	25587	*Phaps elegans (Brush Bronzewing)*			
94.	24596	*Phylidonyris novaehollandiae (New Holland Honeyeater)*			
95.	25720	*Platycercus icterotis (Western Rosella)*			
96.	24681	*Poliocephalus poliocephalus (Hoary-headed Grebe)*			
97.	25731	*Porphyrio porphyrio (Purple Swamphen)*			
98.	24771	*Porzana tabuensis (Spotless Crake)*			
99.	25614	*Rhipidura leucophrys (Willie Wagtail)*			
100.	25534	*Sericornis frontalis (White-browed Scrubwren)*			
101.	24279	*Sericornis frontalis subsp. maculatus*			
102.	24645	*Stagonopleura oculata (Red-eared Firetail)*			
103.	24522	*Sterna bergii (Crested Tern)*			
104.	24554	*Stipiturus malachurus subsp. westernensis*			
105.	25597	*Strepera versicolor (Grey Currawong)*			
106.	25590	*Streptopelia senegalensis (Laughing Turtle-Dove)*			
107.	25705	*Tachybaptus novaehollandiae (Australasian Grebe)*			
108.	24331	*Tadorna tadornoides (Australian Shelduck)*			
109.	24845	*Threskiornis spinicollis (Straw-necked Ibis)*			
110.	25549	*Todiramphus sanctus (Sacred Kingfisher)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
111.	24855	*Tyto novaehollandiae subsp. novaehollandiae (Masked Owl (southern subsp))*		P3	
112.	24386	*Vanellus tricolor (Banded Lapwing)*			
113.	25765	*Zosterops lateralis (Grey-breasted White-eye)*			
Fish					
114.	34030	*Geotria australis (Pouched Lamprey)*		P1	
Invertebrate					
115.		*Anisynta sphenosema*			
116.		*Anobium punctatum*			
117.		*Atractocerus kreuslerae*			
118.		*Austrogomphus lateralis*			
119.		*Austronysius sericus*			Y
120.	33940	*Cherax tenuimanus (Margaret River Marron, Hairy Marron)*		T	
121.		*Chloromerus maculifemur*			Y
122.		*Ephydrella acrostichalis*			Y
123.		*Euomus insculptus*			Y
124.		*Hensaussurea sheardi*			
125.		*Homalictus urbanus*			Y
126.		*Lectrides parilis*			
127.		*Lophyrotoma analis*			Y
128.		*Neotemnopteryx fulva*			
129.		*Opilo congruus*			
130.		*Paleonura rosacea*			Y
131.		*Perga sp.*			
132.		*Spathoptila cyclophora*			Y
133.		*Stenoderus suturalis*			
134.		*Stigmodera cancellata*			
135.		*Techimorphus westraliensis*			Y
136.		*Thoracolopha pissonephra*			Y
137.		*Xylopsocus rubidus*			
138.		*Xylopsocus sp.*			
Mammal					
139.	24086	*Cercartetus concinnus (Western Pygmy-possum)*			
140.	24092	*Dasyurus geoffroii (Chuditch, Western Quoll)*		T	
141.	24215	*Hydromys chrysogaster (Water-rat)*		P4	
142.	24153	*Isoodon obesulus subsp. fusciventer (Quenda, Southern Brown Bandicoot)*		P5	
143.	24133	*Macropus irma (Western Brush Wallaby)*		P4	
144.	24099	*Phascogale tapoatafa subsp. tapoatafa (Southern Brush-tailed Phascogale, Wambenger)*		T	
145.	24164	*Potorous platyops (Broad-faced Potoroo)*		X	
146.	24166	*Pseudocheirus occidentalis (Western Ringtail Possum)*		T	
147.	24243	*Rattus fuscipes (Western Bush Rat)*			
148.	24245	*Rattus rattus (Black Rat)*			
149.	24145	*Setonix brachyurus (Quokka)*		T	
150.	24109	*Sminthopsis dolichura (Little long-tailed Dunnart)*			
151.	24111	*Sminthopsis gilberti (Gilbert's Dunnart)*			
152.	24158	*Trichosurus vulpecula subsp. vulpecula (Common Brushtail Possum)*			
153.	24206	*Vespadelus regulus (Southern Forest Bat)*			
Reptile					
154.	24980	*Christinus marmoratus (Marbled Gecko)*			
155.	30893	*Cryptoblepharus buchananii*			
156.	25047	*Ctenotus impar*			
157.	25049	*Ctenotus labillardieri*			
158.	25251	*Echiopsis curta (Bardick)*			
159.	25096	*Egernia kingii (King's Skink)*			
160.	25100	*Egernia napoleonis*			
161.	25118	*Hemiergis peronii subsp. tridactyla*			
162.	25131	*Lerista distinguenda*			
163.	25133	*Lerista elegans*			
164.	25154	*Lerista microtis subsp. microtis*			
165.	25005	*Lialis burtonis*			
166.	25184	*Menetia greyii*			
167.	25191	*Morethia lineoocellata*			
168.	25192	*Morethia obscura*			
169.	25259	*Pseudonaja affinis subsp. affinis (Dugite)*			
170.	25008	*Pygopus lepidopodus (Common Scaly Foot)*			
171.	25271	*Ramphotyphlops australis*			
172.	25225	*Varanus rosenbergi (Heath Monitor)*			

Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area

Conservation Codes
T - Rare or likely to become extinct
X - Presumed extinct
IA - Protected under international agreement
S - Other specially protected fauna
1 - Priority 1
2 - Priority 2
3 - Priority 3
4 - Priority 4
5 - Priority 5

[1] For NatureMap's purposes, species flagged as endemic are those whose records are wholely contained within the search area. Note that only those records complying with the search criterion are included in the calculation. For example, if you limit records to those from a specific datasource, only records from that datasource are used to determine if a species is restricted to the query area.

Australian Government

Department of Sustainability, Environment, Water, Population and Communities

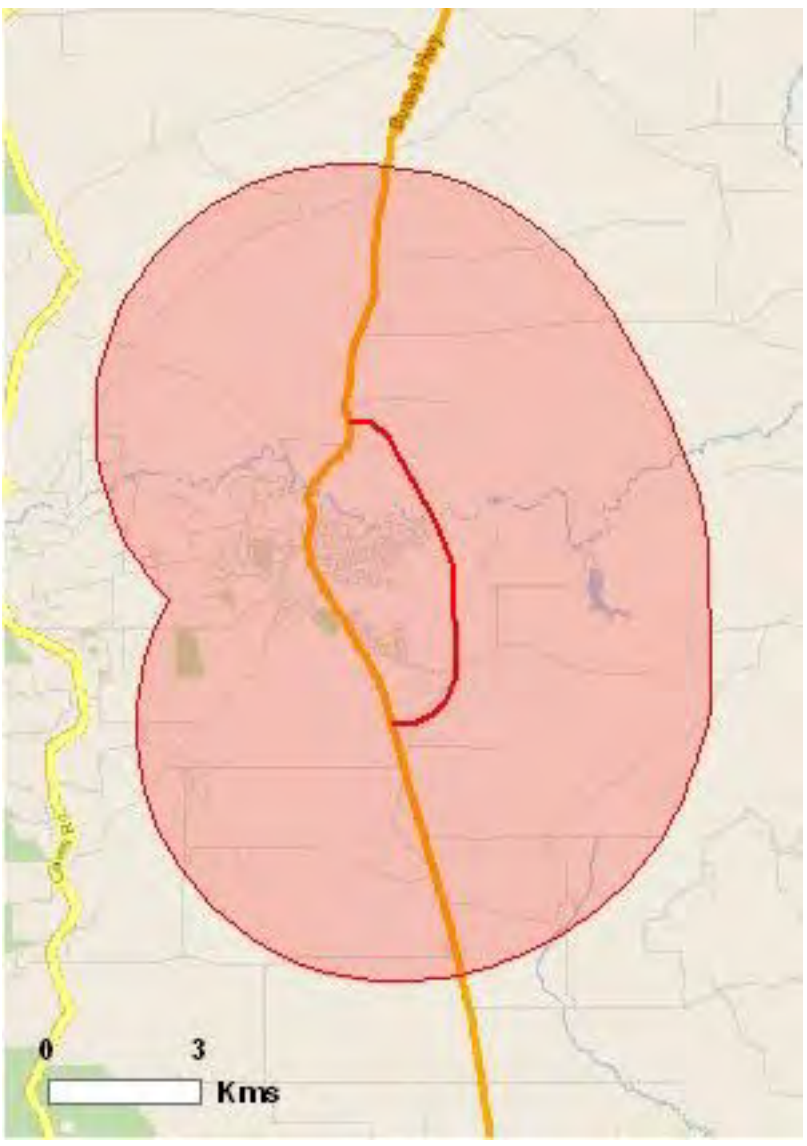
EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

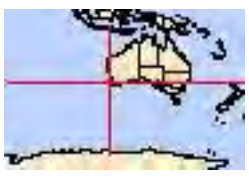
Information about the EPBC Act including significance guidelines, forms and application process details can be found at http://www.environment.gov.au/epbc/assessmentsapprovals/index.html

Report created: 13/11/12 19:11:47



This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2010

Coordinates
Buffer: 5.0Km



Summary

Matters of National Environment Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance - see http://www.environment.gov.au/epbc/assessmentsapprovals/guidelines/index.html

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Areas:	None
Threatened Ecological Communities:	None
Threatened Species:	19
Migratory Species:	8

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place and the heritage values of a place on the Register of the National Estate. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage/index.html

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species. Information on EPBC Act permit requirements and application forms can be found at http://www.environment.gov.

Commonwealth Lands:	1
Commonwealth Heritage Places:	None
Listed Marine Species:	5
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have

Place on the RNE:	2
State and Territory Reserves:	1
Regional Forest Agreements:	1
Invasive Species:	11
Nationally Important Wetlands:	None

Details

Matters of National Environmental Significance

Threatened Species		[Resource Information]
Name	Status	Type of Presence
BIRDS		
Botaurus poiciloptilus		
Australasian Bittern [1001]	Endangered	Species or species habitat may occur within area

Name	Status	Type of Presence
Calyptorhynchus banksii naso		
Forest Red-tailed Black-Cockatoo [67034]	Vulnerable	Species or species habitat may occur within area
Calyptorhynchus baudinii		
Baudin's Black-Cockatoo, Long-billed Black-Cockatoo [769]	Vulnerable	Breeding known to occur within area
Calyptorhynchus latirostris		
Carnaby's Black-Cockatoo, Short-billed Black-Cockatoo [59523]	Endangered	Breeding likely to occur within area
Leipoa ocellata		
Malleefowl [934]	Vulnerable	Species or species habitat may occur within area
CRUSTACEANS		
Cherax tenuimanus		
Hairy Marron, Margaret River Hairy Marron, Margaret River Marron [78931]	Critically Endangered	Species or species habitat known to occur within area
FISH		
Nannatherina balstoni		
Balston's Pygmy Perch [66698]	Vulnerable	Species or species habitat may occur within area
FROGS		
Geocrinia alba		
White-bellied Frog, Creek Frog [26181]	Endangered	Species or species habitat likely to occur within area
MAMMALS		
Dasyurus geoffroii		
Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat likely to occur within area
Pseudocheirus occidentalis		
Western Ringtail Possum [25911]	Vulnerable	Species or species habitat likely to occur within area
PLANTS		
Banksia nivea subsp. uliginosa		
Swamp Honeypot [82766]	Endangered	Species or species habitat may occur within area
Banksia squarrosa subsp. argillacea		
Whicher Range Dryandra [82769]	Vulnerable	Species or species habitat may occur within area
Caladenia hoffmanii		
Hoffman's Spider-orchid [56719]	Endangered	Species or species habitat may occur within area
Caladenia winfieldii		
Majestic Spider-orchid [64504]	Endangered	Species or species habitat may occur within area
Centrolepis caespitosa		
[6393]	Endangered	Species or species habitat likely to occur within area
Drosera fimbriata		
Manypeaks Sundew [18749]	Vulnerable	Species or species habitat known to occur within area
Gastrolobium papilio		
Butterfly-leaved Gastrolobium [78415]	Endangered	Species or species habitat may occur within area
Lambertia echinata subsp. occidentalis		
Western Prickly Honeysuckle [64528]	Endangered	Species or species habitat may occur within area

Name	Status	Type of Presence
Sphenotoma drummondii [21160]	Endangered	Species or species habitat may occur within area

Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat may occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Migratory Terrestrial Species		
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Migratory Wetlands Species		
Ardea alba Great Egret, White Egret [59541]		Species or species habitat may occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Commonwealth Lands [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name
Commonwealth Land -

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat may occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within

Name	Threatened	Type of Presence
		area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area

Extra Information

Places on the RNE [Resource Information]

Note that not all Indigenous sites may be listed.

Name	State	Status
Historic		
St Thomas More Catholic Church	WA	Indicative Place
Basildene Farmhouse (former)	WA	Registered

State and Territory Reserves [Resource Information]

Name	State
Bramley	WA

Regional Forest Agreements [Resource Information]

Note that all areas with completed RFAs have been included.

Name	State
South West WA RFA	Western Australia

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit,

Name	Status	Type of Presence
Mammals		
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat may occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within

Name	Status	Type of Presence
		area
[Lycium ferocissimum](#) African Boxthorn, Boxthorn [19235]		Species or species habitat may occur within area
[Pinus radiata](#) Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
[Rubus fruticosus aggregate](#) Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
[Tamarix aphylla](#) Athel Pine, Athel Tree, Tamarisk, Athel Tamarisk, Athel Tamarix, Desert Tamarisk, Flowering Cypress, Salt Cedar [16018]		Species or species habitat likely to occur within area

Coordinates

-33.930965 115.081297,-33.931421 115.084799,-33.933858 115.087845,-33.949086 115.096373,-33.956092 115.099114,-33.976041 115.099876,-33.980762 115.0982,-33.983046 115.095764,-33.985026 115.091804,-33.985178 115.088606

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World Heritage and Register of National Estate properties, Wetlands of International Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

For species where the distributions are well known, maps are digitised from sources such as recovery plans and detailed habitat studies. Where appropriate, core breeding, foraging and roosting areas are indicated under 'type of presence'. For species whose distributions are less well known, point locations are collated from government wildlife authorities, museums, and non-government organisations; bioclimatic distribution models are generated and these validated by experts. In some cases, the distribution maps are based solely on expert knowledge.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Department of Environment, Climate Change and Water, New South Wales

-Department of Sustainability and Environment, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment and Natural Resources, South Australia
-Parks and Wildlife Service NT, NT Dept of Natural Resources, Environment and the Arts
-Environmental and Resource Management, Queensland
-Department of Environment and Conservation, Western Australia
-Department of the Environment, Climate Change, Energy and Water
-Birds Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-SA Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Atherton and Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
-State Forests of NSW
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

Department of Sustainability, Environment, Water, Population and Communities
GPO Box 787
Canberra ACT 2601 Australia
+61 2 6274 1111

Likelihood of occurrence

Likelihood of occurrence assessment for Threatened and Priority species identified in 2012 database searches that were not identified in Margaret River Bypass: Flora and Fauna Assessment (GHD 2012).

Fauna

Species	Details and Habitat	EPBC Conservation Code	DEC Conservation Code	Likelihood
Leipoa ocellata *Malleefowl*	The shrublands and low woodlands communities where Malleefowl occur are dominated by eucalypts (such as *Eucalyptus socialis*, *E. dumosa* or *E. incrassata*) and occur on sandy or loamy soils that receive 200 to 450 mm of rainfall each year (Frith 1959, 1962a; Marchant & Higgins 1993; Priddel & Wheeler 1995).	Vulnerable	Schedule 1	**Unlikely** Within the Margaret River region there are large intact forested areas that may still be suitable for the species. However there is no suitable habitat for the species within the study area.

Flora

Species	Details and Habitat	EPBC Conservation Code	DEC Conservation Code	Likelihood
Banksia nivea subsp. uliginosa Swamp Honeypot	Giant Spider-orchid is distributed along the Leeuwin Naturaliste Ridge between Yallingup and Karridale, Western Australia. The species occurs within the South West Natural Resource Management Region. The total known population size is 257 plants across 26 small fragmented sub-populations. Grows on hilltops, slopes, swales and low plains in deep pale yellow, white, grey sandy soils and is found among low shrubs in Banksia, Jarrah and Marri woodlands.	Endangered	Threatened	**Unlikely** – limited suitable habitat and not previously recorded within 5 km of the area.

Banksia squarrosa subsp. argillacea Whicher Range Dryandra	Occurs at the base of the Whicher Range, east of Busselton and on the Scott River Plain. Erect, open, non-lignotuberous shrub, 1.2-4 m high. Fl. yellow, Jun to Nov. White/grey sand, gravelly clay or loam. Winter-wet flats, clay flats.	Vulnerable	Threatened	**Unlikely** – limited suitable habitat and not previously recorded within 5 km of the area.
Drosera fimbriata Manypeaks Sundew	Erect tuberous, perennial, herb, 0.05-0.15 m high. Fl. white, Sep to Oct. White sand, granite.	Vulnerable	P4	**Unlikely** – limited suitable habitat and not previously recorded within 5 km of the area.
Gastrolobium papilio Butterfly-leaved Gastrolobium	Tangled, clumped shrub, to 1.5 m high. Fl. cream-red, Oct to Dec. Sandy clay over ironstone and laterite. Flat plains.	Endangered	Threatened	**Unlikely** – limited suitable habitat and not previously recorded within 5 km.
Lambertia echinata subsp. Occidentalis Western Prickly Honeysuckle	Prickly, much-branched, non-lignotuberous shrub, to 3 m high. Fl. yellow, Feb or Apr or Dec. White sandy soils over laterite, orange/brown-red clay over ironstone. Flats to foothills, winter-wet sites.	Endangered	Threatened	**Possible** – some suitable habitat present.
Caladenai huegelii Grand Spider Orchid	Tuberous, perennial, herb, 0.25-0.6 m high. Fl. green & cream & red, Sep to Oct. Grey or brown sand, clay loam.	Endangered	Threatened	**Unlikely** – this species occurs in the Swan Coastal Plain. There is limited habitat available.
Gastrolobium modestum	Prostrate to clumped shrub, to 0.5 m high. Fl. cream-green-pink, Sep to Nov. Shallow red clay-loam or grey sand, ironstone. Gullies and edges of flats.	Vulnerable	Threatened	**Likely** –suitable habitat present and previously recorded within 5 km.

Hakea oldfieldii	Open, straggling shrub, up to 2.5 m high. Fl. white-cream/yellow, Aug to Oct. Red clay or sand over laterite. Seasonally wet flats.		P4	**Possible** – limited suitable habitat present, but previously recorded within 5 km.
Loxocarya magna	Rhizomatous, perennial, herb (sedge-like), 0.5-1.5 m high. Fl. Sep or Nov. Sand, loam, clay, ironstone. Seasonally inundated or damp habitats. Seasonal wet areas, only a small amount in study area.		P3	**Possible** – limited suitable habitat present, but previously recorded within 5 km.
Trichocline sp. Treeton (B.J. Keighery & N. Gibson 564)	Tuberous, perennial, herb, to 1.6 m high. Sand over limestone, sandy clay over ironstone. Seasonally wet flats.		P2	**Possible** – limited suitable habitat present, but previously recorded within 5 km.

Appendix D – Hygiene Management Plan Margaret River Bypass

GHD

Hygiene Management Plan
Margaret River Bypass.

Report compiled by Evan Brown of
Glevan Consulting

GLEVAN
CONSULTING

Disclaimer

This *Phytophthora cinnamomi* Hygiene Management Plan has been prepared in accordance with the scope of work agreed between GHD and Glevan Consulting.

Procedures and guidelines stipulated in various Department of Environment and Conservation and Dieback Working Group manuals are applied as the base methodology used by Glevan Consulting in the delivery of the services and products required by this scope of work.

Version Control

Document ID	Author	Date	Comments
Draft	EB	20/03/2012	
Final	EB	28/03/2012	Accepted client comments

1 BACKGROUND

A *Phytophthora cinnamomi* Hygiene Management Plan focuses on protecting good quality vegetation uninfested by *Phytophthora cinnamomi*. The plan generally achieves this by preventing the introduction of *P. cinnamomi* from outside the site, or spread from other areas within the site through the use of "Clean on Entry" (COE) points.

As part of the Main Roads construction work to create the Margaret River Bypass Road, access will be required through all sections of the construction boundary. The construction area covers private property, road reserve and State forest. This *Phytophthora cinnamomi* Hygiene Management Plan has been developed for use during the construction works within the boundary shown in the attached map.

P. cinnamomi is a largely soil-borne pathogen that invades and destroys the root and root collar cells of susceptible species primarily from the plant families *Proteaceae*, *Epacridaceae*, *Dilleniaceae*, *Fabaceae*, *Xanthorrhoeaceae* and *Myrtaceae*. This pathogen is a microscopic, pseudo-fungus organism requiring warm moist conditions to survive and spread. The pathogen is commonly spread in infested soil material during road construction and other soil disturbing activities, and in water via both surface and sub-surface drainage. *P. cinnamomi* has been identified as the single most destructive plant pathogen in native plant communities in Western Australia.

1.1 DEFINITIONS

The following definitions relate to terminology used in later sections of this management plan.

Cleandown: The removal of soil, soil slurry, mud, and vegetation material from vehicles, plant or machinery using either a brush for dry material or a high pressure water washdown unit for wet material.

Clean on Entry (COE) Point: Identified by a sign positioned at designated position adjacent to the site entry at which a hygiene procedure must be conducted.

Hygiene Boundary: Boundary between Protectable Native Vegetation and other Hygiene Categories.

Hygiene Procedures: Tasks (e.g. Cleandown) that must be completed to ensure that plant pathogen (*P. cinnamomi*) and weeds are not spread into protectable areas.

P. cinnamomi free (Uninfested areas): Areas of native vegetation that an accredited interpreter has determined to be free of plant disease symptoms that would indicate the presence of the pathogen *P. cinnamomi*.

P. cinnamomi infested (Infested areas): Areas of native vegetation that an accredited interpreter has determined have plant disease symptoms consistent with the presence of the pathogen *P. cinnamomi*.

Unmappable: Areas that are sufficiently disturbed so that *P. cinnamomi* occurrence mapping is not possible at the time of inspection.

Protectable Area: Defines DEC managed land over which the hygiene rule, for the plant pathogen *Phytophthora cinnamomi*, of COE will apply (CALM 2003). For the purposes of the Project, Protectable areas include:

- all areas of native vegetation in good condition that have been mapped as Uninfested, and
- constitute a linear unit that can be protected from the spread of *P. cinnamomi* by human vectoring during construction activities.

Site: Construction area for the Margaret River Bypass Road.

Unprotectable Area: Consist of all areas not classed as Protectable (CALM 2003).

1.2 OBJECTIVES

The main objective of this *Phytophthora cinnamomi* Hygiene Management Plan is to control the human-vectored spread of *P. cinnamomi* resulting from construction activities associated with the project.

Specific objectives include:

- provide information to personnel that will enable them to effectively manage their activities to prevent the spread of *P. cinnamomi*;
- identify training requirements for personnel to enable them to fulfill their roles;
- provide a system of documentation and field controls to enable this issue to be managed effectively and ensure Main Roads commitments with regard to *P. cinnamomi* hygiene are met.

This management plan applies to the vegetation clearing and soil excavation and re-distribution activities associated with the proposed construction for the Margaret River Bypass Road.

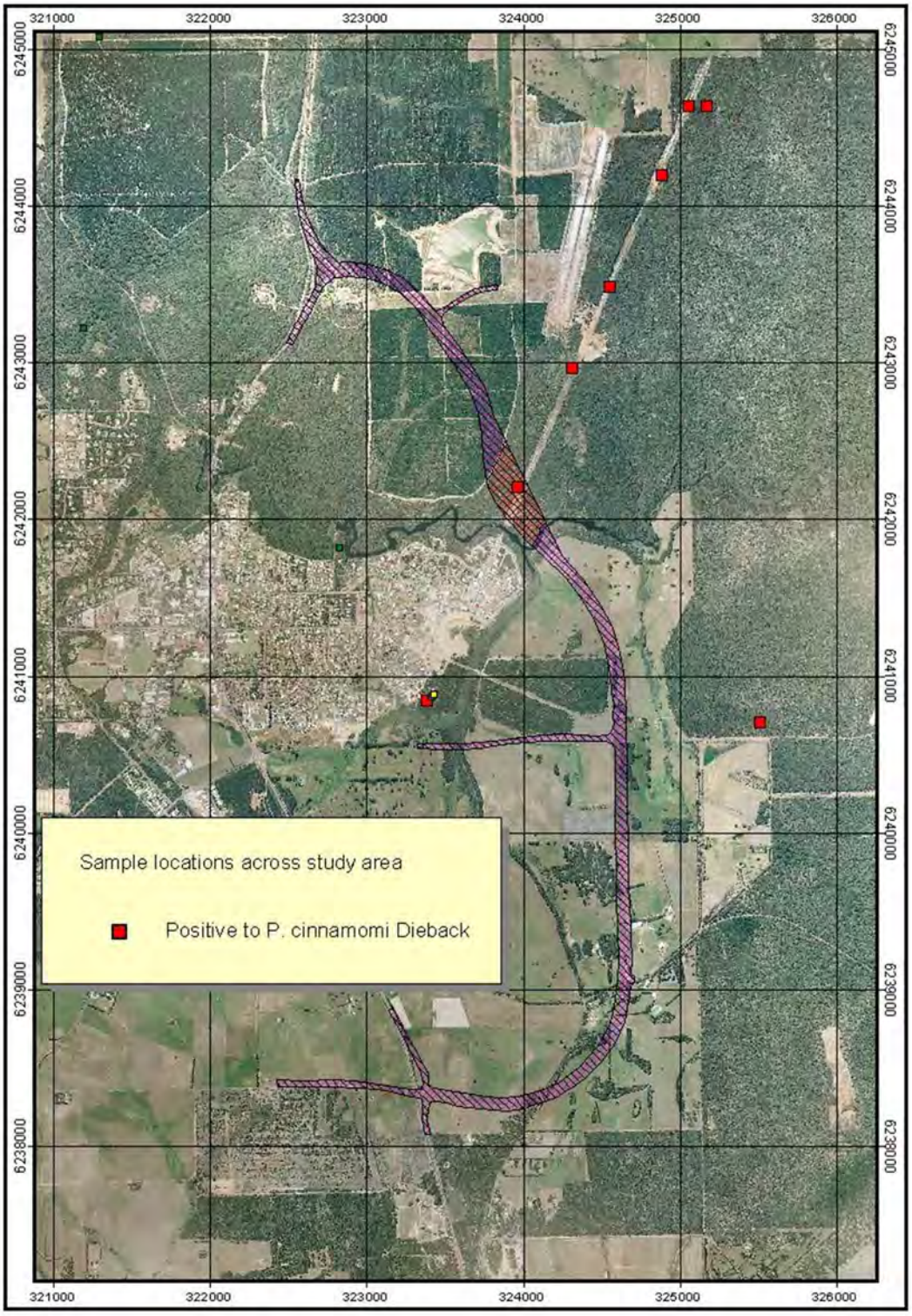
2 FIELD INTERPRETATION

The project area was assessed for the presence of disease caused by *P. cinnamomi* in March 2012. The assessment was conducted by Mr. Evan Brown who is accredited by the Department of Environment and Conservation (DEC) to provide this service.

This assessment covered the vegetation within the clearing area for the Margaret River Bypass Road. Within the section of the alignment on the northern side of the Margaret River, the vegetation adjacent to Bussell Highway is a mosaic of infested and unmappable vegetation with most of the area suffering significant disturbance. The existing pine plantations are considered Unmappable. Known previous assessment surveys have been undertaken by Glevan Consulting and Department of Environment and Conservation in the state forest section of the alignment, specifically for the Busselton – Margaret River Western Power transmission line easement. These previous assessments have determined that the transmission line easement is infested with Dieback with samples taken during previous surveys which have proven the presence of the pathogen. One sample taken in 2007 (323962mE 6242201mN GDA94) has proven the presence of Dieback at the intersection of the proposed Margaret River Bypass Road and the transmission line. The remnant vegetation on the northern and southern side of the transmission line is downslope of the easement and therefore Dieback is likely to have infiltrated into these areas from the infestation on the easement. Whilst sections of the vegetation appear healthy, probably due to the fertility of the soil, scattered deaths attributable to Dieback were noted.

Very little remnant vegetation in any reasonable condition exists within the alignment for the section south of the Margaret River. The vegetation is confined to narrow road reserves, or grazed sections on private property. The vegetation between Darch Road and private property was showing symptoms of Dieback presence at the proposed location of the construction alignment.

Soil and tissue samples were not taken for the assessment. Sampling has been undertaken during previous assessments through the greater area, some of which have proven the presence of the Dieback disease within the clearing area. The sites are shown on the following figure.



No hygiene management is apparently in place along the alignment.

The entire area of the construction clearing site is a mosaic of infested and unmappable areas. All Uninfested vegetation adjacent to the site is upslope, and should not be immediately impacted by activities within the clearing area. The clearing area should be managed as being Unprotectable and as such will not require Clean On Entry (COE) points for control of *P. cinnamomi.* COE points and hygiene practices may still be required to prevent the possible introduction of weeds onto the site, and to mitigate the potential for infested material to be taken from site.

3 MANAGEMENT TASKS

All recommendations are based on this Dieback Hygiene Management Plan being compatible with any existing (or to be developed) Topsoil and Weed Management Plan. The assumption is made that it has been determined to prevent the introduction of weeds into the site during construction works for the Margaret River Bypass Road.

3.1 TRAINING

- Training will be given to all personnel during an initial safety and environment induction course. This will include an explanation of the Project, and specific requirements with regard to *P. cinnamomi* hygiene management.

3.2 ACCESS

- Access to the site during construction will be designated by safe working practices.
- Main Roads or its primary contractor shall designate to all contractors that all vehicles coming to site shall be free of soil and material, to avoid introduction of weeds. Any vehicle not complying with this requirement must be turned away. The site manager or representative will inspect all plant and equipment prior to commencement of work on site.
- All Contractors will supply documentary or checklist evidence to the site manager or representative in the form of an Initial Vehicle/Plant Hygiene Register that equipment has been cleaned of soil and vegetation material and inspected prior to commencement of work on site.

3.3 SIGNAGE

- Main Roads or its primary contractor will erect COE point signs at the designated COE point prior to the commencement of clearing and construction activities.

- Main Roads or its primary contractor will inspect the site daily during construction and ensure that signage remains intact in accordance with this management plan.

3.4 CLEAN ON ENTRY POINTS (COE)

The COE point can be used to ensure vehicles are clean either on entry to the site, or exiting the site. The location of COE point is not shown on the Hygiene Map (Attachment 1) but will be positioned with regard to aspects of safety, convenience and any other special conditions required of the location.

- The COE point considerations will:

  Consider the safety of all personnel on site;

  Take into consideration vehicles accessing the COE from off-site and on-site;

  Have sufficient room to allow for vehicles to safely stop to inspect vehicles and to turn around if refused entry to, or exit from site.
- Vehicles, plant and equipment will stop at the COE point and be inspected by the site manager or representative for soil, soil slurry or vegetation material. Inspections will include tyres / wheels, undercarriage, belly plates, buckets and tracks of all equipment.
- Should any of the mentioned materials be present, the equipment/vehicle must be cleaned and the material removed. Dry conditions will require a brushdown to remove dirt clods or vegetation. Dust does not have to be cleaned from the vehicle. Under wet conditions, mud present on tyres, tracks, under carriages etc will require a washdown with high pressure water.
- Training in vehicle/plant inspection and cleandown procedures to be conducted at COE points will be provided to all contractors and personnel during project induction sessions by Main Roads or its primary contractor.

3.5 BORROW MATERIAL

- Rock, limestone or fill material must not be introduced to the project area unless first classified as weed-free. Suppliers of material should be audited by a qualified person to determine classification as weed-free.
- Material shall only be exported from the site if it is deemed that the site receiving the fill is appropriately classified by an accredited Dieback disease interpreter. All material will be transported such that infested soil cannot fall from the vehicle onto road verges.

3.6 HYGIENE BREACH MANAGEMENT

A hygiene breach is any breach of the hygiene procedures listed above. This includes such incidents as failing to inspect vehicle at designated COE points, failing to washdown or clean vehicle if needed, and failing to adhere to authorised access routes.

- All hygiene breaches must be reported to the site manager or representative within 24 hours.
- An environmental incident report will be completed by the person reporting the hygiene breach in accordance with the Environmental Incident and Investigation procedure for the project.
- The site manager or representative will manage the situation in accordance with the following:

  The site manager or representative will fill out an Environmental Incident Report;

  Investigation by appropriately qualified Main Roads personnel, or its primary contractors personnel, will be conducted;

  Removal from site of personnel will occur after such incidents as passing through Hygiene Inspection Points without stopping and checking the vehicle or using non-approved access routes to or from site;

  Further training of Hygiene requirements will be undertaken by personnel who do not fill out the Hygiene Inspection Register.

3.7 INSPECTIONS AND AUDITING

- The site, COE point and documentation will be monitored regularly for compliance with hygiene procedures by the site manager or representative.
- Daily inspections will include:

  the condition of the COE point;

  evidence of vehicles or machinery leaving the agreed access route without permission; and

  evidence of inspections not being completed.
- On completion of construction and site reinstatement a final audit of the site and environmental management system documentation should be conducted by Main Roads.
- Further training of personnel into *Phytophthora* hygiene management will be provided if problems implementing hygiene are encountered.

4 REFERENCES

CALM (2003) Phytophthora cinnamomi and Disease Caused By It: Volume I – Management Guidelines. Published by the Department of Conservation and Land Management, Perth, Western Australia.

ATTACHMENT 1

321000 322000 323000 324000 325000 326000

6245000 6244000 6243000 6242000 6241000 6240000 6239000 6238000 6237000

LOCALITY

DATA CAPTURE
Boundaries captured by GPS and positioned relative to map features

MAPPING THRESHOLDS
Areas below threshold of 1mm on map are symbolised

ADDITIONAL DATA
Aerial imagery: DLI March 2006
Isohyets: Bureau of Meterology

LEGEND

Unmappable (Unprotectable) Area

Infested (Unprotectable) Area

GLEVAN CONSULTING

N

AREA STATEMENT

Uninfested:	0.0 ha
Uninterpretable:	0.0 ha
Infested:	11.3 ha
Unmappable:	76.3 ha
Total:	87.6 ha

MAP 1.1
Margaret River Bypass Road
Phytophthora cinnamoni Hygiene Map

MAP DETAILS
Scale 1:25 000 @ A3

Client:	GHD
Project:	Margaret River Bypass
Interpretation:	EB 02/2012
Digitising:	EB 03/2012

Appendix E – Ethnographic consultation for the Margaret River East Perimeter Road

AN ETHNOGRAPHIC CONSULTATION FOR THE MARGARET RIVER EAST PERIMETER ROAD, WESTERN AUSTRALIA.

A report prepared for GHD Pty Ltd on behalf of Main Roads Western Australia.

By Mr Brad Goode
Consulting Anthropologist
79 Naturaliste Terrace
DUNSBOROUGH WA 6281
bradnlee@westnet.com.au

Report submitted July 2007 to:

Mr Bruno Rikli
GDH Pty Ltd – Project Manager
10 Victoria Street
BUNBURY WA 6230

Mr Denis Callaghan
Department of Indigenous Affairs
PO Box 7770
Cloisters Square
PERTH WA 6000

HERITAGE SURVEY

79 Naturaliste Terrace
Dunsborough WA 6281
Email:- bradnlee@westnet.com.au
Phone:- 97553716

EXECUTIVE SUMMARY

Main Roads Western Australia (Main Roads) on behalf of the Department for Planning and Infrastructure is planning for a deviation of the Bussell Highway to the east of the Margaret River townsite. The deviation is referred to as the Margaret River East Perimeter Road (MREPR). At this point in time the project is at an early stage of planning, therefore GHD Pty Ltd (GHD) on behalf of Main Roads has conducted preliminary consultations with the Nyungar community to determine whether any sites of significance as defined by section 5 of the 'Act' will be impacted upon by this proposed work thereby fulfilling Main Roads obligations under the West Australian Aboriginal Heritage Act (1972).

As a result of archival research, six previously recorded Aboriginal Heritage sites have been identified in the search area. Two artefact sites, Site ID 4522 Margaret River Dam Site 1 and Site ID 4523 Margaret River Dam Site 2 were identified to be located east of the survey corridor and will not be affected by the project proposal.

Two ethnographic sites, Site ID 21037 Wcm/01 Red Gum Tree and Site ID 21038 Wcm/02 Water Course (Waugly Site) were also identified to the west of the survey corridor and will not be affected by the project proposal. Site ID 4494 Rosa Brook Road (Lore Ground) has also been identified to be located 500m east of the project area and will not be affected by the project proposal.

Site ID 4495 Margaret River will be affected by Main Roads proposal to construct the Margaret River East Perimeter Road Bridge. As such this work will require ministerial consent under Section 18 of the West Australian Aboriginal Heritage Act (1972) for consent to use the land that may contain an Aboriginal site. A number of the Margaret Rivers' tributaries including the Darch Brook are also located within the survey corridor. Any plans that will affect these water courses within 30m of their normal high water mark will also require clearance under Section 18 of the West Australian Aboriginal Heritage Act (1972).

As a result of community consultations held with members of the South West Boojarah and Harris Family Native Title Claim groups, no new ethnographic sites as defined by Section 5 of the West Australian Aboriginal Heritage Act (1972) were identified within the survey corridor.

In relation to Site ID 4495 Margaret River all the Nyungar informants consulted stated that they would support Main Roads request for a Section 18 clearance to cross the main river channel with the MREPR. They further stated the Darch Brook should not be affected if possible. They stated that the proposed bridges span across the Margaret River and should minimally disturb the embankments and not interfere with the natural flow of the waterway.

The informants agreed that their preferred option for the road path within the survey corridor was on the western side of an unnamed tributary of the Margaret River that runs north-south along the eastern boundary of the survey corridor, thereby giving the town room for its inevitable expansion. It was stated by the informants that a kangaroo fence should be constructed on the eastern side of the MREPR so as to protect and stop native animals from crossing the new Perimeter Road. The Aboriginal community also stated that they did not wish for numerous blocks of bushland located amidst open farm paddocks in the centre of the corridor to be disturbed as these are habitats, nesting areas and flight paths used by native birds.

The Aboriginal informants further stated that Main Roads should have a contingency plan to relocate the MREPR so that if Aboriginal skeletal remains were discovered during construction that the remains could be left in situ as it is believed to be culturally inappropriate to move Aboriginal graves. A 60m buffer was seen to be a necessary zone of protection between any graves and the road.

As a result of the above consultations, the following recommendations are made:

It is recommended that as there was no new sites identified under Section 5 of the West Australian Aboriginal Heritage Act (1972) that the project proceed to the second stage of planning in order to identify the actual road alignment within the Margaret River East Perimeter Road survey corridor.

It is recommended that when the actual road alignment is defined that an on the ground archaeological field survey be conducted in order to identify any possible archaeological constraints for the road alignment. This survey should involve members of the South West Boojarah and Harris Family Native Title Claim group. During this survey, if any archaeological sites are recorded, **it is further recommended** that Main Roads endeavour to modify their plans in order to avoid these areas, particularly if skeletal remains are identified.

If it is not possible to avoid any identified archaeological sites, then **it is recommended** that further consultations with the above Native Title Claim groups will be necessary in order to document the sites ethnographic significance, prior to Main Roads seeking consent under Section 18 of the West Australian Aboriginal Heritage Act (1972) to use the land that may contain an Aboriginal site.

In regards to Site ID 4495 Margaret River, **it is recommended** that Main Roads construct a bridge that will minimise disturbance to the embankments and restriction of the flow of water in order to protect the values associated with this site and that this work will require consent under Section 18 of the West Australian Aboriginal Heritage Act (1972). It must be noted that all watercourses that are tributaries of the Margaret River within the survey corridor are components of the site and that any planned impact on these tributaries will also require Section 18 clearance under the 'Act'. **It is the recommendation** of the above claimants consulted that Main Roads minimise their plans to affect all watercourses throughout the survey corridor, particularly the Darch Brook on the western perimeter of the survey area.

It is recommended that Main Roads give consideration to the requests by the Nyungar community to be able to monitor any works that affects the Margaret River and its tributaries. Main Roads should also endeavour to avoid clearing the vegetation islands that are located centrally throughout the survey corridor, as the Nyungar community have identified them as significant for bird habitat. Main Roads should also take into consideration the request for a contingency plan to move the road should Aboriginal skeletal remains be unearthed during construction. It was advised that a 60m buffer was seen to be a necessary zone of protection between any graves and the road in order to cater for any future expansion of the Margaret River East Perimeter Road.

It is finally recommended that Main Roads give due consideration to the Nyungar communities' preference of the Margaret River East Perimeter Road being constructed on the western side of an unnamed tributary of the Margaret River that runs north-south along the eastern boundary of the survey corridor and that a kangaroo fence be erected between the road alignment and this unnamed tributary.

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REPORT

An Ethnographic Consultation for the Margaret River East Perimeter Road, Western Australia

ISSUE

Main Roads Western Australia (Main Roads) on behalf of the Department for Planning and Infrastructure is planning for a deviation of the Bussell Highway to the east of the Margaret River townsite. The deviation is referred to as the Margaret River East Perimeter Road (MREPR). At this point in time the project is at an early stage of planning, therefore GHD Pty Ltd (GHD) on behalf of Main Roads has conducted preliminary consultations with the Nyungar community to determine whether any sites of significance as defined by section 5 of the 'Act' will be impacted upon by this proposed work thereby fulfilling Main Roads obligations under the West Australian Aboriginal Heritage Act (1972).

REPORT OBJECTIVES

To report on archival research in order to determine if any previously recorded Aboriginal Heritage sites will be impacted upon by the above project proposal.

To report on consultations held with representatives of the South West Boojarah WC06/4 and Harris Family WC96/041 Native Title Claim groups in order to determine if any new ethnographic Aboriginal Heritage sites will be affected by this proposal.

BACKGROUND

On 7th June 2007, Mr Bruno Rikli from GHD contacted Brad Goode and Associates in order to request that they conduct an ethnographic survey for the proposed Margaret River East Perimeter Road (MREPR) project. Main Roads are at the preliminary stage of their planning process and before a decision is made for the Perimeter Roads exact location within the planning corridor, GHD would like to conduct preliminary consultations with the Nyungar community in order to identify any Aboriginal heritage issues that will affect the final choice for the roads location within the planning corridor. The preliminary consultation is being conducted so that Main Roads can identify any areas of significance to Nyungar people and potentially avoid these sites in their final planning process for the location of the MREPR

Main Roads has established a need to construct the MREPR as Bussell Highway forms the main street through the Margaret River Township and central business district and as such due to traffic congestion it has now become necessary to find a suitable location to move the flow through traffic around the town. The Shire of Augusta-Margaret River and local community have requested Main Roads initiate this project to mitigate transport conflicts and safety issues.

The eastern boundary of the designated road corridor is described as commencing in the north, deviating east off Bussell Highway, approximately 1km north of the existing Margaret River Bridge. From here the eastern boundary traverses a pine plantation, remnant vegetation and State Forrest. Main Roads has already identified that a new bridge will need to be constructed over the Margaret River, approximately 2km east of the existing Bussell Highway Bridge. The eastern boundary then continues south of Margaret River, with most of the area traversing cleared farmland with a few sections of remnant vegetation. The boundary then crosses Rosa Brook Road before joining back onto Bussell Highway in the south at the intersection of Darch Road and the existing Bussell Highway (see Map in Appendix 3).

As a result of this brief, Mr Brad Goode and Mrs Melinda Cockman conducted the necessary ethnographic consultations with members of the South West Boojarah and Harris Family Native Title Claim groups on the 20th and 22nd June 2007. An archaeological survey will be conducted when planners have made a decision on the final roads location within the survey corridor.

LOCATION

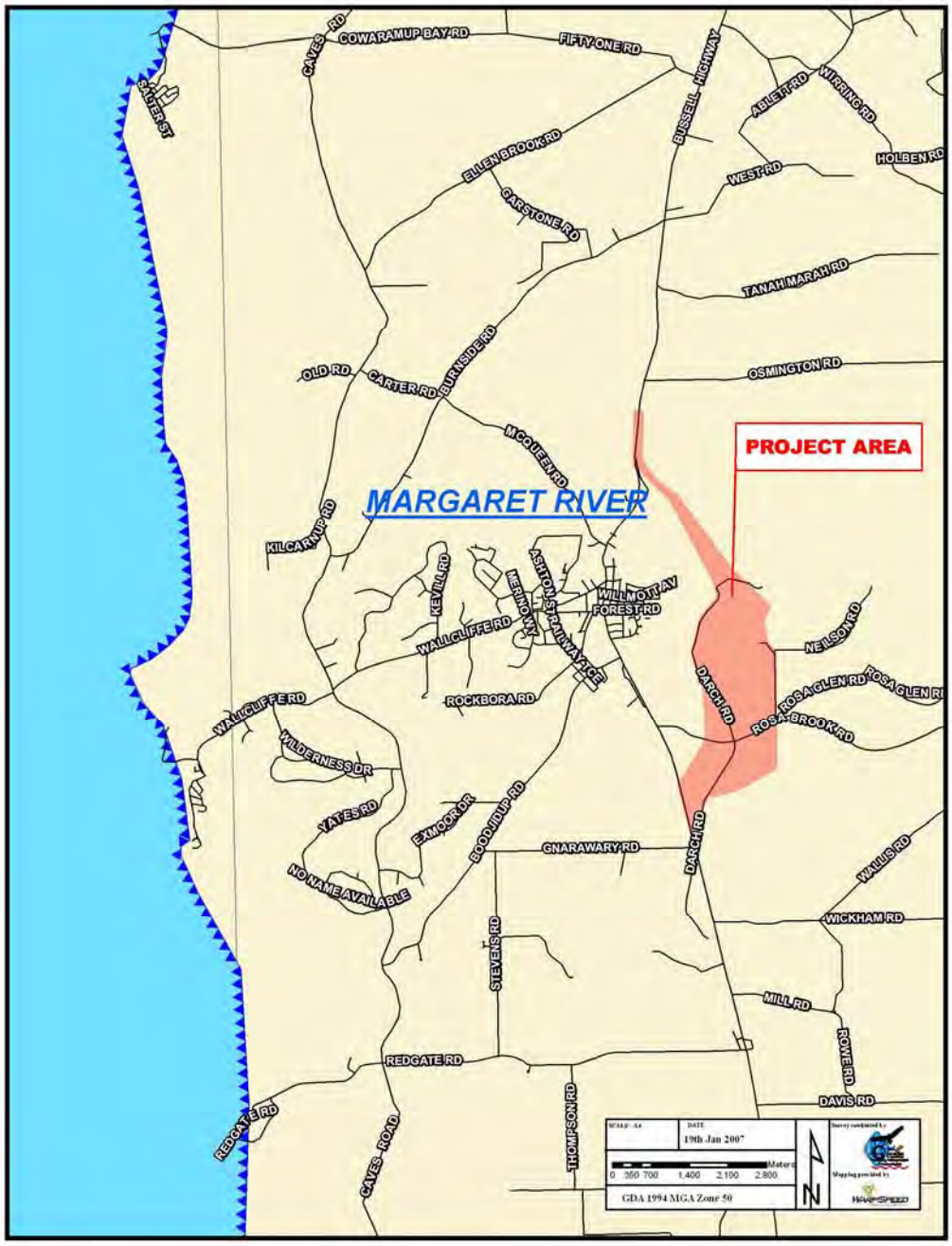

Figure 1. Location of the Project Area

ETHNOGRAPHIC & HISTORICAL BACKGROUND

TRADITIONAL NYUNGAR CULTURE

The southwest of Western Australia is considered to form a distinct cultural bloc defined by the distribution of the Nyungar language. Before Nyungar was used as a group or linguistic name the southwest people recognised themselves, their language and culture, as 'Bibbulmun' (Bates, 1985). Daisy Bates writes that the Bibbulmun people were the largest homogenous group in Australia. Their land took in everything to the west of a line drawn from Jurien Bay on the west coast to Esperance on the south coast (Bates, 1966). Bates also mentions that over seventy groups that shared a common language and some local variations occupied the Bibbulmun area.

> "All coastal *Bibbulmun* were *Waddarn-di* – sea people, and called themselves, and were called by their inland neighbours, *Waddarn-di Bibbulmun*. The inland tribes were distinguished by the character of the country they occupied. They were either *Bilgur* (river people, beel or bil-river), *Darbalung* (estuary people), or *Buyun-gur* (hill people – buya-rock, stone, hill), but all were *Bibbulmun* [*Nyungar*]" (Bates 1985:47).

Tindale (1974) identified thirteen 'tribal groups' in the southwest based on socio-linguistic boundaries and minor dialect differences. He describes the *Pibblemen Bibbulmun's* territory as 'the lower Blackwood River, chiefly on the hills between the Blackwood and the Warren Rivers, east to the Gardner River and Broke inlet; on Scott River; inland to Manjimup and Bridgetown'. The *Pibblemen* people maintained a number of paths between the Vasse area in the north and Augusta to the south, and as far as Bridgetown to the east, which followed the Blackwood River.

The Nyungar or Bibbulmun people of the south-west were a distinct group in that their initiation practices varied markedly from their desert and semi-desert dwelling neighbours. Unlike the desert people, the Nyungars did not practice circumcision or sub-incision, but rather practiced a ritual of nasal septum piercing and ciatricision of the upper body (Bates, 1985). The people who followed these socio-religious practices have been described by Berndt and Berndt (1979), as being of the 'Old Australian Tradition'.

Within the Bibbulmun, two primary moiety divisions existed, the *Manichmat* or 'fair people of the white cockatoo' and *Wordungmat* or 'dark people of the crow', which were the basis of marriage between a further four class subdivisions: *Tondarrup, Didarruk* and *Ballaruk, Nagarnook* (Bates, 1985). Bates describes the only lawful marriage between the groups to be "the cross-cousin marriage of paternal aunts' children to the maternal uncles' children", and states that the four clan groups and relationships, under different names, are "identical in every tribe in Western Australia, east, north, south and southwest…" (Bates 1966:24-25).

Each socio-linguistic group, sometimes referred to as the 'tribe', consisted of a number of smaller groups. Each of these smaller groups was made up of around 12 to 30 persons, related men, their wives and children and, at times, visiting relatives from other groups. These subgroups could be described as a family, a band or a horde. For every subgroup there was a tract of land with which they most closely identified themselves with, an individual or a group's land was called their *Kalla* or fireplace (Moore, 1884). This referred to an area of land which the group used and over which the members of the group exercised the greatest rights to its resources. It was also the area for which the group would act as custodians of. Other groups would also have some rights of access and use gained through marriage.

> "Ownership rights to land were held by groups of people linked through common descent; there was definite ownership of land in both social and personal ways. As well as belonging to a local descent group by birth, each individual simultaneously belonged to an economic or food gathering group" (Le Souef, 1993).

There are two forms of socially organised relationships to the land, a spiritual association and an economic one. Stanner (1965) uses the terms 'estate' and 'range' to distinguish these two different associations, he writes that the 'range' was that land in which the group 'ordinarily hunted and foraged to maintain life'. The 'estate' refers to the spiritual country and which may be 'owned' by either an individual, by the group or by part of the group. The relationship to 'estate' is mostly religious; however there is also an economic benefit. The estate can be considered the country or home of a group. It is sometimes referred to as the 'Dreaming place' and as such includes all religious sites, myths and rituals that occur on or about that land. In this way 'estate' forms part of the Aboriginal ties to Dreaming and place (Stanner, 1965).

> "There is a clear relationship between the individual and the land, which is expressed in a number of ways. There is a direct link between the mythic heroes and spirits of the dreaming and the land. Relationships with these beings, which are transmitted through birth, descent and marriage (to a lesser extent), are a reciprocal arrangement of rights and obligations and they are vital for claiming rights to the land" (Silberbauer, 1994:124).

The link between the individual and the land comes from the conception site, where the animating spirit enters the mother and thus there is a direct connection between the land, spirit and the identity of the individual (Machin, 1996). The spiritual ties with the land strengthened economic rights and land usage involved both ritual and social connections (McDonald *et al.*, 1995). Land use or ownership in traditional Aboriginal Australia is based on a religious view of the world and the position of people in it. This religious view is most often referred to as the Dreaming; the Dreaming is an ideological and philosophical basis for a close emotional connection between Aborigines and their land (Machin, 1996). The Dreaming refers to a distant past when the world had yet to be fully created. Dreamtime stories refer to mythic beings that roamed the Earth creating plant and animal species. During the struggles of these mythic beings many landforms such as hills and rivers were created. The landscape bears testimony to the struggles of creation and is studded with sacred sites recalling the Dreamtime. These sites are owned by or belong to either one or more groups, and so such sites have a shared significance amongst the local population. The shared spiritual significance of these sites had a function of bringing together different groups. Another function of these shared sites is that knowledge of the local myths created rights of use to the land.

> "Rights are recognized through active social relations, a process symbolized through the possession of knowledge. That is, knowledge is only gained through participation in social relations and rights to the land are reliant on the possession of relevant religious knowledge". (Machin, 1996:11)

Traditionally, the Bibbulmun Nyungar people recognized six different seasons in the year. Each of these seasons coincided with a particular seasonal abundance of a wide variety of food resources. Fish traps such as the well documented Barragup Fish Trap were used to catch large migrations of estuarine and river fish. These fish traps were so efficient at providing food that they formed the basis of regular meetings between neighbouring groups and were a focus of cultural activities (Contos et al 1998, Bates 1985). Spears *Gidji-garbel & Gidgie-borryl*, axes *Kadjo* and digging sticks *Wonna,* were used to hunt and procure food (Berndt 1979, Tilbrook 1983). Trees known to contain bird's nests or possum hollows or to have hives with native honey in them had notches cut into their trunks to facilitate climbing. The Bibbulmun Nyungars had an extensive knowledge of plants for both food and medicinal uses (Bird & Beeck 1988, Meagher 1974).

SETTLEMENT AND SOCIAL DISRUPTION

Prior to settlement in Western Australia, the Dutch and the French, as well as sealers and whalers of mixed nationalities, had already landed and made contact with the local Aborigines. From the beginning of the 17th century the Dutch had been sailing north along the Western Australian coast en route to the Dutch East Indies, and ships were often forced close to the coast by the prevailing south westerly winds. Many who realized their proximity to the coast too late came to grief there. The early reports by the Dutch described the coast as a bleak and desolate place. Apart from some expeditions to try and rescue shipwrecked sailors, the Dutch showed little interest in Australia (McDonald et al., 1995).

The Dutch flute *Elburgh* is reported to have recorded the first brief description of the Aborigines near Cape Leeuwin in 1659:

> "An armed party sighted three Nyungar Aborigines wearing kangaroo skin cloaks. At the sight of the European sailors, the tribesmen ran off into the bush leaving behind spears and small axes" (Cresswell, 1989).

Contacts were also made by the whalers and sealers who visited the coast to take on water. The sailors were also interested in the local females, and this interest was discovered by the first settlers to the Augusta region when the local Aboriginal group used the English word 'woman' when referring to females (Shann, 1926). Two further items point to considerable pre-colonization contact with whalers, the first being that in 1827, Major Lockyer of the Albany garrison 'reported incidents of Aboriginal women being found on offshore islands, kidnapped and then abandoned by the sealers'. Secondly, when the first French and British expeditions of the late 17th and early 18th centuries did contact local Aborigines, they reported that while the men were approachable and friendly, they kept their women and children hidden or some distance away (Colwell, 1970).

The first 'settlement' in Western Australia was the establishment of a garrison of soldiers at King George Sound in 1827. In 1829 the Swan River colony was founded and the settlement of Augusta took place in 1830. Initially relations between the Aborigines and the settlers were friendly; the Nyungar people showed the settlers to water sources and the Europeans shared game shot while being guided by the Nyungar men (Shann, 1926). On the 1st of May 1830, the schooner *Emily Taylor* dropped anchor in Flinders Bay close by what is now Augusta. On board were the first settlers who were to create the town of Augusta, the Molloy, Bussell and Turner families and their servants, Dr Green, Sgt Guerin and a detachment of soldiers (Pickering, 1929; Turner, 1956). Horses, cattle, machinery, merchandise and general stores of every description were rafted ashore through the surf. Turner (1956) recounts:

> "While these strange operations were being enacted, natives lurked curiously in the background, watching every movement; it was something entirely new to them. The natives were timid and shy, but to cover this they 'simulated rage,' gesticulated and jabbered at the intrusion on their domain; but the settlers advanced, calling '*abba abba*' and some of the few aborigine words they had already learned, and by offering a few trinkets and with friendly signs they soon established peace, and some natives led them to a 'soak', no doubt the spring so often referred to later" (Turner, 1956:89).

Berndt (1979) suggests that the Aboriginals believed that the first European settlers, because of their light skin colour, were souls of the dead (*djanga*) returned from *Kurannup*, the home of the Bibbulmun dead located beyond the western sea. He describes:

> "…the *kanya* (soul of the newly dead) going first to the *tabu-ed moojarr* or *moodurt* tree (*Nuytsia floribunda* or Christmas tree), where it rested on its way to Kurannup…here, their old skins were discarded and they appeared 'white'" (Berndt, 1979:86).

Many of the tracks created by the Nyungar people were used by the early settlers to explore the land and eventually to create the basis for roads upon these tracks, many of which still follow similar alignments. Not only do the original paths used by the Nyungar people often coincide with existing road alignments but often link traditional areas of importance which are now the location of town sites (Collard, 1994). Augusta, Busselton and Bunbury, formally known as *Talanup, Yoonberup* and *Koombanup* by the Nyungar people, were important regional areas providing good hunting and food gathering opportunities. The settlers in Augusta employed the local Nyungars as guides and trackers and used the Nyungar paths through the bush to reach the Vasse district (Jennings, 1983).

In November of 1833, Georgina Molloy wrote to a friend in England that the Aborigines in Augusta were 'fond' of the settlers, and that the settlers and Aborigines lived "on the most peaceful terms". In the same letter, which took four months to complete, she writes of "being troubled with natives who, though amiable, required watching in case of theft" (Pickering, 1929:47). Whilst relations between the settlers and the Aborigines began amiable, pilfering of food and implements soon tested this. Early in 1834, an incident occurred in which a group of around 30 Aborigines attempted to intimidate Mrs. Molloy and Fanny Bussell whilst Captain Molloy and other male members of the settlement were absent. The Aborigines attempted to take a tablecloth and some potatoes before Mrs. Molloy's servant Dawson (the only male present) produced a pistol and a rifle that scared the aborigines off. From the Molloy house the Aborigines went to Miss Bussell's house from where they took three salt sellers. The Aborigines valued glass (*dillilah*) for pointing their spears. When the theft was discovered the settlers had the garrison of soldiers apprehend the Aborigines. There was an exchange in which the soldiers either threatened to shoot or to bayonet the women or woman responsible (the two accounts from Mrs. Molloy and Miss Bussell vary in detail). The salt sellers were recovered without any actual violence-taking place, yet it marked a significant worsening of relations between the Aborigines and the settlers (Pickering, 1929; letter of Fanny Bussell dated 16/2/1834). Georgina Molloy wrote of the incident:

> "I am sure if Dawson had not been present, Mrs. Dawson and I and the poor children would have been murdered or otherwise injured, for it seemed that mans full intention to prevent me leaving my own premises. It gave me a great fright" (Pickering, 1929).

In 1837, three Nyungar men were killed as a reprisal for the theft of a heifer, in the same year a house belonging to the Turner family in Augusta was burnt to the ground and the Government store was raided (Jennings, 1983). As the settlers expanded their farming operations and took up more and more land, the pressure on the Nyungar people increased as the two lifestyles met. Cattle were speared and settlers attacked. Reprisals led to resentment and conflict replaced the early good will. On June 28, 1837, Lennox Bussell wrote a letter to Captain Molloy in Augusta describing the killing of three Nyungar men as a reprisal for the Aboriginal people taking a heifer (Jennings, 1983). On July 9, he wrote again to Captain Molloy about the reprisals.

> "….I do not view the present daring outrage (The *taking of the heifer*) as a mere breach of the law but as an act of open hostility and defiance… we have inflicted upon the offenders the only adequate punishment in our power… Let us first convince them of their inferiority and then extend to them our protection and it will be gratefully accepted, otherwise with the vanity inherent in a savage, they will fling back the proffered gift and considering every act of forbearance a confession of weakness and inability, will cause in their final subjection which sooner or later must be effected, a sacrifice of life on both sides double or treble to what would have befallen if severer measures had been adopted from the first" (Letter to Captain Molloy from Lennox Bussell, dated July 9, 1837, cited in Jennings, 1983).

As the settlers demand for labour increased, Aboriginal people were employed as farm labour and domestic help in exchange for goods such as flour, sugar and tobacco. The Aborigines became increasingly dependent on these European food supplements and, whilst still practicing some aspects of their traditional economies, the traditional lifestyle of the Nyungar people may have ended as early as the 1860's (Berndt and Berndt, 1979). This relationship between the settlers and the local tribes spelt the beginning of the end for the Aborigines 'fully traditional economies' (Moore, 1989).

Hamelin Bay became a port for ships loading timber cut in the Karridale area in 1875 when Willie Eldridge was granted a fourteen year lease to cut timber in a 75000 acre area around Augusta-Hamelin. There were no facilities to load the ships and the timber was towed into the water by oxen and then loaded onto lighters (sailing barges) to be loaded on the ships. After losing one ship and cargo, and unable to find either markets or financial backing, Eldridge was forced to admit defeat. He was, however, responsible for erecting buildings, building roads and establishing Hamelin Bay as a shipping harbour and base for a business (Creswell 1989). Maurice Cole Davies followed Eldridge in expanding the timber industry in the region. M C Davies took over Eldridge's expired lease in 1878 and in 1881 had laid a rail line linking Boranup and Hamelin Bay, in 1882 construction began on a 1800 foot long jetty at Hamelin Bay. Many miles of rail line were laid linking mills to Hamelin Bay, which rapidly became a thriving port. In 1885 Hamelin Bay was a 'considerable township'. Around 1895 the Cape Leeuwin lighthouse was commissioned and completed in 1896. One person known to have worked on the lighthouse was Joe Hill who was an expiree (a convict who had served his time) employed to drive a bullock team carting stone (Cresswell 1989). Mr Joe Hill is a European ancestor of several Busselton Nyungar families. M C Davies successfully tendered for the construction of the original Alexander Bridge was 400 feet (122 meters) long and seventeen spans wide. The original bridge was located a short distance upstream from the present bridge and much of its structure survived until 1982 when a summer flood destroyed it. It's location has been a popular picnic and bream fishing spot for many years (Cresswell 1989). As a shipping port and timber town, Karridale and Port Hamelin lasted around 35 years. By 1910, most of the best timber in the area has been removed and the mill at Karridale has closed. With the mill closed, Karridale almost disappeared overnight (Cresswell 1989). As work on the timber mill finished, the Nyungar people who worked there moved with the industry to other locations. Busselton and the Geographe Bay area also provided other employment opportunities.

> "In all likelihood the Aboriginal population of the area was attracted to the towns, timber camps and homesteads between the 1860's and 1880's, although as suggested above, a certain degree of mobility may have been maintained with Aboriginal people travelling as itinerant seasonal labourers. Mervyn Longbottom, a long time resident at Darradup, recalled that about the turn of the century there were still Aboriginal groups moving about that area, using traditional foods and camping places. Although they still had some traditional tools, they had European clothes and no longer wore skin cloaks. He also recalled that two hundred or so Aboriginal people would annually pass across the Darradup ford en-route to visit a 'king' at Karridale" (Hallam 1979 in Gibbs, 1989).

Aborigines were seen throughout Western Australia as a convenient source of labour which required little, if any, payment for work, even though the early settlers often relied on the extra labour the Aborigines were able to provide to establish European farming techniques. During the course of a parliamentary debate in 1883, John Forrest stated that, 'Colonization would go on with very slow strides if we had no natives to assist us' (Goddard and Stannage 1984). In 1898, John Forrest wrote a circular to the Aborigines department stating the 'care and protection' of Aborigines had now 'developed on the Government' and that, while the Government and its bureaucracies must provide help to aged and sick Aborigines, it was to be given' with due regard given to the practice of strict economy'. In the same circular, Forrest

takes care to point out that 'no able bodied natives who can provide for their own maintenance should receive rations' (Battye Library Busselton Court House records. ACC #594).

Missionary work had begun as early as 1840, and in 1841 the Reverend George King went 'amongst the blacks and collected eighteen children' aged between five and ten. It was his belief that the children could be 'civilized' only if they were kept away from 'the dark influences of the wandering tribe' (Barley 1984). The missionaries took children from their parents and interfered with traditional marriage arrangements in order to remove their 'converts' from the influences of traditional Aboriginal culture.

The hardships facing the Aboriginal people steadily increased as their mode of life clashed with European notions of farming. Some settlers complained about Aboriginal hunting and fishing practices. Fish traps such as those at Wonnerup and Augusta were traditionally very important to the Nyungars, providing a means to feed large numbers of people. The fish traps were often the reason Nyungars visited certain locations, to take advantage of seasonal runs of fish, which provided enough food to enable large ceremonial gatherings. The settlers destroyed many fish traps in an effort to discourage Aboriginal people from coming onto land, which was being farmed or otherwise occupied by the settlers. The weir type fish traps built by the Nyungar people were also sometimes a hazard to navigation and destroyed because of this. In 1899, the Government passed a law prohibiting the building or use of fish traps, which caused a considerable blow to the traditional Nyungar economy (Tilbrook, 1983).

During the late 1800's and early 1900's, the Government passed a series of Acts which increasingly eroded the Aboriginal people's civil liberties. The Industrial Schools Act (1874) empowered managers of Aboriginal Missions to keep Aboriginal children to the age of 21 and place them as domestic servants or apprentices without their parent's permission. The Aborigines Protection Act (1886) introduced controls over Aboriginal employment. In 1889, the Constitution Act was introduced, it specified that 5000 pounds or 1% of the annual colonial gross revenue, whichever was greater, was to be used to provide for the Aborigines. The Aborigines Act (1897) repealed the Constitution Act (1889) and transferred control of Aboriginal affairs to the West Australian Government, which acted through the Aborigines Department, formed in the same year. Following the Roth Royal Commission in 1904, in which Roth described the Western Australian Police's treatment of Aborigines as 'most brutal and outrageous' and described the conditions experienced by many Aborigines as 'resembling cruelties committed in the Dark Ages', the Aborigines Act (1905) was introduced (Haebich 1988). The Aborigines Act (1905) allowed the Government to remove Aboriginal people to live in mission camps such as Roelands and Carrolup, and to control many aspects of their lives including marriage and employment. Other hardships for the Aboriginal population included the Dog Act (1885), which forced Aborigines to license their dogs or risk their destruction. As the Nyungar people used the dogs to aid in hunting and providing for themselves, the Dog Act (1885) represented a blow to their means of survival.

Nyungar people adapted to the new conditions as best they could, obtaining mostly short term seasonal work as stock workers, domestic help, farm labourers and foresters (Haebich 1988).

Fringe camps occurred on the outskirts of towns as Aboriginal people followed 'runs' from one area of seasonal employment to another. Many Aboriginal people lived in the bush between jobs, surviving on whatever game or bush tucker was seasonally abundant (Tilbrook 1983). Those Aborigines who were working as farm labour and domestic help found that competition for employment increased suddenly with the influx of people attracted to Western Australia during the gold rushes of the 1880's and 1890's (Tilbrook, 1983).

Further inequity saw the Aboriginal unemployed receive a lower sustenance rate than the white unemployed during the Depression of the 1930's. Living more or less permanently in fringe camps, seeking out seasonal employment and supplementing their diet with game, fish and some

bush tucker was a lifestyle, which predominated for the Aboriginal people late into the 1960's (McDonald, Hales & Associates, 1995). In 1965, when two Busselton Nyungar families were moved from 'miserable primitive humpies' to government housing, the newspaper article which reported the move stated that, "although the men were hard and conscientious workers, they had never been able to secure *permanent* employment" (West Australian 29/4/1965). Many of the southwest's Nyungar people have lived in fringe camps at some time during their life, creating a living for themselves doing seasonal work and often supplementing their diet with fresh caught fish from the ocean.

WATER AND ABORIGINAL SIGNIFICANCE

There is no doubt that water, especially fresh water was of vital importance to traditional Aboriginal people right across Australia, the rivers, pools and wetlands were a source of food, linked campsites along walk tracks and in the case of the Blackwood River defined the territories or estates of the *Pibblemen* and *Wardandi* people (Hallam 1979). As the Blackwood River, particularly in the lower reaches created an impassable barrier to people without boats the places where the river could be crossed (Hut Pool and the mouth near Augusta) created an intersection of tracks and as such became focal points of traditional camps where ritual activity often took place. At Hut pool Mrs Vilma Webb (per com 2005) said that this ford was a place where the trading of women from the *Pibblemen* to *Wardandi* would take place for betrothals. Gibbs (1989) drawing upon the writings of Bates states that a number of theses paths were maintained as initiate's tracks, with one of the longest following the Blackwood River south from Augusta through Nannup, Demark, Albany and eventually to Ongerup. Other paths from the Vasse Estuary followed the St John Brook to Barrabup Pool and then south along the Milyeannup Brook to Lake Jasper. (Collard 1994, Kelly per com 2004) Camps along these water courses were often places that had Nyungar names and were noted by the first Europeans' early maps.

> "It should also be recognised that a large number of Aboriginal names have been perpetuated in modern maps, although their original contexts and meanings are unknown. An examination of older maps, such as the 40 chain series held in the Battye Library, do not reveal much more detail, although a limited number of specific features, *especially springs and watercourses*, do have Aboriginal names indicated….Kwaggamai'erup [spring near Nannup], Dallatgurup [part of the Blackwood River, Kweelyjup [lower Blackwood], Eedagulup [River bar Blackwood] (Gibbs. M. 1995)

The Regions Rivers were also important sources of food. Marron and other fresh water Cray fish were an important food source that was caught in the pools along rivers and creeks throughout the region. Fish traps were also constructed on creeks, in rivers and in the tidal zones of estuaries. As these were efficient and abundant, harvests could be made. These places also created focal points for traditional ceremonial activity where large gatherings of Nyungar could be maintained. (Gibbs 1995).

Archaeological research in the South West has also confirmed that all water sources were important to prehistoric traditional Aboriginal people for campsites and food procurement activities. Archaeologists have recognised there is a higher likelihood of finding artefacts from prehistoric campsites around freshwater sources, such as rivers, creeks, lakes and estuaries. Lake Jasper for example has a rich archaeological record with 10 such sites found upon the lake bed and margins showing such camps prior to the formation of the lake some 4,000 years ago. Charles Dortch from the W.A. Museum said that these sites were extremely significant sites to the understanding of the region's pre-historic Aboriginal settlement patterns. They represent camps that have been in use upon the wooded margins of a stream prior to the area becoming inundated by the formation of the lake some 4,000 years ago when sand dunes moved into the area and blocked the stream, flooding the area.

> "The submerged stone artefact scatters at Lake Jasper, at least those at depths sufficiently great that one can be reasonably satisfied that they have remained permanently underwater, differ from those in terrestrial open-air sites in that they have been 'sealed' by their submergence, with definite cut-off dates corresponding to the time when the surrounding trees or other plants were flooded and died. This, of course, provides a minimum age for the artefacts, and thus the temporal control necessary for determining their actual radiocarbon age, by means of excavation, using delicate suction techniques capable of removing sandy sediments in 1 or 2cm levels. Radiocarbon dating of charcoal or other datable material in situ in the upper parts of such lake floor excavations can show whether the artefacts exposed on the lake floor are contemporaneous with the dated stumps in situ in it. Once this was established, it would be possible, in a programme of species identification of plotted trees and other plants, to reconstruct the plant associations or habitats surrounding the archaeological sites, creating an unquestionably valuable record of uncontaminated late Middle Holocene or older campsites in their formerly terrestrial settings, and having the potential for the preservation underwater of wooden implements and other organic remains associated with human activities."(Dortch1990:7)

The records of registered archaeological sites upon the DIA sites register also confirms that within the study area most artefact sites are located upon or in the vicinity of the areas water ways (see archival section).

From the archaeological and ethno-historic records from the region Dortch (2002) has also developed a prehistoric model of hunter-gatherer socio-economic and territorial organization in the southwest coastal regions. In this model Dortch concludes that the distribution of topographical features such as estuaries, rivers and wetlands would have had a strong bearing on the population distribution; "rivers, wetlands and lakes, dune fields, escarpments and other topographical features that certainly would have influenced the positioning of estate boundaries and band foraging ranges were seen as focal points for activity with major topographical features such as the Blackwood river as being important cultural boundaries between Aboriginal groups" (Dortch 2002). In regards to this last point O'Connor writes;

> "Archaeologists and Anthropologists generally agree that prehistoric land use patterns were based on the seasonal migrations between the coastal plain and its hinterland to exploit the various food and water resources. There is a tendency, in all parts of the project area, for sites to be located near the various water sources, such as rivers, creeks, lakes, swamps and estuaries. Based on the existing information, the most important river systems in the project area are the Busselton Drainage Basins, Margaret River and the lower Blackwood River." (O'Connor et al 1995)

Comparative studies with regards to the significance of water that have been conducted in the Northern Territory where it has been found that water bodies also served the above cultural functions as focal points for resource activity and ritual aggregations. In these studies water bodies also almost always had mythic dimensions. Studies by Barber and Rumley (2003), Langton (2002), Toussaint et al (2001) and Yu (2000), state that Aboriginal people as with the land conceptualize that water sources such as rivers, lakes and wetlands have derived from the Dreaming, a time when the world attained its present shape. These studies emphasise the importance of stories about the actions of mythic beings in the origin and maintenance of such water sources. In these stories cultural affiliations to water are expressed in many ways, through social etiquette, narratives about places, rituals and practices of such rituals. Water is described as the living element that both creates and defines the shape and character of the country and gives it sacredness and identity (Jackson 2004).

In the south west of Western Australia several early writers recorded parts of the Aboriginal mythology about water, however clearly a lot of knowledge and stories have been lost in the years since settlement and no complete record of traditional mythology was ever made. Many of the European observers did note the importance of water to the traditional people and that water also occupied a place in the traditional mythology. The small parts of mythology recorded and references to the *Waugal* or a snake like spirit of water are widespread both throughout the south west of Western Australia and other parts of Australia. Bates (1966) recorded that in the southwest: "Their only deity was a *Waugal* or serpent-god that dominated the earth, the sky, the sea, and punished evil doers." (ibid 1996)

> "All permanent native waters have legends attached to them, legends of the "dream" time, which go back to the days when birds and animals possessed human attributes, or were human beings, or were groups of which the bird or animal was representative, or were magic animals and birds possessing the power of human speech. The natives cannot say that the "founders" of the various permanent waters were altogether human, although birds or beasts, or half bird half human, but the bird or animal name only is always given in the legend never a human name." (Bates D. 1966 p. 157)

Another reference to the *Waugal* or snake like spirit of water was recorded by Salvardo (1850) and indicates the fear or reverence with which Aboriginal people regard the spirit of water and also the harmful powers of the 'serpent'.

> "If the natives are afraid to walk about at night time, for fear of *Cienga*, they dread even more going near large pools of water, in which they believe there lurks a great serpent called '*Uocol*' [Waugal], who kills them if they dare to drink there or draw water during the night. A large number of natives came to me one evening asking for water. The first ones took all I had and drank it, and the others, about fifteen of them, asked me to go to the pool nearby to get some for them. I showed them the bucket and told them to go themselves. They all fell silent, and no one dared take the bucket, or tell me what they were afraid of, until, about an hour later, one of them said respectfully: '*N-alla cape uoto, chetchet cuaragn: nunda uoto quaragn iuad*' (If we go and take water, very soon we will be killed, but if you go, you will be alright). I saw quickly that they had some superstition on the subject, and said that I would go with them, with the idea of banishing their false fears. As we went to the pool or stream, they made me go ahead, and all followed me in single file, in deep silence. While they were quenching their thirst, I started to move away, but immediately they shouted, '*Nanap, nanap*' ('Stop, stop'), fearing that I was going to leave them on their own. As we began to go back to the hut, they ran ahead and preceded me, again in single file, so that I came last. When I reproached them for their superstitious ideas, they replied condescendingly: '*Nunda tonga but*' ('You don't know anything about it'). However much the natives of both sexes like to swim 'dog-paddle' style in summer, they will never go into water that is dark and deep, because they say that the serpent *Uocol* is there, and they are afraid of him even during the daytime." (Salvardo 1850)

Salvardo (1850) recorded that the Aborigines 'hide carefully from strangers their customs and, in particular, their beliefs'. Moore (1842) described the *Waugal* as a 'huge winged serpent' that lived in dark waters and was feared as a harmful force. A woman who fell ill or miscarried during a pregnancy was called *Waugalan.* The *Waugal* is of particular danger to pregnant women and so associated with fertility if in a harmful rather than replenishing manner.

Not all of the stories regarding the creation of water sources or rivers in the southwest and wider Nyungar territory involve the *Waugal* or snake like spirit of water. In a story regarding the creation of the Margaret River a magic stick is the means of transformation or creation of the Margaret River.

"The native name of the Margaret River was *Wooditchup*, named after *Wooditch*, who made the River with his magic wand. Nearby is Milyanup, the place of *Milyan*, the wife of *Wooditch*, and daughter of *Ngungaroot*. *Milyan*, who was a very fine looking young woman, fell in love with the *Wooditch*. *Wooditch* was a medicine man who was known as the '*Mulgar Kattuck'* which means 'medicine power possessor'. He could transform one thing into another and do almost anything he chose by a mere touch of his magic wand. *Wooditch* became violently in love with *Milyan* the moment he saw her. He forthwith made know his desires to *Ngungaroot* her father. The old man became very wrath and said that his daughter was already promised to *Wooditch's* eldest brother, *Ngorable*, and that as soon as *Ngorable* came down from *Dudinalup* she would be handed over to him for his lawful wife. *Wooditch* was not deterred by this reply, as he was quite confident that *Milyan* loved him better than any man she had ever seen. He decided to employ his wonderful magic to get her for his wife. For some considerable time he very cautiously watched the movements of *Ngungaroot* and his daughter. One night, before the moon rose, the old man *Ngungaroot* got up, gathered all his equipment, his pear, axe, boomerang, hunting knife and digging stick, awakened *Milyan*, and bade her to take her skin bag and follow him. By midday, they reached the *Kalkardup* country. There the old man mysteriously fell asleep. While he slumbered, *Wooditch*, who, by his magic power, had sent the old man to sleep, made his appearance to *Milyan*, and beckoned her to follow him quickly. After a few minutes, *Ngungaroot* awoke, sprang to his feet, and finding *Milyan* gone, set off in search of her. He picked up her tracks and would soon have overhauled the runaways but *Wooditch*, seeing him coming with his beard in his mouth, muttering curses and preparing his weapons to strike, again exercised the power of his magic wand. He placed the wand upon the ground and commanded a big river to run between them. The old man was dumbfounded. Being a man of great strength, he pulled up large trees by the roots and threw them across the river, but the current was so strong that it washed them down the stream. When the afternoon was half gone, the two enemies, walking on opposite banks of the stream, reached the ocean, where *Wooditch* gave river a lead into the sea. The water was running so swiftly that *Ngungaroot* was still unable to cross and remained on the other side of the river, yelling his curses to the runaways on the opposite bank. *Wooditch* and *Milyan* were now very hungry, and decided to go out on to the reefs at the mouth of the river, to spear groper, which were very plentiful there. They set off, leaving *Ngungaroot* still raging at the other side of the river. After a while, the rushing waters subsided and *Ngungaroot* managed to get over to where the young people were. He was on the point of seizing his daughter, when *Wooditch* struck him with the magic wand and turned him into a groper, which disappeared into a deep hole in the reef. As the couple returned to the wide beach in order to make a fire to roast their fish, *Wooditch* speared a big groper which was swimming close to the shore. He left it with his wand leaning against it while he helped *Milyan* to roast the other fish. While they were eating their fish, *Wooditch* began to feel very sorry he turned the old man into a groper, for *Milyan* kept bursting into tears over the loss of her father. He told her that if the big fish beside him should happen to the groper who had been her father, he wished it would turn into the old man again. Immediately, the transformation took place, and *Ngungaroot* was restored to them. He was now resigned to the union of *Milyan* and the powerful *Wooditch*. They left the neighbourhood and lived happily for many years at a place which has ever since been known as *Milyanup*. When *Ngungaroot* got very old they went back to *Wooditchup* and lived by the river that *Wooditch* had made. After they had been there a little while, one day *Ngungaroot* went into a cave and died. The cave is on the eastern end of the cliff at Walcliffe on the Margaret River. This place is '*Wainilyinup*' or 'the place where the old man died'". (Buller-Murphy, D. 1959)

Another story that is believed to have been recorded in the Kojonup district tells of a crow and a hawk creating a fresh water soak.

> "…Dinah, the mother of the late, distinctive Ted Smith, told (him) this legend of the Kojonup district. The country was gripped in drought and the only known water was salty. The health of the parched Aborigines, birds and animals deteriorated. An eagle-hawk, soaring about the sky and swooping to earth, observed that a fat and shiny crow had a wet beak, wet with fresh water. The eagle-hawk, seething with unparalleled fury, attacked the cunning crow. In so doing his claws split the rocks and the blood of the attacked crow was splattered over the surrounding rocks and earth. So, a fresh water soak is to be found in the Wakhinup area, hidden amid rocks and surrounded by rich, red loam." (Bignell M. 1971).

Another story that was related to the current researcher, by Doc Reynolds an Esperance traditional owner was about the creation of the Young River near Esperance. This story also involves the action of an eagle and a crow. Reynolds states:

> "The Noongar people camped along the banks of the Young River, because the Eagle chased them all away from the fresh water. He wanted to keep it all for himself and not share with anyone. One day all the fresh water dried up. The eye of the crows which were the people had all turned white because they were forced to drink salty water. The Crow and Eagle then had a big fight and the Crow speared the Eagle and killed him. The Eagles wife, the Mallee Hen dragged his body way down to the estuary of the river and buried his body on the east side. Because of the Mallee Hens scratching up of all the sand to bury her husband, her foot markings can still be seen today. The hill on the east side looks like a Mallee Hens nest, were the '*walitj*' is buried." (Doc Reynolds, per com: 2005)

Despite these and no doubt other such tales about the moral aspects of water the predominant theme with regards to water is the Serpent mythology. Radcliffe-Brown (1926) wrote about 'the Rainbow Serpent Myth of Australia'. He wrote that throughout Australia there is a belief in 'a huge serpent, which lives in certain pools or water holes'. He wrote that the serpent was sometimes associated with the rainbow and it could also occur or be seen as "a wavy dark shadow" in the Milky Way. Certain commonalties exist in the myth of a serpent type creature that has creative and punitive powers and that lives in dark or deep pools of water. Radcliffe-Brown points out the similarities of this widespread myth, although throughout his article he refers to different names and different attributes of the 'Rainbow serpent' in different regions.

> "I have been able to trace the belief in the rainbow-serpent, living in deep, permanent water holes, through all the tribes from the extreme southwest at least as far north as the Ninety Mile Beach and eastward into the desert. In the tribes around Perth it is called *wogal*, and certain water holes are pointed out as being each the abode of a *wogal*. It is regarded as dangerous for anyone except a medicine man to approach such a water hole, as the serpent is likely to attack those who venture near its haunts. "It generally attacks females, and the person whom it selects for its victim pines away and dies almost imperceptibly. To this creatures influence the aborigine's attribute all sore and wounds for which they cannot otherwise account." (Radcliff-Brown ; 1926).

The notion of a serpent type deity associated with water also occurs throughout the northern and eastern parts of Australia, at the Daly River in the Northern Territory a serpent like deity is held responsible for the creation of rain and ceremonies are performed to this dreaming character to bring the rain. In this area the deity is the spirit of water, rain and flood that is depicted in the rock art of the Wardaman people who have many sites where hundreds of cuts are incised into the rocks for rain making and to control the cycles of nature governing the monsoonal floods. In the north east goldfields of Western Australia the serpent is called the *Tjilia or the two carpet*

snakes. This dreaming track is associated with the creation of the vital waters thought out the Western Desert, and there are numerous highly secret, scarred sites located upon this track which are important ceremonial centres. Lake Miranda is an important site where this serpent deity resides as is Logan spring in the Bar Smith ranges near Wiluna (Liberman 1976) The Rainbow serpent as a spirit creature is believed to have excavated the beds of the rivers during its travels throughout Aboriginal Australia. It is often the belief that it had 'reached down from the sky to the waterholes and pools, bringing water to the earth'.(Jackson 2004) Throughout Arnhem Land and the Kimberley's the Rainbow Serpent is associated with other myths regarding fertility and is sometimes regarded as male and at others as female (A.W. Reed 2001). Other similarities with the *Waugal* or *Marchant* include the Rainbow Serpent having powers to harm, particularly those who offended against it.

> "In the beliefs of many Aboriginal tribes, the rains would dry up, the earth would become parched, and life would cease to exist if it were not for the Rainbow Serpent." (Reed, A.W.:2001).

In the Esperance region the Mythical serpent that created the water ways was the *'norrun'* (tiger snake). Doc Reynolds who related the story, states that:

> "Long ago the *Norrun* (tiger snake) awoke from its sleep up north and began his journey towards the coast. The land was bare and desolate. As it moved along, its body pushed up the hills/dunes and went under the ground and back up again all the way along the coast. When the rains came is started to fill up the gullies and the flat areas that then became our creeks/rivers and lakes/swamp areas that today make up "*kepwari*". (Doc Reynolds, per com :2005)

Mudrooroo, an Aboriginal writer who has lectured at several Australian Universities offers a contemporary story about the *Waugal* placed in a modern context. The story deals with current social and environmental issues for Nyungar people and the wider community.

> "…this is a story about a big snake. European people do not like snakes. They think that they are bad and good for nothing, but to the *Nyoongar* people, the ancestor of all the snakes, the *Waugyal*, was not only good, but long ago made all the rivers and hills and valleys in South Western Australia. The rivers are the tracks he made as he twisted his way along. One of his tracks is the Swan River where this story happened. But before I begin our story, first of all I would like to say that after *Waugyal* had made everything, he went to sleep in a deep part of the river. And he is still there today. Perhaps I should say he *tries* to sleep, for these days there is too much noise and when he is disturbed, he becomes angry and restless and causes trouble. Sometimes he makes all the fish go away and other times he causes boats to capsize. He does not do these things because he is bad, but because people are bad. I'll tell you one thing about the *Waugyal*. *Wadjelas* have studied us and have found that Aborigines all over Australia respect snakes, and they have joined up all these stories about snakes and made something called a rainbow serpent. They say and even tell us that the *Waugyal* is a rainbow serpent, whatever that is. But he isn't. He is a big hairy snake that made the rivers and hills and valleys and then, after he had done this, went to sleep in the deep part of the river. If he is any colour he is black, but when we tell them this, they say he is a Rainbow Serpent and refuse to listen." (Mudrooroo *A Snake Story of the Nyoongar People – a Childrens Tale,* in Giblett & Webb 1996)

Ethnographers and anthropologists continue to debate the importance of the *Waugal* or water spirit snake to Nyungar people. Some observers believe that so much of the knowledge about the *Waugal* mythology has been lost, and that what is currently retained by the Nyungar community is severely fragmented. Few stories about the *Waugal* or water spirit/snake are

associated with particular places or features. Most places Aboriginal people identify with the *Waugal* do not have a story or explanation to accompany them.

While Bates (1985:221) reports that the '*woggal*' [Waugal] "made all the big rivers of the Southwest" and "wherever it travelled it made a river" she does not indicate that historically all of the watercourses were of the same mythological significance. Rather, Bates (1985:221) notes that around the turn of the last century: "the places where it camped (stayed, entered the land) in these travels were always sacred". That is these earlier reports referred to specific or "certain" places (Bates 1985, Radcliffe- Brown 1926). In contemporary reports, the Waugal now does not generally seem to have the same evil or avoidance/sacred (*winnaitch*) qualities as found in earlier reports. In contemporary reports most Nyungar reporting the presence of the Waugal are unable to provide any localised or contested mythological/ritual/ ceremonial information with regard to the majority of reported Waugal sites. The Waugal is now essentially only the benign bringer of water. (McDonald 2000).

The Aboriginal Communities views with regards to Waugal beliefs have changed over time. Historically the Waugal was both a creative and punitive spiritual force and sacred Waugal sites were places where the Waugal inhabited deep pools and created other features of the landscape such as hills, where it had travelled. McDonald (2000) views this as a modern phenomena and interpretation as being tied to the re-invention of tradition, as those traditional stories have been lost due to western acculturation. In a report by Goode (2003) this modern view of Waugal beliefs was referred to as "generalized significance", significance based upon religious beliefs as opposed to contextualized mythology. In both the Perth metropolitan area and the south west most contemporary Waugal reports are of a generalized nature, yet in the minds of the Aboriginal informants relating the story the significance of the place or water source has not diminished.

Macintyre et al (2003) states that the continuous chain of lakes from Moore River to Mandurah was believed to have been created by the Waugal, the Waugal was believed to have created all the rivers, lakes and wetlands in the Perth region. Dobson (2003) goes on to say that;

> "The Waugal was not only a creative totemic being but it was also a protector of the environment. According to Nyungar law, springs and gnamma holes could not be drained as it was believed that this would kill the guardian Waugal spirit and cause the water source to dry up permanently. The Waugal was said to be responsible for attracting the rain and keeping water holes and springs replenished. It was seen to be both a destructive and creative force in that it could cause sickness as well as cure illness….At a deeper level Waugal mythology was a metaphor that emphasised the pre-scientific mysteries of the rivers, water sources and the landscape. It also explained how water moved throughout the Swan Coastal Plain as a system of underground streams interlinking wetlands to the rivers and ocean." (Dobson 2003:13)

In contemporary times the Waugal has become or is seen to be present in all water bodies – it is the benign 'bringer' of water. This change of view is largely based upon Aboriginal people now not knowing the traditional mythical stories about specific places but attributing significance by reading the country and assigning general significance. (Goode, 2003a, Villers, 2002). McDonald has described the Waugal as having changed or been lessened in meaning, from an entity that made all of the rivers in the past to now 'a benign bringer of water'. Although Bates recorded that the Waugal made all of the rivers and watercourses in the southwest it was formally the places where it had camped or where it lived in the land which were the sacred or were *winnaitch* areas. McDonald would seem to be suggesting that formally these places were of greater mythological significance than the other parts of the watercourses. This point of view explains the Waugal as being seen in a different way than that recorded by early European observers – Bates and Radcliffe-Brown can be contrasted with another view that sees the Waugal as a force in the present tense that is multi dimensional and more based upon religious philosophy than traditional mythology, contemporary observers such as O'Connor et al. 1989

and Goode 2003a, 2003b have recorded the *Waugal* as a more complex entity and associated with a wider belief system, O'Connor sums it up with this statement;

> "The Waugal is not *just* a mythic serpent, an Australian version of the Loch Ness Monster. The Waugal is not *just* a totemic ancestor. The Waugal is not *just* a spiritual being, a semi deity. The Waugal is indeed all of these but is, more fundamentally, a personification, or perhaps more correctly *animalization*, of the vital force of running water….As such also, the question does this permanent river (or creek, or spring or other water source) have (or belong to, or be associated with) a Waugal (or the Waugal) becomes, from an Aboriginal viewpoint, meaningless and condescending. The presents of living water bespeaks Waugal immanence." (O'Connor et al. 1989)

ARCHIVAL RESEARCH

Archival research involved an examination of the Department of Indigenous Affairs (DIA) Sites Register, a review of any relevant site files, and a review of any unpublished ethnographic reports that relate to the Margaret River area.

SITES REGISTER SEARCH

A search of the DIA Sites Register was conducted on the 12th of June 2007 by auto download from DIA FPT site onto a cadastral base of the project area, in order to determine if there were any Aboriginal Heritage sites that would affect the project proposal. The search revealed six previously recorded Aboriginal Heritage sites which were located within and close to the survey corridor.

Two artefact sites, Site ID 4522 Margaret River Dam Site 1 and Site ID 4523 Margaret River Dam Site 2 were identified to be located east of the survey corridor and will not be affected by the project proposal. Also both of these sites have been accessioned as 'Stored Data' on the DIA database and as such are no longer protected under the 'Act'.

Two ethnographic sites, Site ID 21037 Wcm/01 Red Gum Tree and Site ID 21038 Wcm/02 Water Course (Waugly Site) were also identified to be located to the west of the survey corridor and will not be affected by the project proposal. Also both of these sites have been accessioned as 'Stored Data' on the DIA database and as such are no longer protected under the 'Act'

Site ID 4494 Rosa Brook Roads (Lore Ground) DIA buffered extent has been identified to overlay the survey corridor's south-eastern boundary between Rosa Brook and Darch Roads and as such could have some potential to affect the project plans. Research by Goode and Greenfeld (2006) has determined that this sites actual location to be some 500m east of the survey corridor and as such the site does not place any constraints upon the project plans This site is currently accessioned as 'Stored Data' however additional information recorded and reported in a closed format by the above authors and yet to be assessed by the DIA make the area likely to be recorded as a site under Section 5(a) and 5(b) and its significance assessed under Section 39.2(a), (b) and (c) and 39.3 of the West Australian Aboriginal Heritage Act (1972) and placed upon the permanent register.

Site ID 4495 Margaret River is recorded as a significant mythological site and has been identified to bisect the survey corridor and therefore will affect Main Roads proposal to construct the bridge across the Margaret River. As such the proposal to construct the bridge across the Margaret River will require ministerial consent under Section 18 of the West Australian Aboriginal Heritage Act (1972) for consent to use the land that may contain an Aboriginal site. Any work that is planned that will affect the tributaries of the Margaret River particularly the Darch Brook will also require consent under section 18 of the 'Act'.

The name, type and indicative location of the Aboriginal Heritage sites are shown in Table 1.

Table 1. Summary of Registered Aboriginal Heritage Sites within the project area.

SITE ID.	Status	Access	Restriction	Name	Location (AMG Zone 50)* East	North	Site Type
4522	S	O	N	Margaret River Dam Site 1	326589mE	6240447mN	Artefact
4523	S	O	N	Margaret River Dam Site 2	326739mE	6240647mN	Artefact

SITE ID.	Status	Access	Restriction	Name	Location (AMG Zone 50)* East	North	Site Type
4495	P	O	N	Margaret River	337007mE	6246112mN	Myth
4494	S	C	M	Rosa Brook Road	325139mE	6245147mN	Ceremony
21037	S	O	N	Wcm/01 – Red Gum Tree	322905mE	6240562mN	Natural
21038	S	O	N	Wcm/02 – Water Course (Waugly Site)	323022mE	6240708mN	Myth

* Please note: Coordinates are indicative locations that represent the centre of sites as shown on maps produced by the DIA – they may not necessarily represent the true centre of all sites.

I – Interim Register, S – Stored Data, P – Permanent Register, O – Access Open, N – File Not Restricted.

REVIEW OF RELEVANT SITE FILES

Site ID 4522 Margaret River Dam Site 1. This archaeological site was recorded by Smith & McDonald as a quartz artefact scatter on 22/11/1989 in a survey conducted on behalf of the West Australian Water Corporation for the proposed Margaret River Ten Mile Brook Dam project. The site extent is described as a 5m x 5m area at the base of a fallen tree, 3 metres to the west of Lorry Road, which is described as a track through the State Forrest which has now likely been submerged within Ten Mile Brook Dam. The lithogy of the site was described as a discrete assemblage of approximately 10 quartz pieces (flake) with one formal tool that had a round edged and was described as micro-scraper or 'thumbnail' scraper. Other artefacts included a quartz piece, 5 flakes and chips, these pieces were described as waste flakes from tool making. The site file does not describe whether the site was archaeologically significant and has been determined by Resolution ID 4350 (Resolution number 123) at the ACMC meeting 000484 on the 8/8/2000 to not be a site under the 'Act' and has moved it to 'stored data'. It is likely that this reported area is now submerged by the Ten Mile Brook Dam.

Site ID 4523 Margaret River Dam Site 2. This archaeological site was recorded by Smith & McDonald as an artefact scatter on the 22/11/1989 in a survey conducted on behalf of the West Australian Water Corporation for the proposed Margaret River Ten Mile Brook Dam project. The sites extent is described as a 20m x 20m area located on the east side of Lorry Road and adjacent to SEC power line clearings amongst large trees which has now likely been submerged within Ten Mile Brook Dam. This sites lithogy consisted of predominantly quartz assemblage with one multi-platform micro-core, 8 quartz flakes, 2 quartz pieces, chips and one Silcrete flake. The site file does not describe wether the site was archaeologically significant and has been determined by Resolution ID 4350 (Resolution number 123) at the ACMC meeting 000484 on the 8/8/2000 to not be a site under the 'Act' and has moved it to 'stored data'. It is likely that this reported area is now submerged by the Ten Mile Brook Dam.

Site ID 4495 Margaret River. This site was first recorded by Smith & McDonald as a mythological site in a survey of the Ten Mile Brook Dam for West Australian Water Corporation in 1989. In this report the Aboriginal informants noted "While it was reported, the Margaret River was thought to once have had a Waugal, the Ten Mile Brook was not reported to have any significance". (McDonald 1989:14)

In a survey undertaken for a housing development at Sussex Location 972, 412 and Lot 1 Burnside, the Margaret River was also reported to have mythological associations to a dreamtime ancestor known as "Wooditch". This ancestor was known to have created the

Margaret River by casting a magic stick. In this report other Aboriginal consultants reported the Margaret River to have a Waugal (McDonald 1989:30-2). As a result of these reports the Margaret River was assessed by the ACMC as a site under Section 5b and a determination of its significance made under Section 39.2(b) and 39.2(c) and placed upon the permanent register on the 7/8/2001.

In February 2004 and October 2004 Brad Goode and Associates conducted Aboriginal Heritage Survey's for a Proposed Waste Water Treatment Plan on Lot 667 Riverslea Estate and Housing Sub-Division on Lot 27 Bussell Highway. During these survey's the Darch Brook and its tributaries and all the other tributaries of the Margaret River were identified by the Aboriginal community as being of significance in the same terms as the Margaret River in association with the Wooditch mythology and of generalised significance in association with the Waugal beliefs. Resulting from this report all the tributaries were added to the Margaret River's sites extent which has been determined as 30m from the normal high water mark of all these water channels.

In relation to our current report, this site has been identified to bisect the project area and therefore will be affected by Main Roads proposal to construct the Margaret River East Perimeter Roads bridge. As such this work will require ministerial consent under Section 18 of the West Australian Aboriginal Heritage Act (1972) for consent to use the land that may contain an Aboriginal site.

Site ID 4494 Rosa Brook Road. This site was first recorded by McDonald Hales & Associates in November 1989. The site which was recorded as a meeting place (corroboree ground) and is located somewhere along Rosa Brook Road. The informants could not accurately locate the site but it was thought to be east of the Ten Mile Brook Dam. The sites verification project on the 14/02/1998 assessed that there was insufficient information to list this report as a site and accessioned the sit to 'stored data'.

Additional information has since been recorded in 2006 by Brad Goode and Paul Greenfeld in a restricted format for males only and is currently undergoing assessment at the DIA. Following this assessment, it is likely that this area will be considered a site and put on the 'Permanent Register under Sections 5(a), 5(b) and its significance assessed under Section 39.2(a), (b) and (c) and 39.3 of the West Australian Aboriginal Heritage Act (1972). In relation to our current report, this site is located approximately 500m east of the south-eastern boundary of the project area and therefore will not be affected by the project proposal.

Site ID 21037 - WCM/01 Red Gum Tree. This site was recorded by Jeremy Maling from Australian Interaction Consultants in a survey in 2003 in a survey on behalf of the Water Corporation. The informant Mr Phillip Prosser a representative of the South West Boojarah Native Title Claim group identified a large Marri tree located at coordinates AMG 322905mE 6240562mN as being of cultural significance for medicinal purposes. Mr Prosser also identified a potential ochre source to the north-west of this tree. The sites extent is described as a 25 metre radius around the above coordinate. No other information is given in the site file with regards to this site. Advice from the DIA suggests that without the informant providing further information about the specific use or significance of this Marri tree as opposed to other such trees in the area it is likely that the ACMC would determine that there is insufficient information to class this tree as a site under sections 5(a) of the Western Australian Aboriginal Heritage (1972). As a result of its assessment the ACMC determined this not to be a site and has accessioned the site report as 'stored data'.

Site ID 21038 – WCM/02 Water Course (Waugly Site). This site was first recorded by Jeremy Maling for Australian Interaction Consultants in a survey in 2003 on behalf of the Water Corporation. The informant Mr Phillip Prosser identified a watercourse flowing east from a culvert under the Bussell Highway located adjacent to the intersection of the Bussell Highway

and Boojidup Road as a site of mythological significance in association with the Waugal. Mr Prosser said that the swamp land and pools along this watercourse that extend to the west and to the south of Tingle Avenue are also to be considered as a component of this site. Goode 2004a and 2004b re-recorded this site in surveys on behalf of the Water Corporation and the Lester Property Group Greendene Holdings as a component of site ID 4495 the Margaret River. The Aboriginal informants from the South West Boojarah Native Title Claimant group determined that the Margaret River began its journey from springs that fed these creeks which flowed into the Darch Brook which in turn flowed into the Margaret River. The informants determined that all the water courses that were hydro-logically connected with the Margaret River constituted elements of the Margaret River. As a result of its assessment the ACMC determined this not to be a site and recommended that the information be retained on the sites register as 'stored data'.

REVIEW OF RELEVANT ETHNOGRAPHIC REPORTS

Goode et al. 2003. *Report on South West Yarragadee-Blackwood Groundwater Area Aboriginal Cultural Values Survey*. Prepared for the Department of Environment, Waters and Rivers Commission, Bunbury WA.

This report documents consultations with the South West Boojarah Native Title Claim group with regards to the values that they attach to all water resources within their native title claim area. This report puts forward Aboriginal community view that water is of pivotal significance from both a religious and domestic perspective. In this report the South West Boojarah group argues that all watercourses that are hydro logically connected are of the same spiritual essence and therefore should be considered by heritage management professionals as a single site with regards to the Aboriginal Heritage Act (1972). The Margaret River and its tributaries were identified as such a site by this claim group.

Goode B, 2004. *An Aboriginal Heritage Survey of Proposed Lot 667, Riverslea Estate, Margaret River, Western Australia* – Prepared for Koltasz Smith & Partners on behalf (Lester Group Pty Ltd.) of the Greendene Development Corporation.

This report was commissioned by Koltasz Smith & Partners, town planners and project managers, on behalf of Lester Group Pty Ltd with regards to the construction of a sewerage pumping station to service the Riverslea Estate and other associated housing estates in the area. The results of this survey identified the Darch Brook a tributary of the Margaret River to be a component of Site ID 4495 'Margaret River'. The Darch Brook and its associated ephemeral creeks and wetlands were considered by the Aboriginal community to be of the same spiritual essence (the Waugal) as the Margaret River and therefore as the same site. As a result of this survey the community requested that the Lester Group Pty Ltd relocate the proposed sewerage pumping station away from the wetlands that associate with the Darch Brook. A four meter Buffer was given to be adequate protection between the pumping station and the edge of the affected wetland adjacent and within lot 667.

Goode B, 2004. *An Aboriginal Heritage Survey of Lot 27 Bussell Highway, Margaret River, Western Australia.* Prepared for Koltasz Smith & Partners on behalf of Balwyn Margaret River Pty Ltd, a Lester Group Ltd Company.

This report was commission by Koltasz Smith & Partners on behalf of Lester Group Pty Ltd (Greendene Developments) with regards to the development of Lot 27 Bussell Highway for housing. The proposed development survey area is located adjacent to the Darch Brook to the east and the Bussell Highway to the west, on the south side of the Margaret River Township. The Darch Brook, which is a tributary of the Margaret River and a component of Site ID 4495, borders the development area. There are a number of ephemeral creeks and wetlands within lot 27 that flow into the Darch Brook. As a result of this survey the community consultation process identified that the watercourses contained within Lot 27 are also to be considered

components of Site ID 4495 Margaret River. It was recommended that the DIA register these watercourses as such. This registration would include and supersede Site ID 21038 Water Course (Waugly Site), which was previously recorded by Jeremy Maling in 2003.

Goode B. 2006. *An Aboriginal Heritage Survey for the Margaret River Water Supply Upgrade, Western Australia.* A report prepared for the Water Corporation

This report was commissioned by the Water Corporation for a proposed upgrade to the Margaret River Town Water Supply. It was reported that the Margaret River Site ID 4495 was located to the north and adjacent to the proposed project; however a number its tributaries including the Darch Brook would be intersected by the proposed pipeline and therefore will be affected by the Water Corporations proposal. The Aboriginal community were prepared to support a Section 18 request with their preferred method of crossing being to run the pipe within exiting concrete structures crossing tributaries of the Margaret River and the Darch Brook.

As an addition of this report, Mr Brad Goode and Mr Paul Greenfeld on behalf of the sites custodian Mr Wayne Webb recorded additional information in regards to Site ID 4494 Rosa Brook Road (Margaret River Lore Ground). This information was reported to the DIA in a restricted format.

Maling, J. 2003. *Archaeological and Ethnographic Site Identification Survey Under the Aboriginal Heritage Act (1972) of a Proposed High Level Transfer Main at Margaret River, WA: With representatives of the South West Boojarah, Isaacs and Harris Families*. A report prepared by Australian Interaction Consultants on behalf of the Water Corporation.

This report was commissioned by the Water Corporation with regards to a high pressure water main that was needed in order to service Riverslea Estate and other housing developments within the area. The outcomes of this survey identified two sites, Site ID 21037 and Site ID 21038, to be located adjacent to the proposed pipeline, which runs parallel to an ephemeral creek running east from the intersection of the Bussell Highway and Boojidup Road to the Darch Brook. The Aboriginal informants from the South West Boojarah Native Title Claim group expressed opposition to the proposed pipeline installation through this area, as they believe it would adversely affect the watercourse identified as Site ID 21038.

McDonald, Hales and Associates. 1989. *An Archaeological and Ethnographic Survey of the Ten Mile Brook Dam Site Rosa Brook Road, Margaret River, Western Australia.* Prepared for the Water Authority of Western Australia.

This report was commissioned by the Water Authority of Western Australia in regards to the construction of the proposed Ten Mile Brook Dam Site on the Ten Mile Brook. During the survey up to 12 members of the Busselton Aboriginal community conducted a details inspection of the project area and did not identify any Aboriginal Heritage sites to be located within the area proposed for the Dam. With regards to the significance of the Ten Mile Brook, the report noted that while the Margaret River was once noted to have a Waugal the Ten Mile Brook was not reported to have any significance (ibid 14). During the survey the informants believed that a ceremonial ground existed within the region but during the field work the informants failed to relocate the site. The consensus of the informants was that this site was likely to be located further west along Rosa Brook Road.

McDonald Hales & Associates. 2000. *Report of an Aboriginal Heritage Survey of the Proposed Margaret River East Bypass.* Prepared for SMEC Australia upon behalf of Main Roads WA.

In May 2000 McDonald & Hales conducted an Aboriginal Heritage Survey for the Margaret River East Bypass. The results of this survey identified that the Margaret River Site ID 4495 would be impacted upon and that Site ID 4494 Rosa Brook Road could not be accurately located from the information held at the DIA. This survey also mentioned that an unnamed creek that crossed Darch Road was reported by the Aboriginal consultants to have cultural significance, in that it was an Aboriginal run. This run was reported to contain an abundance of foods and other resources. As a result of this report if it was necessary for any works to affect this creek then the works, should be monitored by an Archaeologist and Aboriginal community members.

The report of this creek is likely to be the Darch Brook or Wild Dog Gully, which also runs through our current survey area on the south west side. No mention was made in McDonalds report of this creek having any mythological associations, however it was noted by the Aboriginal consultants that it was a drainage feature of the Margaret River and thus of the same significance. Site ID 4494 Rosa Brook Road could not be located during fieldwork. The Aboriginal consultants who participated in this survey had no knowledge of this site in this survey. The site was described in the 1989 report as a meeting place for tribal groups, a battleground or a corroboree ground. No other spatial information is known, thus the DIA have formally placed a 10km box over the site which is located somewhere along Rosa Brook Road. The site has since be rerecorded by Goode and Greenfeld in 2006, the site is 500m east of the south east boundary of our current study area and will not be affected by Main Roads proposed work.

OUTCOMES OF ARCHIVAL RESEARCH

As a result of archival research, six previously recorded Aboriginal Heritage sites have been identified in the search area. Two artefact sites, Site ID 4522 Margaret River Dam Site 1 and Site ID 4523 Margaret River Dam Site 2 were identified to be located east of the survey corridor and will not be affected by the project proposal. Also both of these sites have been accessioned as ‘Stored Data’ on the DIA database and they are no longer protected under the ‘Act’

Two ethnographic sites, Site ID 21037 Wcm/01 Red Gum Tree and Site ID 21038 Wcm/02 Water Course (Waugly Site) were also identified to the west of the survey corridor and will not be affected by the project proposal. Also both of these sites have been accessioned as ‘Stored Data’ on the DIA database and they are no longer protected under the ‘Act’.

Site ID 4494 Rosa Brook Road (Lore Ground) has also been identified to be located 500m east of the project area will not be affected by the project proposal. This site was formerly accessioned as ‘Stored Data’ however additional information has been since reported by Goode and Greenfeld 2006 in a closed format and is yet to be assessed by the DIA. When this assessment has been made the area is likely to be recorded as a site under Section 5(a) and 5(b) and its significance assessed under Section 39.2(a), (b) and (c) and 39.3 of the West Australian Aboriginal Heritage Act (1972).

Site ID 4495 Margaret River is recorded as a mythological site and has been identified to bisect the project area and therefore will be affected by Main Roads proposal to construct the Margaret River East Perimeter Road Bridge. As such this site will require ministerial consent under Section 18 of the West Australian Aboriginal Heritage Act (1972) for consent to use the land that may contain an Aboriginal site. A number of the Margaret Rivers’ tributaries including the Darch Brook are also located within the survey corridor. Any plans that will affect these water courses within 30m of their normal high water mark will also require clearance under section 18 of the West Australian Aboriginal Heritage Act (1972).

IDENTIFICATION OF SPOKESPEOPLE

THE RIGHT TO SPEAK ON HERITAGE ISSUES

Various authors have discussed the contemporary problem of who in the Aboriginal Community has the authority to speak on heritage issues within an area. O'Connor et al. (1989:51) suggest that when this question is posed to people in Aboriginal Australia, answers are usually framed by such terms as 'the traditional owners', i.e., those people who are defined by place of birth i.e. descent. Meyers presents a broader and more contemporary view of 'ownership' based upon descent and association:

> "An estate, commonly a sacred site, has a number of individuals who may identify with it and control it. They constitute a group solely in relationship to this estate. Identification refers to a whole set of relationships a person can claim or assert between himself or herself and a place. Because of this multiplicity of claims, land holding groups take essentially the form of bilateral, descending kindred. Membership as a recognised owner is widely extended" (cited in Machin, 1993:22).

Meyers then goes on to further clarify the current perception of 'ownership' when he states:

> "....such rights exist only when they are accepted by others. The movement of the political process follows a graduated series of links or claims of increasing substantiality, from mere identification and residual interest in a place to actual control of its sacred association. The possession of such rights as recognised by others, called 'holding' (*kanyininpa*) a country, is the product of negotiation" (Ibid.).

While the notion of descent is clearly an important criterion within Meyers analysis, it must be seen in terms of the contemporary Nyungar situation. Nyungar tradition in the south west has been seriously eroded since colonisation, lines of descent have been broken, and previously forbidden and mixed marriages have interconnected many Nyungar groups who would not have traditionally had a close association (Ibid.). Consequently, in contemporary times the criteria of historical 'association' seems to be important in regards to the 'right to speak' on heritage issues within an area:

> "Traditional subsistence no longer sufficed to support Aboriginals so they combined this with menial work on farms and over time new relationships to land developed. As a consequence, the more recent history associated with their involvement with European agriculture and labour patterns is often more relevant than the pre-contact mode of attachment to an old way of life and the roots of the identity as original owners of the land. Biographical associations are often tied to post-settlement labour patterns and identification. These can predominate. This is part of a dynamic process of ethnicity, identity and tradition" (Machin, 1995:11).

O'Connor, et al. (1989) identified several criteria for determining contemporary community spokes people. A spokesperson must have a long-term association with an area, usually as a young person, and had extensive contact with a member or members of the 'pivotal generation of the culture transmitters'; those people whom, as children themselves, had contact with people who could pass on their traditional knowledge. A spokesperson must also demonstrate knowledge of the region's natural resources, its hunting, fishing and camping grounds, its local water sources, and the flora. This is important because a person without this knowledge is unlikely to be seen by their fellow Nyungars as truly being from that country, despite having been born or lived in that area. In some cases, people from outside a specific region have established themselves by political activism. They are accepted by their fellow Nyungar because they may have participated in mainstream white pursuits, such as advanced education,

or legal and political careers, that have empowered them within the broader community. As such, these people are a valuable resource to the local Aboriginal Community. The people consulted in this survey fulfil at least one of these criteria.

NATIVE TITLE CLAIMS OVER THE SURVEY AREA

Currently, there are two registered Native Title applications and one unregistered application that overlays the project area, lodged with the Register of Native Title Claims and the Schedule of Applications held by the Commonwealth Native Title Tribunal. The Schedule of Applications includes registered applications, unregistered applications, and applications still undergoing the registration test.

- South West Boojarah WC 06/4 (supersedes unregistered claim 98/063)

  Applicants:
  Mr William Webb, Mr Donald Hayward, Mr Bertram Williams, Mr William Thompson, Ms Margaret Culbung, Ms. Barbara Corbett-Councillor Stammner, Ms. Wendy Williams.

- Harris Family WC 96/41(registered)

  Applicants:
  Mrs. Minnie Van Leeuwin

- Single Noongar Claim (Area 2) WC03/7 (awaiting registration)

  Applicants:
  Anthony Bennell, Alan Blurton, Alan Bolton, Martha Borinelli, Robert Bropho, Glen Colbung, Ken Colbung, Donald Collard, Clarrie Collard-Ugle, Albert Corunna, Shawn Councillor, Dallas Coyne, Dianna Coyne, Margaret Colbung, Edith De Giambattista, Rita Dempster, Aden Eades, Trevor Eades, Doolan-Leisha Eattes, Essard Flowers, Greg Garlett, John Garlett, Ted Hart, George Hayden, Reg Hayden, John Hayden, Val Headland, Eric Hayward, Jack Hill, Oswald Humphries, Robert Isaacs, Allan Jones, James Khan, Justin Kickett, Eric Krakouer, Barry McGuire, Wally McGuire, Winnie McHenry, Peter Michael, Theodore Michael, Samuel Miller, Diane Mippy, Fred Mogridge, Harry Narkle, Doug Nelson, Joe Northover, Clive Parfitt, John Pell, Kathleen Penny, Carol Petterson, Fred Pickett, Rosemary Pickett, Phillip Prosser, Robert Riley, Lomas Roberts, Bill Reidy, Mal Ryder, Ruby Ryder, Charlie Shaw, Iris Slater, Barbara Stamner-Corbett, Harry Thorne, Angus Wallam, Charmaine Walley, Joseph Walley, Richard Walley, Trevor Walley, William Warrell, William Webb, Beryl Weston, Bertram Williams, Gerald Williams, Richard Wilkes, Mervyn Winmar, Andrew Woodley, Humphrey Woods, Dianne Yappo, Reg Yarran, Saul Yarran, Myrtle Yarran.

SELECTION OF SPOKESPEOPLE FOR THIS SURVEY

The selection of spokespeople for this survey was based on advice given from South West Aboriginal Land and Sea Council (SWALSC) by Mr Kevin Fitzgerald, South West Boojarah working party member Mr Jack Hill and applicant Ms Barbara Corbett and Harris Family applicant Mrs Mini Van Leeuwin. The consultants own previous experience in conducting Heritage survey's in the region for more than a decade has also greatly aided the selection of knowledgeable and appropriate spokespeople who represent those with both traditional and historical interests within the area. As a result of this pre-consultation process, the following Aboriginal people were selected to participate in the survey:

South West Boojarah WC06/4 Native Title Claim group

Miss Ellen Hill is a descendant of the traditional Pibblemen Wardandi people. Miss Ellen Hill is a member of the South West Boojarah Native Title Claim and an executive member of the Gnuraren Aboriginal Corporation of Busselton. Miss Hill also assists with the Nyungar Education Committee which helps Nyungar children at school. The country Miss Hill feels she has rights to speak for includes the Busselton, Margaret River, Karridale area through to Manjimup and north towards Bridgetown. Miss Ellen Hill was selected to participate in this survey by the consultant on advice from Ms Barbara Corbett and Mr Jack Hill as she is the senior elder in the Busselton community, having lived in the area all her life and having participated in heritage surveys in the region for more than a decade.

Mr Jack Hill is a former applicant to the South West Boojarah Native Title Claim and a current working party member. Mr Hill was born in Busselton; he is the son of Les and Gloria Hill and the grandson of Edward and Mary Hill (nee Isaacs) who were born in Karridale and Busselton. Mr Hill is a member of the Gnuraren Aboriginal Corporation of Busselton, the Lake Jasper Juvenile Justice Project and also sits on the executive committee of the South West Aboriginal Land and Sea Council. Mr Hill has held a number of government positions throughout his life in the Ministry of Justice, Family and Children's Services, the Australian Bureau of Statistics and is currently employed by Aims Security in Perth. Mr Hill was formerly the chairperson of the Nyungar Employment Development Aboriginal Corporation (NEDAC) in Bunbury. Mr Jack Hill was selected to participate in this survey by nomination from the consultant and SWALSC.

Ms Barbara Corbett is a current applicant to the South West Boojarah and Gnaala Karla Booja Native Title Claim and an executive member for the working parties. Ms Corbett has strong ties to the region being the daughter of Mr Frank Corbett and the niece of Mr Dan Corbett who were schooled at the Bussell family's Ellensbrook Mission at the turn of the 19th century. Ms Barbara Corbett was born at Picton and claims traditional blood ties through matrilineal descent to the Bunbury region and traditional ties through her farther and uncle to the Busselton-Margaret River area. Ms Corbett was selected to participate in this survey by nomination from SWALSC and the consultant as an applicant to South West Boojarah Native Title claim group.

Mr Phillip Prosser is a former applicant to the South West Boojarah Native Title Claim and president of the Aboriginal Veterans Affairs Association. Mr Prosser was born in Busselton and grew up at Ryans Mill in Cowaramup with his parents, Arthur and Gladys Prosser. Mr Prosser's parents are descendents of the Sambo's. His grandmother Eva Frances Wattling (who died at 82 years of age) was said to be the last of the traditional people in the area and had initiation scars on her shoulders and chest. Mr Prosser was taken from his parents by police officers in 1944 and was schooled at Roelands Mission. Mr Prosser was selected to participate in this survey by the consultant as a traditional Elder from the region.

Mrs Vilma Webb is a former applicant of the South West Boojarah Native Title Claim. Mrs Webb is a member of the Bibbulmun Mia Aboriginal Corporation of Busselton. Mrs Vilma Webb is also involved in teaching Nyungar language, history and culture to primary and high school students and TAFE colleges throughout the region. Mrs Webb and her family run the Wardan Aboriginal Cultural Centre at Wyadup. Mrs Webb has lived in the area most of her life and has a wide knowledge of both traditional and more recent historical usage of the region and is a primary informant for the registration of the Blackwood River and many other heritage sites throughout the survey area. Mrs Webb was selected to participate in this survey by the consultant and SWALSC as an Elder of the region.

Mr Bill Webb is the eldest son of Mrs Vilma Webb and is an applicant to the South West Boojarah Native Title claim group. Mr Webb has the same genealogical connection to the area as his mother Mrs Vilma Webb and through his father he is a descendant of the Isaacs clan from Margaret River. Mr Webb runs a cultural heritage tourism business at Wyadup near Yallingup

called the Wardan Aboriginal Cultural Centre which focuses upon educating tourists about local Nyungar culture. Mr Webb is an applicant and active participant at the working party of the South West Boojarah Native Title group and was identified to participate in this survey by SWALSC.

Harris Family WC96/041 Native Title Claim group

Mrs Mini Van Leeuwin is the primary applicant for the Harris Family Native Title Claim. Mrs Van Leeuwin speaks for the country west of Capel to Margaret River and Augusta. Mrs Van Leeuwin is also a member of the Nyungar Circle of Elders, a group that participates in meetings with developers concerning heritage issues in Perth. Mrs Mini Van Leeuwin was born in Busselton and her family can trace their family's linage in the area to 1896. Mrs Van Leeuwin was selected to participate in this survey by the consultant as an applicant to the claim group.

Mr Norman Harris is a claimant of the Harris Family Native Title Claim. Mr Harris worked in Eagle Bay for a local professional salmon fisherman. With his son Gary Harris and other Nyungar men he regularly camped in Eagle Bay for the duration of the salmon season. He associates himself with the Busselton and Margaret River area. Mr Harris is knowledgeable about the country's recent history through his own and his family's long-term association with it. Mr Harris was selected to participate in this survey by the consultant and Mrs Van Leeuwin.

Ms Carrie Harris is a sister to Mrs Mini Van Leeuwin and Mr Norman Harris. Ms Carrie Harris has worked for the Department of Community Services in Perth, Katherine and Alice Springs before returning to the South West. Ms Carrie Harris currently resides in Perth but she shares the same ancestral ties as the rest of the family. Ms Harris was selected to participate in this survey by the consultant and Mrs Van Leeuwin.

Mrs Dorothy Blurton (nee Harris) is the sister of Mr Norman Harris, Ms Carrie Harris and Mrs Mini Van Leeuwin and so shares the same family lineage and connections to the area. Mrs Blurton currently lives in Busselton. Mrs Blurton was selected to participate in this survey by the consultant and Mrs Van Leeuwin.

Mr Garry Harris is a claimant of the Harris Family Native Title Claim, is a member of the Gnuraren Aboriginal Corporation and the Bibbulmun Mia Aboriginal Corporation. Mr Garry Harris feels he can speak for the Busselton shire area and has knowledge of the surrounding country. Mr Harris and his parents were born in the area and have traditional ancestral ties that associate with the country from Busselton to Margaret River. Mr Harris claims little traditional knowledge but has a great deal of knowledge about the historical use of the area by Aboriginal people and their association with the farming and fishing industries. Mr Harris was selected to participate in this survey by the consultant and Mrs Van Leeuwin.

COMMUNITY CONSULTATION

AIMS

- To establish contact with Aboriginal people who retain traditional or historical cultural knowledge pertaining to the region.
- To determine if there are any sites of significance as defined by Section 5 of the West Australian Aboriginal Heritage Act (1972) within the Main Roads survey corridor.
- To record any ethnographic information provided about identified sites.
- To generate consensual recommendations from the Aboriginal community representatives in regards to any Section 18 requests and to record management strategies for identified ethnographic and archaeological sites identified within the survey corridor.

METHOD

The Aboriginal informants selected were contacted by phone, briefed as to the requirements of the survey and onsite meetings were arranged to meet outside the Margaret River Hotel prior to proceeding to the survey area. At the meetings the informants were orientated to the project plans by a description of the works from Mr Bruno Rikli (Project Manager) with the aid of a large aerial photograph clearly identifying the survey corridor within which the proposed Margaret River East Perimeter Road (MREPR) is to be constructed. The informants were driven to accessible sections of the eastern and western boundaries of the survey corridor where an inspection was conducted from the vehicles. At these locations further discussions where conducted as to the effect that this work would have on the cultural values of the area and any issues identified were recorded by the anthropologist.

COMMUNITY CONSULTATION PROCESS

On the 20th June 2006, Mr Brad Goode and assistant Mrs Melinda Cockman met with members of the South West Boojarah Native Title Claim group Mr Philip Prosser, Mr Jack Hill, Ms Ellen Hill, Ms Barbara Corbett, Mrs Vilma Webb and Mr Bill Webb in Margaret River along with Mr Bruno Rikli from GHD and Mr Jason Gick (Project Manager) from Main Roads. From here the group immediately drove to the southern end of the MREPR just off Darch Road, stopping in front of the Watershed Winery.

Here Mr Gick explained to the Nyungar informants that Main Roads are at the preliminary stage of the planning process and before a determination is made for the Perimeter Roads exact location, GHD would like to conduct consultations with the Nyungar community in order to seek their views with regards to areas of significance within a large portion of land designated for a road corridor. Mr Gick stated that the preliminary consultation is being conducted so that Main Roads could identify any areas of significance to Nyungars and potentially avoid these sites prior to finalising the exact location of the MREPR. Mr Gick further explained that the reason Main Roads was constructing the MREPR was due to Bussell Highway being the main street through the Margaret River Township and central business district and that the Shire of Augusta-Margaret River and the local community had identified that this road causes transport conflicts, noise pollution and are highly concerned for road and public safety.

Mr Brad Goode, further explained that an archaeological inspection had not yet been conducted as this was a preliminary consultation and that an archaeological inspection would be conducted once Main Roads had finalised the exact path of the MREPR. With the aid of an aerial photograph clearly identifying the area of land selected for the proposed MREPR to be constructed within, Mr Goode identified the previously recorded Aboriginal Heritage Sites within and around the bounds of the survey corridor. Mr Goode stated that the Margaret River and possibly some of its tributaries would be directly affected by the project proposal and that Main Roads would require clearances under Section 18 of the West Australian Aboriginal Heritage Act (1972) in order to progress the work. Mr Goode advised that five other previously

recorded sites identified were either located outside of the project area or had been accessioned by the ACMC as 'Stored Data', therefore these sites would not be affected.

Figure 2. Mr Jack Hill, Mr Bruno Rikli, Mr Brad Goode, Mr Philip Prosser and Mr Bill Webb inspecting the aerial photograph used to identify the project area. View looking to the north-east.

Following this discussion, the Aboriginal informants advised that they would like to view the Margaret River crossing, as this site is of the upmost importance and significance to the local Nyungar community. The group then proceeded to the Margaret River crossing area and stopped on the corner of Bankside Retreat, an area close to the actual crossing location which was not accessible by vehicle. At this location, Mr Brad Goode asked the community if they had any preferred options or ideas to where the MREPR should be constructed within the defined parameters provided by Main Roads.

At this location Mr Bill Webb stated that if the Perimeter Road was built on the eastern boundary, that this would allow the Margaret River township to expand out towards this road, but could not expand any further as the eastern boundary boarders the State Forestry. Mr Webb stated that this was his preferred option with the Perimeter Road being constructed on the western side of an unnamed tributary of the Margaret River that runs north-south along the eastern boundary. Mr Webb said that this would protect the native animals (kangaroos, possums etc) that live in the forestry as they could still utilise the tributary without having to cross the MREPR. Mr Webb also stated that to further protect these animals that a kangaroo fence should be erected to stop animals being able to cross the MREPR, thereby protecting native animals and creating a safer environment for drivers using the MREPR. Mr Webb further stated that he did not want the Darch Brook, which was located on the western corridor, to be crossed and that this was a site of significance associated with the Margaret River and should not be disturbed by the construction of the Perimeter Road if it is not necessary and better options were available.

Another option mentioned by the Nyungar informants, which was seen as less likely to disturb tributaries of the Blackwood River was a more central path which mainly traversed open farm paddocks. Although this area mainly went through open farm land, numerous blocks of thick remnant bush vegetation were noted that would be directly affected by the construction of the MREPR. The Aboriginal informants stated that these islands of bush were habitats for wildlife and birds and that if these were disturbed they could destroy breeding areas and disturb the

flight path that birds use. Mr Philip Prosser stated that these parcels of bushland should not be disturbed and should be avoided by Main Roads. In relation to the proposed river crossings, Mr Webb said that it was his preference that any Bridge that was constructed across the Margaret River was of a type that minimised the restriction to the rivers flow and that disturbance to the embankments was kept to a minium. Mr Webb advised that monitoring of this work by Nyungars should take place. Ms Barbara Corbett also stated that the bridge should be constructed with a pedestrian crossing for safety reasons. Mr Bill Webb further requested that a copy of the Environment report in relation to the construction of the MREPR be provided to the Aboriginal consultants, as Mr Webb stated there are significant species (e.g. marron) located in and around the Margaret River area that need to be protected during this construction phase.

In relation to the final selection of the roads path within the survey corridor the Nyungar informants stated that when Main Roads made there selection they would need to allow for an archaeologist to thoroughly inspect the area and that if any archaeological sites were discovered that further consultations would be required with the Nyungar community to assess the significance of the material before approval could be given to disturb the area. It was also stated that it would be necessary to erect a kangaroo fence on the eastern side of the decided MREPR. The Aboriginal informants also advised that it would be necessary for Nyungar monitors to be engaged whilst all clearing works where being conducted to ensure all areas are free from any possible subsurface archaeological materials and that if they are discovered that the material is treated with respect in a culturally appropriate manner before being moved or salvaged under Section 18 approval.

The informants also stated to Mr Bruno Rikli that Main Roads should have a contingency plan in place to relocate the road in the event that skeletal remains are located within the path of the Perimeter Road selected as it was culturally inappropriate to move graves. In the event of this occurring, the informants stated that a minimum 60m buffer would need to be established around the site of the grave and the road. This was thought necessary to protect the area from disturbance during construction and to allow for future expansion of the road. Mr Jack Hill also requested that employment opportunities be provided for Nyungar people to assist in the project.

Figure 3. Members of the South West Boojarah Native Title Claim group, Mr Bruno Rikli and Mr Brad Goode at the Margaret River. View looking to the south- east.

On the 22nd June 2007, Mr Brad Goode and assistant Mrs Melinda Cockman met with five members of the Harris Family Native Title Claim group Mrs Mini Van Leeuwin, Mr Norman Harris, Ms Dorothy Blurton, Mr Garry Harris and Ms Carrie Harris at a Margaret River Café along with Mr Bruno Rikli and Ms Jeanette Della Bona from Main Roads. Due to wet weather conditions, the group decided to discuss the project proposal at the Café.

Mr Brad Goode, with the aid of an aerial photograph provided an overview of the project proposal as was done with the previous group. Mr Goode explained that Main Roads was in the preliminary stages of the MREPR project and that they were seeking the Aboriginal communities views with regards to a large portion of land designated for the road to be constructed within. Mr Goode stated that Main Roads wished to identify any areas of significance to Nyungars before finalising the exact location of the MREPR so as to potentially avoid these sites or areas of significance. Mr Goode also informed the Harris Family informants that members of the South West Boojarah Native Title claim group had two days earlier been consulted with and provided the group with details of their preferred option for the Perimeter Road, their reasons for choosing this route and their recommendations to Main Roads. It was also explained that Main Roads would be impacting upon Site ID 4495 Margaret River and therefore they would be requiring clearances under Section 18 of the West Australian Aboriginal Heritage Act (1972) in order to progress the work. Following this discussion, Mr Goode asked the Aboriginal informants for their comments on the project proposal and if they had any issues or recommendations for Main Roads.

Mrs Mini Van Leeuwin, as spokesperson for the group stated that the Margaret River and its tributaries such as Darch Brook are sites of spiritual significance to Aboriginal people and that they need to be protected. Mrs Leeuwin also stated that they supported the views and recommendations of the previous group and stated that they preferred the option of constructing the MREPR on the western side of an unnamed tributary of the Margaret River that runs north-south along the eastern boundary. Mrs Leeuwin stated that kangaroo fences would be a necessity in order to ensure the protection of native wildlife coming from the adjacent State Forest. Mrs Van Leeuwin stated that they were not aware of any further sites that would be affected by the project proposal, however it was requested that the group be driven along the perimeter on the eastern side of the project area.

Figure 4. View of the unnamed tributary of the Blackwood River that runs parallel with the eastern boundary. View looking to the north-west.

The group conducted vehicular inspections of the project area starting from the southern end of the project area at the intersection of Darch Road and Bussell Highway. The group drove north along Darch Road, turning east onto Rosa Brook Road, then turning north along Neilson Road, which is the boarder of the eastern boundary of the survey corridor. The group proceeded along this road for a couple of kilometres, viewing the unnamed tributary of the Margaret River in which they recommended that the MREPR be constructed on the western side until they were forced to stop due to a fallen tree crossing the road path at coordinate 324896mE and 6241180mN. The group then turned around and proceeded back to the north along Neilson Road, turning west onto Rosa Brook Road and turning north onto Darch Road. The survey team followed the Darch Road for a couple of kilometres viewing the Darch Brook and block areas of bushland amongst cleared farmland within the survey corridor. Once again, the vehicles were stopped by another fallen tree in the roads path. The informants stated that they were happy with what they had seen and the survey team proceeded back to the Margaret River Café to record their recommendations.

Mrs Mini Van Leeuwin as spokesperson for the group advised that they would support Main Roads request for a Section 18 clearance to cross the Margaret River and any associated tributaries. Mrs Van Leeuwin stated that all disturbance works by Main Roads should be monitored, in particular the disturbance of the Margaret River and that the bridges to be constructed over these water courses should have minimal impact on the embankments and should not restrict the natural flow of the waterways.

COMMUNITY CONSULTATION OUTCOMES

As a result of community consultations held with members of the South West Boojarah and Harris Family Native Title Claim groups, no new ethnographic sites as defined by Section 5 of the West Australian Aboriginal Heritage Act (1972) were identified within the survey corridor.

In relation to Site ID 4495 Margaret River all the Nyungar informants consulted stated that they would support Main Roads request for a Section 18 clearance to cross the main river channel with the MREPR. They further stated the Darch Brook should not be affected if possible. They further stated that monitors should be engaged during all disturbances conducted on the Margaret River and any associated tributaries. They stated that the proposed bridges span across the Margaret River should only minimally disturb the embankments and should not interfere with the natural flow of the waterway.

The informants agreed that their preferred option for the road path within the survey corridor was on the western side of an unnamed tributary of the Margaret River that runs north-south along the eastern boundary of the survey corridor, thereby giving the town room for its inevitable expansion. It was stated by the informants that a kangaroo fence should be constructed on the eastern side of the MREPR so as to protect and stop native animals from crossing the new Perimeter Road. The Aboriginal community also stated that they did not wish for numerous blocks of bushland located amidst open farm paddocks in the centre of the corridor to be disturbed as these were habitats, nesting areas and flight paths used by native birds migrating between bushland on the coast and the State Forrest east of the town.

The Aboriginal informants further stated that Main Roads should have a contingency plan to relocate the MREPR so that if Aboriginal skeletal remains were discovered during construction that the remains could be left in situ as it is believed to be culturally inappropriate to move Nyungar graves. A 60m buffer was seen to be a necessary zone of protection between any graves and the road to allow for future expansion of the road and protecting the grave.

SUMMARY AND RECOMMENDATIONS

Main Roads Western Australia (Main Roads) on behalf of the Department for Planning and Infrastructure is planning for a deviation of the Bussell Highway to the east of the Margaret River townsite. The deviation is referred to as the Margaret River East Perimeter Road (MREPR). At this point in time the project is at an early stage of planning, therefore GHD Pty Ltd (GHD) on behalf of Main Roads has conducted preliminary consultations with the Nyungar community to determine whether any sites of significance as defined by section 5 of the 'Act' will be impacted upon by this proposed work thereby fulfilling Main Roads obligations under the West Australian Aboriginal Heritage Act (1972).

As a result of community consultations held with members of the South West Boojarah and Harris Family Native Title Claim groups, no new ethnographic sites as defined by Section 5 of the West Australian Aboriginal Heritage Act (1972) were identified within the survey corridor.

In relation to Site ID 4495 Margaret River all the Nyungar informants consulted stated that they would support Main Roads request for a Section 18 clearance to cross the main river channel with the MREPR. They further stated the Darch Brook should not be affected if possible. They stated that the proposed bridges span across the Margaret River and should minimally disturb the embankments and not interfere with the natural flow of the waterway.

The informants agreed that their preferred option for the road path within the survey corridor was on the western side of an unnamed tributary of the Margaret River that runs north-south along the eastern boundary of the survey corridor, thereby giving the town room for its inevitable expansion. It was stated by the informants that a kangaroo fence should be constructed on the eastern side of the MREPR so as to protect and stop native animals from crossing the new Perimeter Road. The Aboriginal community also stated that they did not wish for numerous blocks of bushland located amidst open farm paddocks in the centre of the corridor to be disturbed as these are habitats, nesting areas and flight paths used by native birds.

The Aboriginal informants further stated that Main Roads should have a contingency plan to relocate the MREPR so that if Aboriginal skeletal remains were discovered during construction that the remains could be left in situ as it is believed to be culturally inappropriate to move Aboriginal graves. A 60m buffer was seen to be a necessary zone of protection between any graves and the road.

As a result of the above consultations, the following recommendations are made:

It is recommended that as there was no new sites identified under Section 5 of the West Australian Aboriginal Heritage Act (1972) that the project proceed to the second stage of planning in order to identify the actual road alignment within the Margaret River East Perimeter Road survey corridor.

It is recommended that when the actual road alignment is defined that an on the ground archaeological field survey be conducted in order to identify any possible archaeological constraints for the road alignment. This survey should involve members of the South West Boojarah and Harris Family Native Title Claim group. During this survey, if any archaeological sites are recorded, **it is further recommended** that Main Roads endeavour to modify their plans in order to avoid these areas, particularly if skeletal remains are identified.

If it is not possible to avoid any identified archaeological sites, then **it is recommended** that further consultations with the above Native Title Claim groups will be necessary in order to document the sites ethnographic significance, prior to Main Roads seeking consent under

Section 18 of the West Australian Aboriginal Heritage Act (1972) to use the land that may contain an Aboriginal site.

In regards to Site ID 4495 Margaret River, **it is recommended** that Main Roads construct a bridge that will minimise disturbance to the embankments and restriction of the flow of water in order to protect the values associated with this site and that this work will require consent under Section 18 of the West Australian Aboriginal Heritage Act (1972). It must be noted that all watercourses that are tributaries of the Margaret River within the survey corridor are components of the site and that any planned impact on these tributaries will also require Section 18 clearance under the 'Act'. **It is the recommendation** of the above claimants consulted that Main Roads minimise their plans to affect all watercourses throughout the survey corridor, particularly the Darch Brook on the western perimeter of the survey area.

It is recommended that Main Roads give consideration to the requests by the Nyungar community to be able to monitor any works that affects the Margaret River and its tributaries. Main Roads should also endeavour to avoid clearing the vegetation islands that are located centrally throughout the survey corridor, as the Nyungar community have identified them as significant for bird habitat. Main Roads should also take into consideration the request for a contingency plan to move the road should Aboriginal skeletal remains be unearthed during construction. It was advised that a 60m buffer was seen to be a necessary zone of protection between any graves and the road in order to cater for any future expansion of the Margaret River East Perimeter Road.

It is finally recommended that Main Roads give due consideration to the Nyungar communities' preference of the Margaret River East Perimeter Road being constructed on the western side of an unnamed tributary of the Margaret River that runs north-south along the eastern boundary of the survey corridor and that a kangaroo fence be erected between the road alignment and this unnamed tributary.

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APPENDIX 1. SITES REGISTER SEARCH

Search Criteria

6 sites in a search box. The box is formed by these diagonally opposed corner points:

MGA Zone 50	
Northing	Easting
6235993	322771
6244886	328283

Disclaimer

Aboriginal sites exist that are not recorded on the Register of Aboriginal Sites, and some registered sites may no longer exist. Consultation with Aboriginal communities is on-going to identify additional sites. The AHA protects all Aboriginal sites in Western Australia whether or not they are registered.

Copyright

Legend

Restriction		Access		Status	
N	No restriction	C	Closed	I	Interim register
M	Male access only	O	Open	P	Permanent register
F	Female access	V	Vulnerable	S	Stored data

Coordinate Accuracy

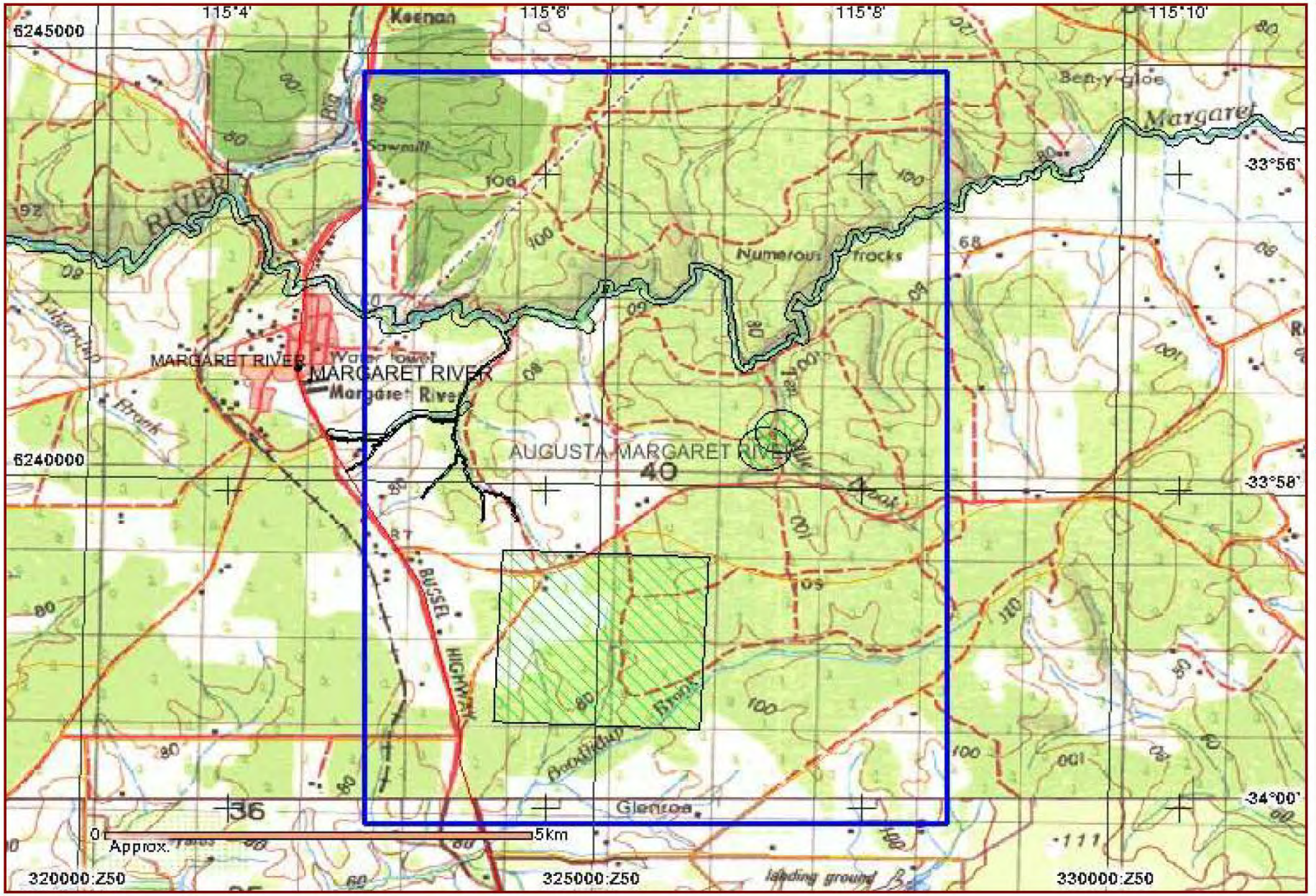
Accuracy is shown as a code in brackets following the site coordinates.

[Reliable]	The spatial information recorded in the site file is deemed to be reliable, due to methods of capture.
[Unreliable]	The spatial information recorded in the site file is deemed to be unreliable due to errors of spatial data capture and/or quality of spatial information reported.

Spatial Accuracy

Index coordinates are indicative locations and may not necessarily represent the centre of sites, especially for sites with an access code “closed” or “vulnerable”. Map coordinates (Lat/Long) and (Easting/Northing) are based on the GDA 94 datum. The Easting / Northing map grid can be across one or more zones. The zone is indicated for each Easting on the map, i.e. '5000000:Z50' means Easting=5000000, Zone=50.

Site ID	Status	Access	Restriction	Site Name	Site Type	Additional Info	Informants	Coordinates	Site No.
4494	S	C	M	Rosa Brook Road (Margaret River Lore Ground)	Ceremonial	Meeting Place, Camp, [Other: Battle ground]	*Registered Informant names available from DIA.	Not available for closed sites	S02613
4495	P	O	N	Margaret River.	Mythological	[Other: WAUGAL (FORMER]	*Registered Informant names available from DIA.	334373mE 6245401mN Zone 50 [Reliable]	S02614
4522	S	O	N	Margaret River Damsite 1	Artefacts / Scatter			326589mE 6240447mN Zone 50 [Reliable]	S02579
4523	S	O	N	Margaret River Damsite 2	Artefacts / Scatter			326739mE 6240647mN Zone 50 [Reliable]	S02580
21037	S	O	N	Wcm/01 - Red Gum Tree		Plant Resource, Natural Feature, [Other: Medicinal Purposes]	*Registered Informant names available from DIA.	322905mE 6240562mN Zone 50 [Reliable]	
21038	S	O	N	Wcm02-Water Course (Waugly Site)		Natural Feature, Water Source	*Registered Informant names available from DIA.	323023mE 6240698mN Zone 50 [Unreliable]	



Legend

- Highlighted Area
- Town
- Map Area
- Search Area

APPENDIX 2. LETTERS OF ADVICE

Brad Goode
Consulting Anthropologist
Heritage Assessments

79 Naturaliste Terrace
DUNSBOROUGH WA 6281
Phone: (08) 9755 3716
Fax: (08) 9756 7660
E-mail: bradnlee@westnet.com.au
ABN: 40 803 184 260

20th June 2007

We the undersigned have been consulted by Bradley Goode on behalf of GHD for Main Roads for works on the proposed construction of the Margaret River East Perimeter Road and we understand the nature and extent of the works. We would like to make the following recommendations with regards to the West Australian Aboriginal Heritage Act (1972).

* Sec 18 approval to build a bridge over the Margaret river is given at no further time from any owners if discovered.
* Rec monitoring of all watercourses impacted
* Rec Kangaroo fence west of eastern water course
* Rec do not clear remnant veg islands as they are habitat for birds.

South West Boojarah WC 06/4 Native Title Claim Group

Name	Date	Signature
Vilma Webb	20.6.2007	Vilma Webb
Philip Prosser	20.6.2007	
Barbara Corbett	20.6.2007	Barbara Corbett
Ellen Hill	20.6.2007	Ellen Hill
Jack Hill	20.6.2007	Jack Hill
Bill Webb	20.6.2007	W Webb

Brad Goode
Consulting Anthropologist
Heritage Assessments

79 Naturaliste Terrace
DUNSBOROUGH WA 6281
Phone: (08) 9755 3716
Fax: (08) 9756 7660
E-mail: bradnlee@westnet.com.au
ABN: 40 803 184 260

22nd June 2007

We the undersigned have been consulted by Bradley Goode on behalf of GHD for Main Roads for works on the proposed construction of the Margaret River East Perimeter Road and we understand the nature and extent of the works. We would like to make the following recommendations with regards to the West Australian Aboriginal Heritage Act (1972).

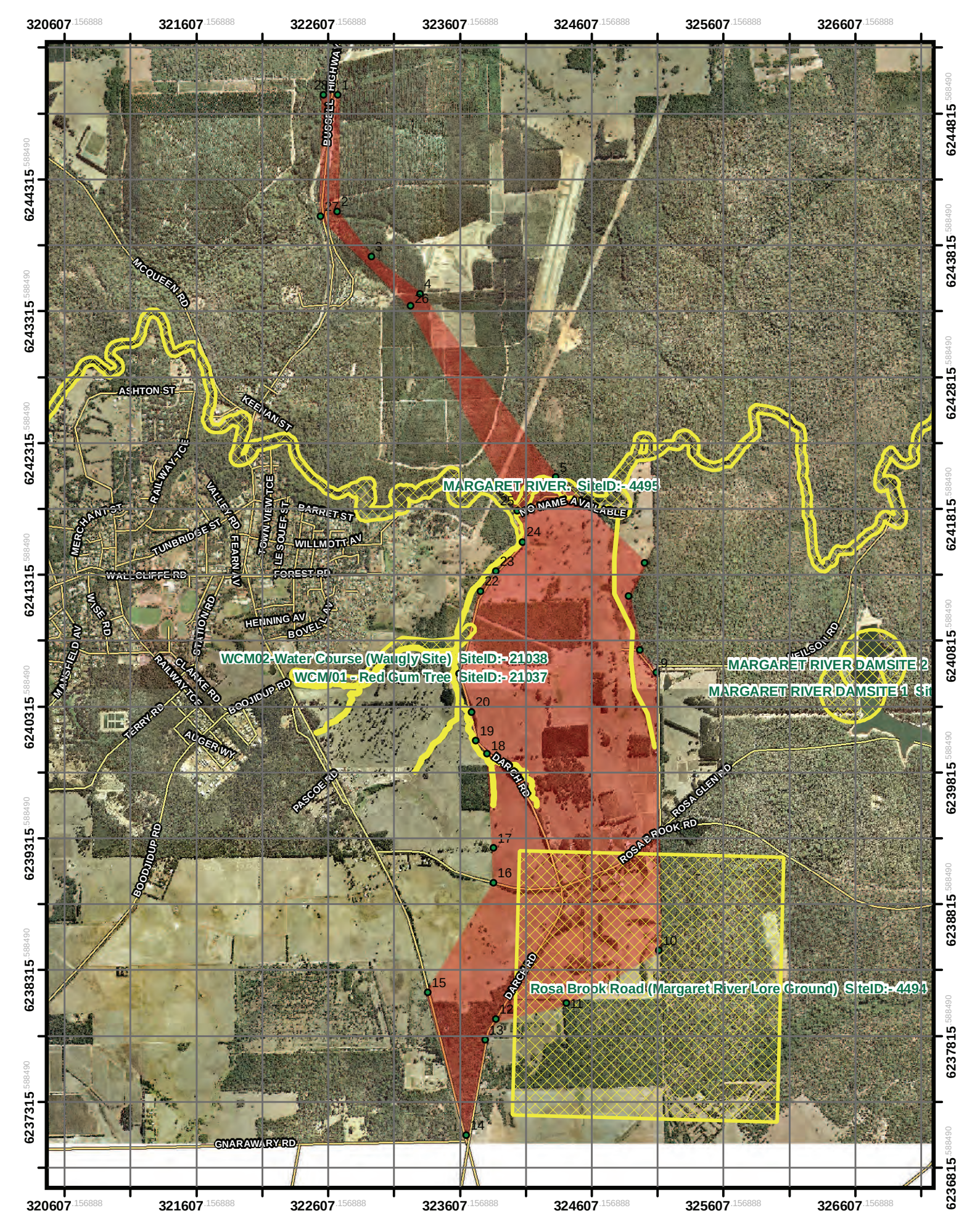
* Support Sec 18 clearance for the Bridge over the Margaret River

* Support SWB rec's

Harris Family WC 96/041 Native Title Claim Group

Name	Date	Signature
Mini Van Leeuwin	**22.6.2007**	
Carrie Harris	**22.6.2007**	
Dorothy Blurton	**22.6.2007**	
Norman Harris	**22.6.2007**	
Gary Harris	**22.6.2007**	

APPENDIX 3. MAP OF THE PROJECT AREA IN RELATION TO ABORIGINAL HERITAGE SITES



Legend

- Cape_Roads
- DIA Sites Extent
- Project Study Area

CLIENT:-

Margaret River East Perimeter Road

in relation to Aboriginal Site

SCALE - A4	SCALE - BAR
1:35,419	0 137.5 275 550 825 1,100 Meters
DATE: 12th June 2007	GDA 1994 MGA Zone 50

Survey conducted by

Mapping provided by

Appendix F – Aboriginal Heritage Survey for the Margaret River East Bypass Road

A REPORT ON AN ABORIGINAL HERITAGE SURVEY FOR THE MARGARET RIVER EAST BY-PASS ROAD, WESTERN AUSTRALIA

A report prepared for GHD Pty Ltd on behalf of Main Roads Western Australia

By Mr Brad Goode
Consulting Anthropologist
79 Naturaliste Terrace
DUNSBOROUGH WA 6281
bradnlee@westnet.com.au

Mrs Jacqueline Harris
Consulting Archaeologist
26 Camelia Street
NORTH PERTH WA 6006
jacque234@bigpond.net.au

Report submitted May 2012 to:

Ms Fionnuala Hannon
GHD Pty Ltd
10 Victoria Street
BUNBURY WA 6230

The Registrar
Department of Indigenous Affairs
PO Box 7770
Cloisters Square
PERTH WA 6000

HERITAGE SURVEY

79 Naturaliste Terrace
Dunsborough WA 6281
Email:- bradnlee@westnet.com.au
Phone:- 97553716

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- Ms Fionnuala Hannon - GHD Pty Ltd (Senior Environmental Scientist)
- Mr Neil McCarthy - GHD Pty Ltd (Principle Environmental Scientist)
- Mrs Leah Mackie - Brad Goode & Associates Pty Ltd (Assistant)
- Ms Melissa Lamanna - Brad Goode & Associates Pty Ltd (Assistant)
- Mrs Jacqueline Harris - Brad Goode & Associates Pty Ltd (Archaeologist)
- Mr Wayne & Toni Webb - Brad Goode & Associates Pty Ltd (Archaeological Assistant)

South West Boojarah 2 (WC06/4) Native Title Claim group representatives

- Mr Wayne Webb
- Ms Gloria Hill
- Ms Samantha Nannup
- Ms Gwenda Chapman (nee Webb)
- Mr Jack Hill
- Mr David Pell (nee Hill)

Harris Family (WC96/41) Native Title Claim group representatives

- Mrs Minnie Van Leeuwin
- Ms Carrie Harris
- Mr Wendy Harris
- Ms Naomi Downey
- Ms Dorothy Blurton
- Mr Travis Narkle (nee Harris)

DISCLAIMER

All of the information contained in this report is believed to be correct and accurate at the time it was recorded. The author does not take responsibility or accept any liability for errors or omissions contained in the report based upon information supplied by others.

*Note: This report, in terms of its assessment under section 5 of the Western Australian Aboriginal Heritage Act (1972), should be read in conjunction with the archaeological report by J. Harris, 2012.

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GLOSSARY OF TERMS

The Proponent – Main Roads
The Consultant – Brad Goode & Associates Pty Ltd
AHA – Western Australian *Aboriginal Heritage Act (1972)*
DIA – Department of Indigenous Affairs
ACMC – Aboriginal Cultural Material Committee
CHMP – Cultural Heritage Management Plan
SWALSC – South West Aboriginal Land and Sea Council
SWB – South West Boojarah 2 (WC06/4) Native Title Claim group
SLK – Straight Line Kilometre

EXECUTIVE SUMMARY

Main Roads Western Australia (Main Roads) acting on behalf of the Department for Planning and Infrastructure is now proposing a By-Pass road to the east of the Margaret River townsite.

The purpose of this road is to relieve Margaret River from traffic congestion and heavy haulage vehicles passing through the town during peak periods. The proposed road connects to the Bussell Highway in the north at Bramley, and then reconnects to Bussell Highway 1km south of Rosa Brook Road, a total distance of 11km.

In 2007 a broad planning corridor was subject to a preliminary ethnographic Aboriginal heritage survey. Resulting from this survey a number of issues relating to the effect that this road proposal would have upon the Margaret River and the Darch Brook were identified. The preliminary survey found that ministerial consent under section 18 of the AHA would be required to bridge these water courses and that stream flow maintenance was central to the Nyungar communities concerns.

Main Roads have now developed a full road design and are considering a number of bridging options to cross the Margaret River and the Darch Brook. Planning for T-section bridges across the Margaret River (40m span) and pipe culvert bridges across the Darch Brook are now well advanced but not yet settled. Geo-technical issues and other compliances such as noise abatement are to be determined prior to selecting a final bridge design and in the case of the Margaret River crossing a final road alignment option; either 'Black or Blue' (see plans Appendix 3).

As a result Main Roads have now commissioned a 'Site Identification Aboriginal Heritage Survey' in order to address these issues under section 18 application of AHA, and to ensure that compliance is maintained should the plan move to construction.

As a result of the 2007 preliminary ethnographic survey, six previously recorded Aboriginal Heritage sites/places were identified within the survey corridor (see Archival Research, Goode 2007).

In 2012 a reduced corridor identifies **one** registered site to be affected by the road/bridge construction proposal.

Site ID 4495 Margaret River, inclusive of the Darch Brook will be affected by Main Roads proposal to construct the Margaret River By-Pass Road bridges. Any plans that will affect this water course within 30m of their normal high water mark will also require clearance under Section 18 of the AHA to proceed.

As a result of consultations held with members of the South West Boojarah WC06/4 and Harris Family WC96/41 Native Title Claim groups, no new ethnographic sites as defined by Section 5 of the AHA were identified within the survey corridor.

In relation to Site ID 4495 Margaret River, all the Nyungar informants consulted stated that they would support Main Roads request for a Section 18 clearance to cross the main river channel provided that the proposed bridges span across the Margaret River and that Main Roads develop strategies to minimise disturbance to the embankments and not to adversely interfere with the natural flow of the waterway. Pylons within the main river channel (flow restricting) were rejected with preference given to bridge designs that placed pylons outside of the river or culvert designs that maximise stream flows.

During the consultations preference was also given to the 'Blue Alignment' crossing the Margaret River. This alignment was preferred due to this design being seen by the Nyungar representatives as having less potential to pollute the river with runoff from roads.

During the consultations the informants requested that employment opportunities be made available to Nyungar people, in particular in regards to rehabilitation work. All requested that rehabilitation use species with local provenance. All advised that rehabilitation done along the Darch Brook within the Riverslea Estate was a good example of what should be done after bridges and culverts are constructed. The group further advised that the bridge should be named after *Wooditchup,* the Nyungar name for the Margaret River.

No other issues were raised during the survey and it was advised the Nyungar community would support the proposal and wish to seek ministerial consent in order to proceed.

As a result of the above consultations, the following recommendations are made:

It is recommended that as there are no new sites identified under Section 5 of the AHA that the project can continue to a final design for construction without reference to further heritage survey requirements.

In regards to Site ID 4495 Margaret River, **it is recommended** that Main Roads construct a bridge that will minimise disturbance to the embankments and restriction of the flow of water in order to protect the values associated with this site and that this work will require consent under Section 18 of the AHA to proceed. It must be noted that all watercourses that are tributaries of the Margaret River (i.e. Darch Brook) within the survey corridor are components of the site and that any planned impact on these tributaries will also require section 18 clearance under the 'Act'.

It is the recommendation of the above claimants consulted that Main Roads adopt the 'Blue Alignment' for crossing the Margaret River. This option was perceived to best protect the river from runoff pollution and was seen as less disturbing to human values as it is further east of houses.

It is recommended that Main Roads give consideration to the requests by the Nyungar community to be able to monitor any works that affects the Margaret River and its tributaries.

Main Roads should also endeavour to connect the vegetation islands that are located centrally throughout the survey corridor, as the Nyungar community have identified them as significant for bird habitat.

It is recommended that Main Roads give due consideration to the Nyungar community request that a kangaroo fence be erected between the road alignment and vegetation corridors. It was further requested that wildlife underpasses be installed to maintain the connections between vegetation corridors.

It is recommended that Main Roads develop an Aboriginal Cultural Heritage Management Plan (CHMP) to advise construction crews of what is required should Aboriginal skeletal remains be unearthed during construction. In the event that skeletal material is discovered during earthworks the following protocol is recommended:

1. Any earthworks occurring in the area stops immediately;
2. The Western Australian Police Service is contacted.

In the event it is an Aboriginal set or partial set of remains:

1. The Department of Indigenous Affairs are contacted.

2. The Nyungar community is informed and consulted regards appropriate management of the area
3. If the remains cannot be left in situ then the proponents would need to seek ministerial consent pursuant to a section 18 application under the AHA to exhume and relocate the material in keeping with the wishes of the Elders who have custodial rights in the area.

It is finally recommended that all cultural heritage management strategies and any conditions attached as a result of ministerial consent should be detailed within this CHMP and that this plan should inform all construction activities associated with the project.

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REPORT

Report of an Aboriginal Heritage Survey for the Margaret River East By-Pass Road, Western Australia

ISSUE

Main Roads Western Australia (Main Roads) acting on behalf of the Department for Planning and Infrastructure is now proposing a By-Pass road to the east of the Margaret River townsite.

Main Roads has commissioned a site identification Aboriginal Heritage survey in order to determine whether any sites of significance as defined by section 5 of the 'Act' will be impacted upon by this proposed work thereby fulfilling Main Roads obligations under the West Australian *Aboriginal Heritage Act* (1972 - AHA).

REPORT OBJECTIVES

To report on archival research in order to determine if any previously recorded Aboriginal Heritage sites will be impacted upon by the above project proposal.

To report on consultations held with representatives of the South West Boojarah 2 WC06/4 and Harris Family WC96/041 Native Title Claim groups in order to determine if any new ethnographic Aboriginal Heritage sites will be affected by this proposal.

BACKGROUND

On 9th August 2011, Mr Neil McCarthy from GHD contacted Brad Goode and Associates to request that they conduct a site identification Aboriginal heritage survey for the proposed Margaret River East Perimeter Road By-Pass project.

The purpose of this road is to relieve the Town of Margaret River from traffic congestion and heavy vehicles passing through the town during peak periods. The proposed road connects to the Bussell Highway in the north at Bramley, and then reconnects to Bussell Highway approximately 1km south of Rosa Brook Road.

The study area extends approximately 11km commencing at the Department of Environment and Conservation (DEC) offices on Bussell Highway at Bramley, 2kms north of Margaret River. In a south eastern direction the route traverses a State pine plantation and then crosses the Margaret River near the Darch Brook. It extends directly south through farmland and then west, crossing the Darch Brook to connect with John Archibald Drive. The route intersects Rosa Brook Road and Darch Road and continues onward to reconnect with Bussell Highway, 950m south of the Rosa Brook Road intersection. The width of the corridor varies from 30m to 80m generally along the alignment, extending to 200m at the crossing of the Margaret River where the 'Black and Blue' bridge alignments are proposed.

In 2007 a broad planning corridor was subject to a preliminary ethnographic survey. Resulting from this survey a number of issues relating to the effect that this road proposal would have upon the Margaret River and the Darch Brook were identified. The preliminary survey found that ministerial consent under section 18 of the AHA would be required to bridge water courses and that stream flow maintenance was central to the Nyungar communities concerns. Six previously recorded Aboriginal Heritage sites/places were identified within the survey corridor during this preliminary survey (see Archival Research, Goode 2007).

Main Roads have now developed a full road design and are considering a number of bridging options to cross the Margaret River and the Darch Brook. Planning for T-section bridges across the Margaret River (40m span) and pipe culvert bridges across the Darch Brook are now well advanced but not yet settled. Geo-technical issues and other compliances such as noise abatement are to be determined prior to selecting a final bridge design and in the case of the Margaret River crossing a final option, either 'Black or Blue' road alignments are currently planned (see plans Appendix 3).

As a result of this brief, an archaeological survey was conducted by Jacqueline Harris and Wayne Webb on the 28th and 30th March 2012 and Mr Brad Goode and Ms Melissa Lamanna conducted the necessary ethnographic consultations with members of the South West Boojarah and Harris Family Native Title Claim groups on the 17th and 18th April 2012.

LOCATION

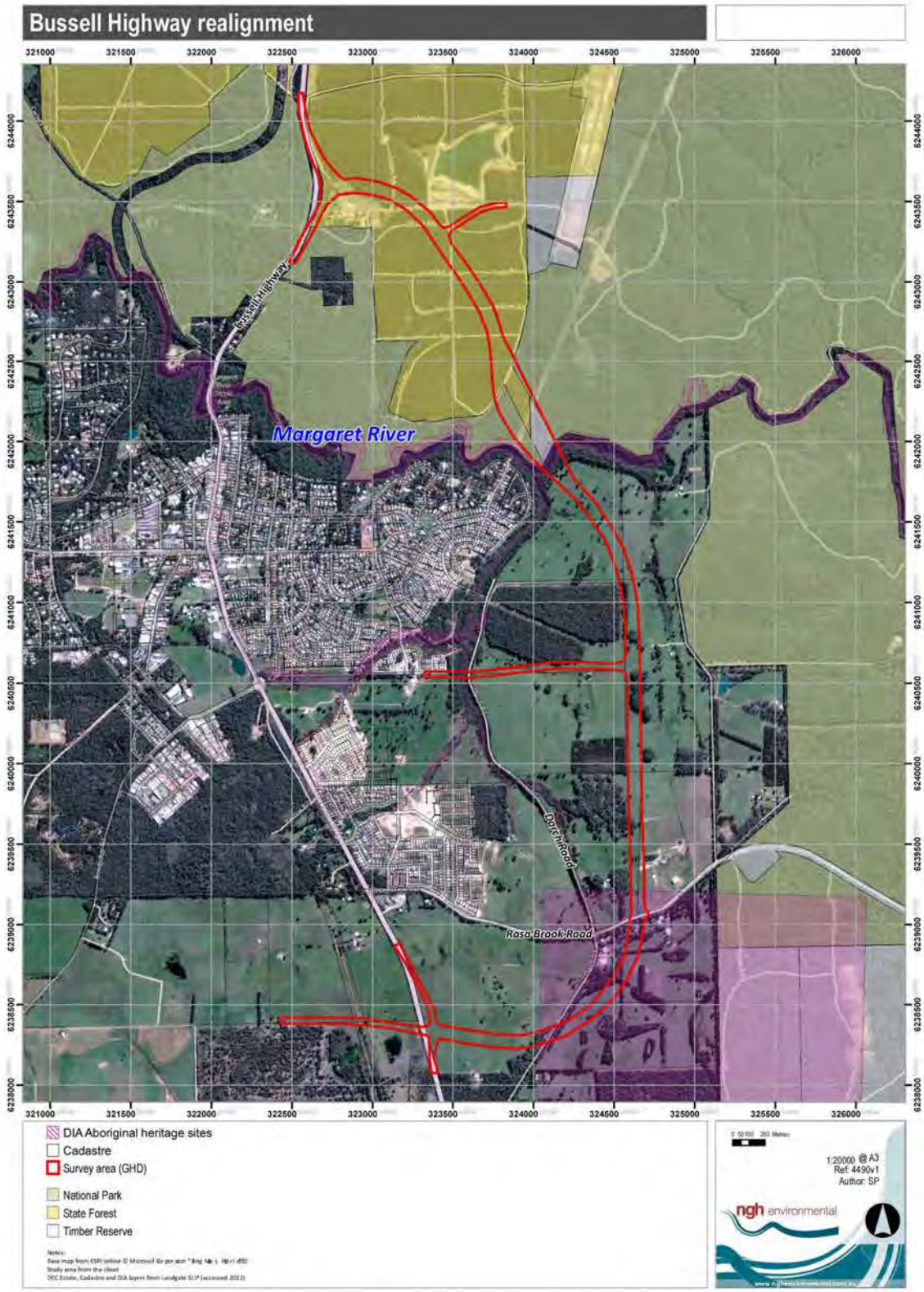

Figure 1: Location of the survey area.

ETHNOGRAPHIC & HISTORICAL BACKGROUND

TRADITIONAL NYUNGAR CULTURE

The southwest of Western Australia is considered to form a distinct cultural bloc defined by the distribution of the Nyungar language. Before Nyungar was used as a group or linguistic name the southwest people recognised themselves, their language and culture, as 'Bibbulmun' (Bates 1985). Daisy Bates writes that the Bibbulmun people were the largest homogenous group in Australia. Their land took in everything to the west of a line drawn from Jurien Bay on the west coast to Esperance on the south coast (Bates 1966). Bates also mentions that over seventy groups that shared a common language and some local variations occupied the Bibbulmun area.

> All coastal *Bibbulmun* were *Waddarn-di* – sea people, and called themselves, and were called by their inland neighbours, *Waddarn-di Bibbulmun*. The inland tribes were distinguished by the character of the country they occupied. They were either *Bilgur* (river people, beel or bil-river), *Darbalung* (estuary people), or *Buyun-gur* (hill people – buya-rock, stone, hill), but all were *Bibbulmun* [*Nyungar*] (Bates 1985:47).

Tindale (1974) identified thirteen 'tribal groups' in the southwest based on socio-linguistic boundaries and minor dialect differences. He describes the *Pibblemen Bibbulmun's* territory as 'the lower Blackwood River, chiefly on the hills between the Blackwood and the Warren Rivers, east to the Gardner River and Broke inlet; on Scott River; inland to Manjimup and Bridgetown'. The *Pibblemen* people maintained a number of paths between the Vasse area in the north and Augusta to the south, and as far as Bridgetown to the east, which followed the Blackwood River.

The Nyungar or Bibbulmun people of the south-west were a distinct group in that their initiation practices varied markedly from their desert and semi-desert dwelling neighbours. Unlike the desert people, the Nyungars did not practice circumcision or sub-incision, but rather practiced a ritual of nasal septum piercing and cicatrisation of the upper body (Bates 1985: 151-162). The people who followed these socio-religious practices have been described by Berndt and Berndt (1979), as being of the 'Old Australian Tradition'.

Within the Bibbulmun, two primary moiety divisions existed, the *Manichmat* or 'fair people of the white cockatoo' and *Wordungmat* or 'dark people of the crow', which were the basis of marriage between a further four class subdivisions: *Tondarrup, Didarruk* and *Ballaruk, Nagarnook* (Bates 1985). Bates describes the only lawful marriage between the groups to be "the cross-cousin marriage of paternal aunts' children to the maternal uncles' children", and states that the four clan groups and relationships, under different names, are "identical in every tribe in Western Australia, east, north, south and southwest…" (Bates 1966:24-25).

Each socio-linguistic group, sometimes referred to as the 'tribe', consisted of a number of smaller groups. Each of these smaller groups was made up of around 12 to 30 persons, related men, their wives and children and, at times, visiting relatives from other groups. These subgroups could be described as a family, a band or a horde. For every subgroup there was a tract of land with which they most closely identified themselves with, an individual or a group's land was called their *Kalla* or fireplace (Moore 1884). This referred to an area of land which the group used and over which the members of the group exercised the greatest rights to its resources. It was also the area for which the group would act as custodians of. Other groups would also have some rights of access and use gained through marriage.

> Ownership rights to land were held by groups of people linked through common descent; there was definite ownership of land in both social and personal ways. As well as belonging to a local descent group by birth, each individual simultaneously belonged to an economic or food gathering group (Le Souef 1993:30).

There are two forms of socially organised relationships to the land, a spiritual association and an economic one. Stanner (1965) uses the terms 'estate' and 'range' to distinguish these two different associations, he writes that the 'range' was that land in which the group 'ordinarily hunted and foraged to maintain life'. The 'estate' refers to the spiritual country and which may be 'owned' by either an individual, by the group or by part of the group. The relationship to 'estate' is mostly religious; however there is also an economic benefit. The estate can be considered the country or home of a group. It is sometimes referred to as the 'Dreaming place' and as such includes all religious sites, myths and rituals that occur on or about that land. In this way 'estate' forms part of the Aboriginal ties to Dreaming and place (Stanner 1965).

> There is a clear relationship between the individual and the land, which is expressed in a number of ways. There is a direct link between the mythic heroes and spirits of the dreaming and the land. Relationships with these beings, which are transmitted through birth, descent and marriage (to a lesser extent), are a reciprocal arrangement of rights and obligations and they are vital for claiming rights to the land (Silberbauer 1994:124).

The link between the individual and the land comes from the conception site, where the animating spirit enters the mother and thus there is a direct connection between the land, spirit and the identity of the individual (Machin 1996). The spiritual ties with the land strengthened economic rights and land usage involved both ritual and social connections (McDonald *et al.*, 1995). Land use or ownership in traditional Aboriginal Australia is based on a religious view of the world and the position of people in it. This religious view is most often referred to as the Dreaming; the Dreaming is an ideological and philosophical basis for a close emotional connection between Aborigines and their land (Machin 1996). The Dreaming refers to a distant past when the world had yet to be fully created. Dreamtime stories refer to mythic beings that roamed the Earth creating plant and animal species. During the struggles of these mythic beings many landforms such as hills and rivers were created. The landscape bears testimony to the struggles of creation and is studded with sacred sites recalling the Dreamtime. These sites are owned by or belong to either one or more groups, and so such sites have a shared significance amongst the local population. The shared spiritual significance of these sites had a function of bringing together different groups. Another function of these shared sites is that knowledge of the local myths created rights of use to the land.

> Rights are recognized through active social relations, a process symbolized through the possession of knowledge. That is, knowledge is only gained through participation in social relations and rights to the land are reliant on the possession of relevant religious knowledge (Machin 1996:11).

Traditionally, the Bibbulmun Nyungar people recognized six different seasons in the year. Each of these seasons coincided with a particular seasonal abundance of a wide variety of food resources. Fish traps such as the well documented Barragup Fish Trap were used to catch large migrations of estuarine and river fish. These fish traps were so efficient at providing food that they formed the basis of regular meetings between neighbouring groups and were a focus of cultural activities (Contos et al 1998; Bates 1985). Spears *Gidji-garbel & Gidgie-borryl,* axes *Kadjo* and digging sticks *Wonna,* were used to hunt and procure food (Berndt 1979; Tilbrook 1983). Trees known to contain bird's nests or possum hollows or to have hives with native honey in them had notches cut into their trunks to facilitate climbing. The Bibbulmun Nyungars had an extensive knowledge of plants for both food and medicinal uses (Bird & Beeck 1988; Meagher 1974).

SETTLEMENT AND SOCIAL DISRUPTION

Prior to settlement in Western Australia, the Dutch and the French, as well as sealers and whalers of mixed nationalities, had already landed and made contact with the local Aborigines. From the beginning of the 17th century the Dutch had been sailing north along the Western Australian coast en route to the Dutch East Indies, and ships were often forced close to the coast by the prevailing south westerly winds. Many who realized their proximity to the coast too late came to grief there. The early reports by the Dutch described the coast as a bleak and desolate place. Apart from some expeditions to try and rescue shipwrecked sailors, the Dutch showed little interest in Australia (McDonald et al., 1995).

The Dutch flute *Elburgh* is reported to have recorded the first brief description of the Aborigines near Cape Leeuwin in 1659:

> "An armed party sighted three Nyungar Aborigines wearing kangaroo skin cloaks. At the sight of the European sailors, the tribesmen ran off into the bush leaving behind spears and small axes" (Creswell 1989).

Contacts were also made by the whalers and sealers who visited the coast to take on water. The sailors were also interested in the local females, and this interest was discovered by the first settlers to the Augusta region when the local Aboriginal group used the English word 'woman' when referring to females (Shann 1926). Two further items point to considerable pre-colonization contact with whalers, the first being that in 1827, Major Lockyer of the Albany garrison 'reported incidents of Aboriginal women being found on offshore islands, kidnapped and then abandoned by the sealers'. Secondly, when the first French and British expeditions of the late 17th and early 18th centuries did contact local Aborigines, they reported that while the men were approachable and friendly, they kept their women and children hidden or some distance away (Colwell 1970).

The first 'settlement' in Western Australia was the establishment of a garrison of soldiers at King George Sound in 1827. In 1829 the Swan River colony was founded and the settlement of Augusta took place in 1830. Initially relations between the Aborigines and the settlers were friendly; the Nyungar people showed the settlers to water sources and the Europeans shared game shot while being guided by the Nyungar men (Shann 1926). On the 1st of May 1830, the schooner *Emily Taylor* dropped anchor in Flinders Bay close by what is now Augusta. On board were the first settlers who were to create the town of Augusta, the Molloy, Bussell and Turner families and their servants, Dr Green, Sgt Guerin and a detachment of soldiers (Pickering, 1929; Turner, 1956). Horses, cattle, machinery, merchandise and general stores of every description were rafted ashore through the surf. Turner (1956) recounts:

> While these strange operations were being enacted, natives lurked curiously in the background, watching every movement; it was something entirely new to them. The natives were timid and shy, but to cover this they 'simulated rage,' gesticulated and jabbered at the intrusion on their domain; but the settlers advanced, calling '*abba abba*' and some of the few aborigine words they had already learned, and by offering a few trinkets and with friendly signs they soon established peace, and some natives led them to a 'soak', no doubt the spring so often referred to later (Turner 1956:89).

Berndt (1979) suggests that the Aboriginals believed that the first European settlers, because of their light skin colour, were souls of the dead (*djanga*) returned from *Kurannup*, the home of the Bibbulmun dead located beyond the western sea. He describes:

> "…the *kanya* (soul of the newly dead) going first to the *tabu-ed moojarr* or *moodurt* tree (*Nuytsia floribunda* or Christmas tree), where it rested on its way to Kurannup…here, their old skins were discarded and they appeared 'white'" (Berndt 1979:86).

Many of the tracks created by the Nyungar people were used by the early settlers to explore the land and eventually to create the basis for roads upon these tracks, many of which still follow similar alignments. Not only do the original paths used by the Nyungar people often coincide with existing road alignments but often link traditional areas of importance which are now the location of town sites (Collard 1994). Augusta, Busselton and Bunbury, formally known as *Talanup, Yoonberup* and *Koombanup* by the Nyungar people, were important regional areas providing good hunting and food gathering opportunities. The settlers in Augusta employed the local Nyungars as guides and trackers and used the Nyungar paths through the bush to reach the Vasse district (Jennings 1983).

In November of 1833, Georgina Molloy wrote to a friend in England that the Aborigines in Augusta were 'fond' of the settlers, and that the settlers and Aborigines lived "on the most peaceful terms". In the same letter, which took four months to complete, she writes of "being troubled with natives who, though amiable, required watching in case of theft" (Pickering, 1929:47). Whilst relations between the settlers and the Aborigines began amiable, pilfering of food and implements soon tested this. Early in 1834, an incident occurred in which a group of around 30 Aborigines attempted to intimidate Mrs Molloy and Fanny Bussell whilst Captain Molloy and other male members of the settlement were absent. The Aborigines attempted to take a tablecloth and some potatoes before Mrs Molloy's servant Dawson (the only male present) produced a pistol and a rifle that scared the aborigines off. From the Molloy house the Aborigines went to Miss Bussell's house from where they took three salt sellers. The Aborigines valued glass (*dillilah*) for pointing their spears. When the theft was discovered the settlers had the garrison of soldiers apprehend the Aborigines. There was an exchange in which the soldiers either threatened to shoot or to bayonet the women or woman responsible (the two accounts from Mrs Molloy and Miss Bussell vary in detail). The salt sellers were recovered without any actual violence-taking place, yet it marked a significant worsening of relations between the Aborigines and the settlers (Pickering 1929; letter of Fanny Bussell dated 16/2/1834). Georgina Molloy wrote of the incident:

> "I am sure if Dawson had not been present, Mrs. Dawson and I and the poor children would have been murdered or otherwise injured, for it seemed that mans full intention to prevent me leaving my own premises. It gave me a great fright" (Pickering 1929).

In 1837, three Nyungar men were killed as a reprisal for the theft of a heifer, in the same year a house belonging to the Turner family in Augusta was burnt to the ground and the Government store was raided (Jennings 1983). As the settlers expanded their farming operations and took up more and more land, the pressure on the Nyungar people increased as the two lifestyles met. Cattle were speared and settlers attacked. Reprisals led to resentment and conflict replaced the early good will. On June 28, 1837, Lennox Bussell wrote a letter to Captain Molloy in Augusta describing the killing of three Nyungar men as a reprisal for the Aboriginal people taking a heifer (Jennings 1983). On July 9, he wrote again to Captain Molloy about the reprisals.

> ….I do not view the present daring outrage (The *taking of the heifer*) as a mere breach of the law but as an act of open hostility and defiance… we have inflicted upon the offenders the only adequate punishment in our power… Let us first convince them of their inferiority and then extend to them our protection and it will be gratefully accepted, otherwise with the vanity inherent in a savage, they will fling back the proffered gift and considering every act of forbearance a confession of weakness and inability, will cause in their final subjection which sooner or later must be effected, a sacrifice of life on both sides double or treble to what would have befallen if severer measures had been adopted from the first (Letter to Captain Molloy from Lennox Bussell, dated July 9, 1837, cited in Jennings 1983).

As the settlers demand for labour increased, Aboriginal people were employed as farm labour and domestic help in exchange for goods such as flour, sugar and tobacco. The Aborigines became increasingly dependent on these European food supplements and, whilst still practicing some aspects of their traditional economies, the traditional lifestyle of the Nyungar people may have ended as early as the 1860's (Berndt and Berndt 1979). This relationship between the settlers and the local tribes spelt the beginning of the end for the Aborigines 'fully traditional economies' (Moore 1989).

Hamelin Bay became a port for ships loading timber cut in the Karridale area in 1875 when Willie Eldridge was granted a fourteen year lease to cut timber in a 75000 acre area around Augusta-Hamelin. There were no facilities to load the ships and the timber was towed into the water by oxen and then loaded onto lighters (sailing barges) to be loaded on the ships. After losing one ship and cargo, and unable to find either markets or financial backing, Eldridge was forced to admit defeat. He was, however, responsible for erecting buildings, building roads and establishing Hamelin Bay as a shipping harbour and base for a business (Creswell 1989). Maurice Cole Davies followed Eldridge in expanding the timber industry in the region. M C Davies took over Eldridge's expired lease in 1878 and in 1881 had laid a rail line linking Boranup and Hamelin Bay, in 1882 construction began on a 1800 foot long jetty at Hamelin Bay. Many miles of rail line were laid linking mills to Hamelin Bay, which rapidly became a thriving port. In 1885 Hamelin Bay was a 'considerable township'. Around 1895 the Cape Leeuwin lighthouse was commissioned and completed in 1896. One person known to have worked on the lighthouse was Joe Hill who was an expiree (a convict who had served his time) employed to drive a bullock team carting stone (Creswell 1989). Mr Joe Hill is a European ancestor of several Busselton Nyungar families. M C Davies successfully tendered for the construction of the original Alexander Bridge was 400 feet (122 meters) long and seventeen spans wide. The original bridge was located a short distance upstream from the present bridge and much of its structure survived until 1982 when a summer flood destroyed it. It's location has been a popular picnic and bream fishing spot for many years (Creswell 1989). As a shipping port and timber town, Karridale and Port Hamelin lasted around 35 years. By 1910, most of the best timber in the area has been removed and the mill at Karridale has closed. With the mill closed, Karridale almost disappeared overnight (Creswell 1989). As work on the timber mill finished, the Nyungar people who worked there moved with the industry to other locations. Busselton and the Geographe Bay area also provided other employment opportunities.

> In all likelihood the Aboriginal population of the area was attracted to the towns, timber camps and homesteads between the 1860's and 1880's, although as suggested above, a certain degree of mobility may have been maintained with Aboriginal people travelling as itinerant seasonal labourers. Mervyn Longbottom, a long time resident at Darradup, recalled that about the turn of the century there were still Aboriginal groups moving about that area, using traditional foods and camping places. Although they still had some traditional tools, they had European clothes and no longer wore skin cloaks. He also recalled that two hundred or so Aboriginal people would annually pass across the Darradup ford en-route to visit a 'king' at Karridale (Hallam 1979 cited in Gibbs 1989).

Aborigines were seen throughout Western Australia as a convenient source of labour which required little, if any, payment for work, even though the early settlers often relied on the extra labour the Aborigines were able to provide to establish European farming techniques. During the course of a parliamentary debate in 1883, John Forrest stated that, 'Colonization would go on with very slow strides if we had no natives to assist us' (Goddard and Stannage 1984). In 1898, John Forrest wrote a circular to the Aborigines department stating the 'care and protection' of Aborigines had now 'developed on the Government' and that, while the Government and its bureaucracies must provide help to aged and sick Aborigines, it was to be given' with due regard given to the practice of strict economy'. In the same circular, Forrest

takes care to point out that 'no able bodied natives who can provide for their own maintenance should receive rations' (Battye Library Busselton Court House records. ACC #594).

Missionary work had begun as early as 1840, and in 1841 the Reverend George King went 'amongst the blacks and collected eighteen children' aged between five and ten. It was his belief that the children could be 'civilized' only if they were kept away from 'the dark influences of the wandering tribe' (Barley 1984). The missionaries took children from their parents and interfered with traditional marriage arrangements in order to remove their 'converts' from the influences of traditional Aboriginal culture.

The hardships facing the Aboriginal people steadily increased as their mode of life clashed with European notions of farming. Some settlers complained about Aboriginal hunting and fishing practices. Fish traps such as those at Wonnerup and Augusta were traditionally very important to the Nyungars, providing a means to feed large numbers of people. The fish traps were often the reason Nyungars visited certain locations, to take advantage of seasonal runs of fish, which provided enough food to enable large ceremonial gatherings. The settlers destroyed many fish traps in an effort to discourage Aboriginal people from coming onto land, which was being farmed or otherwise occupied by the settlers. The weir type fish traps built by the Nyungar people were also sometimes a hazard to navigation and destroyed because of this. In 1899, the Government passed a law prohibiting the building or use of fish traps, which caused a considerable blow to the traditional Nyungar economy (Tilbrook 1983).

During the late 1800's and early 1900's, the Government passed a series of Acts which increasingly eroded the Aboriginal people's civil liberties. The Industrial Schools Act (1874) empowered managers of Aboriginal Missions to keep Aboriginal children to the age of 21 and place them as domestic servants or apprentices without their parent's permission. The Aborigines Protection Act (1886) introduced controls over Aboriginal employment. In 1889, the Constitution Act was introduced, it specified that 5000 pounds or 1% of the annual colonial gross revenue, whichever was greater, was to be used to provide for the Aborigines. The Aborigines Act (1897) repealed the Constitution Act (1889) and transferred control of Aboriginal affairs to the West Australian Government, which acted through the Aborigines Department, formed in the same year. Following the Roth Royal Commission in 1904, in which Roth described the Western Australian Police's treatment of Aborigines as 'most brutal and outrageous' and described the conditions experienced by many Aborigines as 'resembling cruelties committed in the Dark Ages', the Aborigines Act (1905) was introduced (Haebich 1988). The Aborigines Act (1905) allowed the Government to remove Aboriginal people to live in mission camps such as Roelands and Carrolup, and to control many aspects of their lives including marriage and employment. Other hardships for the Aboriginal population included the Dog Act (1885), which forced Aborigines to license their dogs or risk their destruction. As the Nyungar people used the dogs to aid in hunting and providing for themselves, the Dog Act (1885) represented a blow to their means of survival.

Nyungar people adapted to the new conditions as best they could, obtaining mostly short term seasonal work as stock workers, domestic help, farm labourers and foresters (Haebich 1988).

Fringe camps occurred on the outskirts of towns as Aboriginal people followed 'runs' from one area of seasonal employment to another. Many Aboriginal people lived in the bush between jobs, surviving on whatever game or bush tucker was seasonally abundant (Tilbrook 1983). Those Aborigines who were working as farm labour and domestic help found that competition for employment increased suddenly with the influx of people attracted to Western Australia during the gold rushes of the 1880's and 1890's (Tilbrook 1983).

Further inequity saw the Aboriginal unemployed receive a lower sustenance rate than the white unemployed during the Depression of the 1930's. Living more or less permanently in fringe camps, seeking out seasonal employment and supplementing their diet with game, fish and

some bush tucker was a lifestyle, which predominated for the Aboriginal people late into the 1960's (McDonald 1995). In 1965, when two Busselton Nyungar families were moved from 'miserable primitive humpies' to government housing, the newspaper article which reported the move stated that, "although the men were hard and conscientious workers, they had never been able to secure *permanent* employment" (West Australian 29/4/1965). Many of the southwest's Nyungar people have lived in fringe camps at some time during their life, creating a living for themselves doing seasonal work and often supplementing their diet with fresh caught fish from the ocean.

WATER AND ABORIGINAL SIGNIFICANCE

There is no doubt that water, especially fresh water was of vital importance to traditional Aboriginal people right across Australia, the rivers, pools and wetlands were a source of food, linked campsites along walk tracks and in the case of the Blackwood River defined the territories or estates of the *Pibblemen* and *Wardandi* people (Hallam 1979). As the Blackwood River, particularly in the lower reaches created an impassable barrier to people without boats the places where the river could be crossed (Hut Pool and the mouth near Augusta) created an intersection of tracks and as such became focal points of traditional camps where ritual activity often took place. At Hut pool Mrs Vilma Webb (per com 2005) said that this ford was a place where the trading of women from the *Pibblemen* to *Wardandi* would take place for betrothals. Gibbs (1989) drawing upon the writings of Bates states that a number of theses paths were maintained as initiate's tracks, with one of the longest following the Blackwood River south from Augusta through Nannup, Demark, Albany and eventually to Ongerup. Other paths from the Vasse Estuary followed the St John Brook to Barrabup Pool and then south along the Milyeannup Brook to Lake Jasper (Collard 1994; Kelly per com 2004). Camps along these water courses were often places that had Nyungar names and were noted by the first Europeans' early maps.

> It should also be recognised that a large number of Aboriginal names have been perpetuated in modern maps, although their original contexts and meanings are unknown. An examination of older maps, such as the 40 chain series held in the Battye Library, do not reveal much more detail, although a limited number of specific features, *especially springs and watercourses*, do have Aboriginal names indicated….Kwaggamai'erup [spring near Nannup], Dallatgurup [part of the Blackwood River, Kweelyjup [lower Blackwood], Eedagulup [River bar Blackwood] (Gibbs 1995).

The Regions Rivers were also important sources of food. Marron and other fresh water Cray fish were an important food source that was caught in the pools along rivers and creeks throughout the region. Fish traps were also constructed on creeks, in rivers and in the tidal zones of estuaries. As these were efficient and abundant, harvests could be made. These places also created focal points for traditional ceremonial activity where large gatherings of Nyungar could be maintained (Gibbs 1995).

Archaeological research in the South West has also confirmed that all water sources were important to prehistoric traditional Aboriginal people for campsites and food procurement activities. Archaeologists have recognised there is a higher likelihood of finding artefacts from prehistoric campsites around freshwater sources, such as rivers, creeks, lakes and estuaries. Lake Jasper for example has a rich archaeological record with 10 such sites found upon the lake bed and margins showing such camps prior to the formation of the lake some 4,000 years ago. Charles Dortch from the W.A. Museum said that these sites were extremely significant sites to the understanding of the region's pre-historic Aboriginal settlement patterns. They represent camps that have been in use upon the wooded margins of a stream prior to the area becoming inundated by the formation of the lake some 4,000 years ago when sand dunes moved into the area and blocked the stream, flooding the area.

> The submerged stone artefact scatters at Lake Jasper, at least those at depths sufficiently great that one can be reasonably satisfied that they have remained permanently underwater, differ from those in terrestrial open-air sites in that they have been 'sealed' by their submergence, with definite cut-off dates corresponding to the time when the surrounding trees or other plants were flooded and died. This, of course, provides a minimum age for the artefacts, and thus the temporal control necessary for determining their actual radiocarbon age, by means of excavation, using delicate suction techniques capable of removing sandy sediments in 1 or 2cm levels. Radiocarbon dating of charcoal or other datable material in situ in the upper parts of such lake floor excavations can show whether the artefacts exposed on the lake floor are contemporaneous with the dated stumps in situ in it. Once this was established, it would be possible, in a programme of species identification of plotted trees and other plants, to reconstruct the plant associations or habitats surrounding the archaeological sites, creating an unquestionably valuable record of uncontaminated late Middle Holocene or older campsites in their formerly terrestrial settings, and having the potential for the preservation underwater of wooden implements and other organic remains associated with human activities (Dortch 1990:7).

The records of registered archaeological sites upon the DIA sites register also confirms that within the study area most artefact sites are located upon or in the vicinity of the area's water ways.

From the archaeological and ethno-historic records from the region Dortch (2002) has also developed a prehistoric model of hunter-gatherer socio-economic and territorial organization in the southwest coastal regions. In this model Dortch concludes that the distribution of topographical features such as estuaries, rivers and wetlands would have had a strong bearing on the population distribution; "rivers, wetlands and lakes, dune fields, escarpments and other topographical features that certainly would have influenced the positioning of estate boundaries and band foraging ranges were seen as focal points for activity with major topographical features such as the Blackwood river as being important cultural boundaries between Aboriginal groups" (Dortch 2002). In regards to this last point O'Connor writes;

> Archaeologists and Anthropologists generally agree that prehistoric land use patterns were based on the seasonal migrations between the coastal plain and its hinterland to exploit the various food and water resources. There is a tendency, in all parts of the project area, for sites to be located near the various water sources, such as rivers, creeks, lakes, swamps and estuaries. Based on the existing information, the most important river systems in the project area are the Busselton Drainage Basins, Margaret River and the lower Blackwood River (O'Connor et al 1995).

Comparative studies with regards to the significance of water that have been conducted in the Northern Territory where it has been found that water bodies also served the above cultural functions as focal points for resource activity and ritual aggregations. In these studies water bodies also almost always had mythic dimensions. Studies by Barber and Rumley (2003), Langton (2002), Toussaint et al (2001) and Yu (2000), state that Aboriginal people as with the land conceptualize that water sources such as rivers, lakes and wetlands have derived from the Dreaming, a time when the world attained its present shape. These studies emphasise the importance of stories about the actions of mythic beings in the origin and maintenance of such water sources. In these stories cultural affiliations to water are expressed in many ways, through social etiquette, narratives about places, rituals and practices of such rituals. Water is described as the living element that both creates and defines the shape and character of the country and gives it sacredness and identity (Jackson 2004).

In the south west of Western Australia several early writers recorded parts of the Aboriginal mythology about water, however clearly a lot of knowledge and stories have been lost in the

years since settlement and no complete record of traditional mythology was ever made. Many of the European observers did note the importance of water to the traditional people and that water also occupied a place in the traditional mythology. The small parts of mythology recorded and references to the *Waugal* or a snake like spirit of water are widespread both throughout the south west of Western Australia and other parts of Australia. Bates (1966) recorded that in the southwest: "Their only deity was a *Waugal* or serpent-god that dominated the earth, the sky, the sea, and punished evil doers" (ibid 1996).

> All permanent native waters have legends attached to them, legends of the "dream" time, which go back to the days when birds and animals possessed human attributes, or were human beings, or were groups of which the bird or animal was representative, or were magic animals and birds possessing the power of human speech. The natives cannot say that the "founders" of the various permanent waters were altogether human, although birds or beasts, or half bird half human, but the bird or animal name only is always given in the legend never a human name (Bates 1966:157).

Another reference to the *Waugal* or snake like spirit of water was recorded by Salvado (1850) and indicates the fear or reverence with which Aboriginal people regard the spirit of water and also the harmful powers of the 'serpent'.

> If the natives are afraid to walk about at night time, for fear of *Cienga*, they dread even more going near large pools of water, in which they believe there lurks a great serpent called '*Uocol*' [*Waugal*], who kills them if they dare to drink there or draw water during the night. A large number of natives came to me one evening asking for water. The first ones took all I had and drank it, and the others, about fifteen of them, asked me to go to the pool nearby to get some for them. I showed them the bucket and told them to go themselves. They all fell silent, and no one dared take the bucket, or tell me what they were afraid of, until, about an hour later, one of them said respectfully: '*N-alla cape uoto, chetchet cuaragn: nunda uoto quaragn iuad*' (If we go and take water, very soon we will be killed, but if you go, you will be alright). I saw quickly that they had some superstition on the subject, and said that I would go with them, with the idea of banishing their false fears. As we went to the pool or stream, they made me go ahead, and all followed me in single file, in deep silence. While they were quenching their thirst, I started to move away, but immediately they shouted, '*Nanap, nanap*' ('Stop, stop'), fearing that I was going to leave them on their own. As we began to go back to the hut, they ran ahead and preceded me, again in single file, so that I came last. When I reproached them for their superstitious ideas, they replied condescendingly: '*Nunda tonga but*' ('You don't know anything about it'). However much the natives of both sexes like to swim 'dog-paddle' style in summer, they will never go into water that is dark and deep, because they say that the serpent *Uocol* is there, and they are afraid of him even during the daytime (Salvado 1850).

Salvado (1850) recorded that the Aborigines 'hide carefully from strangers their customs and, in particular, their beliefs'. Moore (1842) described the *Waugal* as a 'huge winged serpent' that lived in dark waters and was feared as a harmful force. A woman who fell ill or miscarried during a pregnancy was called *Waugalan*. The *Waugal* is of particular danger to pregnant women and so associated with fertility if in a harmful rather than replenishing manner.

Not all of the stories regarding the creation of water sources or rivers in the southwest and wider Nyungar territory involve the *Waugal* or snake like spirit of water. In a story regarding the creation of the Margaret River a magic stick is the means of transformation or creation of the Margaret River.

The native name of the Margaret River was *Wooditchup*, named after *Wooditch*, who made the River with his magic wand. Nearby is Milyanup, the place of *Milyan*, the wife of *Wooditch*, and daughter of *Ngungaroot*. *Milyan*, who was a very fine looking young woman, fell in love with the *Wooditch*. *Wooditch* was a medicine man who was known as the '*Mulgar Kattuck'* which means 'medicine power possessor'. He could transform one thing into another and do almost anything he chose by a mere touch of his magic wand. *Wooditch* became violently in love with *Milyan* the moment he saw her. He forthwith made know his desires to *Ngungaroot* her father. The old man became very wrath and said that his daughter was already promised to *Wooditch's* eldest brother, *Ngorable*, and that as soon as *Ngorable* came down from *Dudinalup* she would be handed over to him for his lawful wife. *Wooditch* was not deterred by this reply, as he was quite confident that *Milyan* loved him better than any man she had ever seen. He decided to employ his wonderful magic to get her for his wife. For some considerable time he very cautiously watched the movements of *Ngungaroot* and his daughter. One night, before the moon rose, the old man *Ngungaroot* got up, gathered all his equipment, his pear, axe, boomerang, hunting knife and digging stick, awakened *Milyan*, and bade her to take her skin bag and follow him. By midday, they reached the *Kalkardup* country. There the old man mysteriously fell asleep. While he slumbered, *Wooditch*, who, by his magic power, had sent the old man to sleep, made his appearance to *Milyan*, and beckoned her to follow him quickly. After a few minutes, *Ngungaroot* awoke, sprang to his feet, and finding *Milyan* gone, set off in search of her. He picked up her tracks and would soon have overhauled the runaways but *Wooditch*, seeing him coming with his beard in his mouth, muttering curses and preparing his weapons to strike, again exercised the power of his magic wand. He placed the wand upon the ground and commanded a big river to run between them. The old man was dumbfounded. Being a man of great strength, he pulled up large trees by the roots and threw them across the river, but the current was so strong that it washed them down the stream. When the afternoon was half gone, the two enemies, walking on opposite banks of the stream, reached the ocean, where *Wooditch* gave river a lead into the sea. The water was running so swiftly that *Ngungaroot* was still unable to cross and remained on the other side of the river, yelling his curses to the runaways on the opposite bank. *Wooditch* and *Milyan* were now very hungry, and decided to go out on to the reefs at the mouth of the river, to spear groper, which were very plentiful there. They set off, leaving *Ngungaroot* still raging at the other side of the river. After a while, the rushing waters subsided and *Ngungaroot* managed to get over to where the young people were. He was on the point of seizing his daughter, when *Wooditch* struck him with the magic wand and turned him into a groper, which disappeared into a deep hole in the reef. As the couple returned to the wide beach in order to make a fire to roast their fish, *Wooditch* speared a big groper which was swimming close to the shore. He left it with his wand leaning against it while he helped *Milyan* to roast the other fish. While they were eating their fish, *Wooditch* began to feel very sorry he turned the old man into a groper, for *Milyan* kept bursting into tears over the loss of her father. He told her that if the big fish beside him should happen to the groper who had been her father, he wished it would turn into the old man again. Immediately, the transformation took place, and *Ngungaroot* was restored to them. He was now resigned to the union of *Milyan* and the powerful *Wooditch*. They left the neighbourhood and lived happily for many years at a place which has ever since been known as *Milyanup*. When *Ngungaroot* got very old they went back to *Wooditchup* and lived by the river that *Wooditch* had made. After they had been there a little while, one day *Ngungaroot* went into a cave and died. The cave is on the eastern end of the cliff at Walcliffe on the Margaret River. This place is '*Wainilyinup*' or 'the place where the old man died' (Buller-Murphy 1959).

Another story that is believed to have been recorded in the Kojonup district tells of a crow and a hawk creating a fresh water soak.

> …Dinah, the mother of the late, distinctive Ted Smith, told (him) this legend of the Kojonup district. The country was gripped in drought and the only known water was salty. The health of the parched Aborigines, birds and animals deteriorated. An eagle-hawk, soaring about the sky and swooping to earth, observed that a fat and shiny crow had a wet beak, wet with fresh water. The eagle-hawk, seething with unparalleled fury, attacked the cunning crow. In so doing his claws split the rocks and the blood of the attacked crow was splattered over the surrounding rocks and earth. So, a fresh water soak is to be found in the Wakhinup area, hidden amid rocks and surrounded by rich, red loam (Bignell 1971).

Another story that was related to the current researcher, by Doc Reynolds an Esperance traditional owner was about the creation of the Young River near Esperance. This story also involves the action of an eagle and a crow. Reynolds states:

> The Noongar people camped along the banks of the Young River, because the Eagle chased them all away from the fresh water. He wanted to keep it all for himself and not share with anyone. One day all the fresh water dried up. The eye of the crows which were the people had all turned white because they were forced to drink salty water. The Crow and Eagle then had a big fight and the Crow speared the Eagle and killed him. The Eagles wife, the Mallee Hen dragged his body way down to the estuary of the river and buried his body on the east side. Because of the Mallee Hens scratching up of all the sand to bury her husband, her foot markings can still be seen today. The hill on the east side looks like a Mallee Hens nest, were the '*walitj*' is buried (Doc Reynolds, per com; Goode 2005).

Despite these and no doubt other such tales about the moral aspects of water the predominant theme with regards to water is the Serpent mythology. Radcliffe-Brown (1926) wrote about 'the Rainbow Serpent Myth of Australia'. He wrote that throughout Australia there is a belief in 'a huge serpent, which lives in certain pools or water holes'. He wrote that the serpent was sometimes associated with the rainbow and it could also occur or be seen as "a wavy dark shadow" in the Milky Way. Certain commonalties exist in the myth of a serpent type creature that has creative and punitive powers and that lives in dark or deep pools of water. Radcliffe-Brown points out the similarities of this widespread myth, although throughout his article he refers to different names and different attributes of the 'Rainbow serpent' in different regions.

> I have been able to trace the belief in the rainbow-serpent, living in deep, permanent water holes, through all the tribes from the extreme southwest at least as far north as the Ninety Mile Beach and eastward into the desert. In the tribes around Perth it is called *wogal*, and certain water holes are pointed out as being each the abode of a *wogal*. It is regarded as dangerous for anyone except a medicine man to approach such a water hole, as the serpent is likely to attack those who venture near its haunts. "It generally attacks females, and the person whom it selects for its victim pines away and dies almost imperceptibly. To this creatures influence the aborigine's attribute all sore and wounds for which they cannot otherwise account (Radcliffe-Brown 1926).

The notion of a serpent type deity associated with water also occurs throughout the northern and eastern parts of Australia, at the Daly River in the Northern Territory a serpent like deity is held responsible for the creation of rain and ceremonies are performed to this dreaming character to bring the rain. In this area the deity is the spirit of water, rain and flood that is depicted in the rock art of the Wardaman people who have many sites where hundreds of cuts are incised into the rocks for rain making and to control the cycles of nature governing the monsoonal floods. In the north east goldfields of Western Australia the serpent is called the *Tjilia or the two carpet*

snakes. This dreaming track is associated with the creation of the vital waters thought out the Western Desert, and there are numerous highly secret, scarred sites located upon this track which are important ceremonial centres. Lake Miranda is an important site where this serpent deity resides as is Logan spring in the Bar Smith ranges near Wiluna (Liberman 1976). The Rainbow serpent as a spirit creature is believed to have excavated the beds of the rivers during its travels throughout Aboriginal Australia. It is often the belief that it had 'reached down from the sky to the waterholes and pools, bringing water to the earth' (Jackson 2004). Throughout Arnhem Land and the Kimberley's the Rainbow Serpent is associated with other myths regarding fertility and is sometimes regarded as male and at others as female (Reed 2001). Other similarities with the Waugal or Marchant include the Rainbow Serpent having powers to harm, particularly those who offended against it.

> "In the beliefs of many Aboriginal tribes, the rains would dry up, the earth would become parched, and life would cease to exist if it were not for the Rainbow Serpent" (Reed 2001).

In the Esperance region the Mythical serpent that created the water ways was the *'norrun'* (tiger snake). Doc Reynolds who related the story, states that:

> Long ago the *Norrun* (tiger snake) awoke from its sleep up north and began his journey towards the coast. The land was bare and desolate. As it moved along, its body pushed up the hills/dunes and went under the ground and back up again all the way along the coast. When the rains came is started to fill up the gullies and the flat areas that then became our creeks/rivers and lakes/swamp areas that today make up "*kepwari*" (Doc Reynolds, per comm; Goode 2005).

Mudrooroo, an Aboriginal writer who has lectured at several Australian Universities offers a contemporary story about the *Waugal* placed in a modern context. The story deals with current social and environmental issues for Nyungar people and the wider community.

> …this is a story about a big snake. European people do not like snakes. They think that they are bad and good for nothing, but to the *Nyoongar* people, the ancestor of all the snakes, the *Waugyal*, was not only good, but long ago made all the rivers and hills and valleys in South Western Australia. The rivers are the tracks he made as he twisted his way along. One of his tracks is the Swan River where this story happened. But before I begin our story, first of all I would like to say that after *Waugyal* had made everything, he went to sleep in a deep part of the river. And he is still there today. Perhaps I should say he *tries* to sleep, for these days there is too much noise and when he is disturbed, he becomes angry and restless and causes trouble. Sometimes he makes all the fish go away and other times he causes boats to capsize. He does not do these things because he is bad, but because people are bad. I'll tell you one thing about the *Waugyal*. *Wadjelas* have studied us and have found that Aborigines all over Australia respect snakes, and they have joined up all these stories about snakes and made something called a rainbow serpent. They say and even tell us that the *Waugyal* is a rainbow serpent, whatever that is. But he isn't. He is a big hairy snake that made the rivers and hills and valleys and then, after he had done this, went to sleep in the deep part of the river. If he is any colour he is black, but when we tell them this, they say he is a Rainbow Serpent and refuse to listen (Mudrooroo *A Snake Story of the Nyoongar People – a Childrens Tale,* in Giblett & Webb 1996).

Ethnographers and anthropologists continue to debate the importance of the *Waugal* or water spirit snake to Nyungar people. Some observers believe that so much of the knowledge about the *Waugal* mythology has been lost, and that what is currently retained by the Nyungar community is severely fragmented. Few stories about the *Waugal* or water spirit/snake are

associated with particular places or features. Most places Aboriginal people identify with the *Waugal* do not have a story or explanation to accompany them.

While Bates (1985:221) reports that the '*woggal*' [*Waugal*] "made all the big rivers of the Southwest" and "wherever it travelled it made a river" she does not indicate that historically all of the watercourses were of the same mythological significance. Rather, Bates (1985:221) notes that around the turn of the last century: "the places where it camped (stayed, entered the land) in these travels were always sacred". That is these earlier reports referred to specific or "certain" places (Bates 1985, Radcliffe- Brown 1926). In contemporary reports, the *Waugal* now does not generally seem to have the same evil or avoidance/sacred (*winnaitch*) qualities as found in earlier reports. In contemporary reports most Nyungar reporting the presence of the *Waugal* are unable to provide any localised or contested mythological/ritual/ ceremonial information with regard to the majority of reported *Waugal* sites. The *Waugal* is now essentially only the benign bringer of water (McDonald 2000).

The Aboriginal Communities views with regards to *Waugal* beliefs have changed over time. Historically the *Waugal* was both a creative and punitive spiritual force and sacred *Waugal* sites were places where the *Waugal* inhabited deep pools and created other features of the landscape such as hills, where it had travelled. McDonald (2000) views this as a modern phenomena and interpretation as being tied to the re-invention of tradition, as those traditional stories have been lost due to western acculturation. In a report by Goode (2003) this modern view of *Waugal* beliefs was referred to as "generalized significance", significance based upon religious beliefs as opposed to contextualized mythology. In both the Perth metropolitan area and the south west most contemporary *Waugal* reports are of a generalized nature, yet in the minds of the Aboriginal informants relating the story the significance of the place or water source has not diminished.

Macintyre et al (2003) states that the continuous chain of lakes from Moore River to Mandurah was believed to have been created by the *Waugal*, the *Waugal* was believed to have created all the rivers, lakes and wetlands in the Perth region. Dobson (2003) goes on to say that;

> The Waugal was not only a creative totemic being but it was also a protector of the environment. According to Nyungar law, springs and gnamma holes could not be drained as it was believed that this would kill the guardian Waugal spirit and cause the water source to dry up permanently. The Waugal was said to be responsible for attracting the rain and keeping water holes and springs replenished. It was seen to be both a destructive and creative force in that it could cause sickness as well as cure illness….At a deeper level Waugal mythology was a metaphor that emphasised the pre-scientific mysteries of the rivers, water sources and the landscape. It also explained how water moved throughout the Swan Coastal Plain as a system of underground streams interlinking wetlands to the rivers and ocean (Dobson 2003:13).

In contemporary times the *Waugal* has become or is seen to be present in all water bodies – it is the benign 'bringer' of water. This change of view is largely based upon Aboriginal people now not knowing the traditional mythical stories about specific places but attributing significance by reading the country and assigning general significance. (Goode 2003a; Villiers 2002) McDonald has described the *Waugal* as having changed or been lessened in meaning, from an entity that made all of the rivers in the past to now 'a benign bringer of water'. Although Bates recorded that the *Waugal* made all of the rivers and watercourses in the southwest it was formally the places where it had camped or where it lived in the land which were the sacred or were *winnaitch* areas. McDonald would seem to be suggesting that formally these places were of greater mythological significance than the other parts of the watercourses. This point of view explains the *Waugal* as being seen in a different way than that recorded by early European observers – Bates and Radcliffe-Brown can be contrasted with another view that sees the *Waugal* as a force in the present tense that is multi-dimensional and more based upon religious philosophy than traditional mythology, contemporary observers such as O'Connor et al. 1989

and Goode 2003a, 2003b have recorded the *Waugal* as a more complex entity and associated with a wider belief system, O'Connor sums it up with this statement;

> The Waugal is not *just* a mythic serpent, an Australian version of the Loch Ness Monster. The Waugal is not *just* a totemic ancestor. The Waugal is not *just* a spiritual being, a semi deity. The Waugal is indeed all of these but is, more fundamentally, a personification, or perhaps more correctly *animalization*, of the vital force of running water….As such also, the question does this permanent river (or creek, or spring or other water source) have (or belong to, or be associated with) a Waugal (or the Waugal) becomes, from an Aboriginal viewpoint, meaningless and condescending. The presents of living water bespeaks Waugal immanence (O'Connor et al. 1989).

ARCHIVAL RESEARCH

Archival research involved an examination of the Department of Indigenous Affairs (DIA) Sites Register, a review of any relevant site files, and a review of any unpublished ethnographic reports that relate to the Margaret River area.

SITES REGISTER SEARCH

The DIA Aboriginal Sites Register categorises places reported to be of importance and significance to Aboriginal people into two separate categories.

The DIA Aboriginal Sites Register categorises places reported to be of importance and significance to Aboriginal people into two separate categories.

The first category contains sites classified as **'Registered',** which have been assessed by the ACMC as meeting the definition of section 5 of the AHA and are fully protected in law. Disturbance to land that contains such sites requires a section 18 application for ministerial consent should proponents wish to use the land that contain these sites.

'Other Heritage Places' is the second category within the Aboriginal sites register. This category includes reported sites both 'Lodged' and awaiting ACMC assessment, and 'Information Assessed' by the ACMC, however awaiting a final decision on the places status. Also there are places where the ACMC have determined there is 'Insufficient' information for these places to be fully 'Registered' under the AHA, however that there is enough information to warrant their temporary protection. Within the category of 'Other Heritage Places' sites that are awaiting assessment or are lodged are protected by the provisions of the AHA, until assessed and their final status determined. Other heritage places that have been assessed and fail to meet the definition of section 5 of the AHA are classified as 'Stored Data'. Places in this category are not sites under the AHA as they have failed to meet the definition of section 5.

In relation to this survey a search of the DIA Aboriginal Sites Register was conducted for this project on the **23rd April 2012**, in order to determine if there were any previously recorded Aboriginal heritage sites that would be affected by the project proposal (see Appendix 1: Sites Register Search).

The search confirmed that only Site ID 4495 Margaret River will be directly affected where the Main Highway crosses the Margaret River adjacent to Riverview Drive (324097mE & 6241887mN) and where the connection to town with John Archibald Drive crosses the Darch Brook at 323560mE & 6240553mN), ministerial consent will be required to proceed.

Table 1: Summary of Aboriginal heritage sites within project area

Site ID	Name	Status	Access	Restriction	Location (GDA94 Zone 50)* mE	mN	Site Type
Registered Aboriginal Sites							
4495	Margaret River	R	O	N	334424	6245429	Myth
Other Heritage Places							
4494	Rosa Brook Road (Margaret River Lore Ground)	S	C	N	NA	NA	Ceremonial

***** Please note: Coordinates are indicative locations that represent the centre of sites as shown on maps produced by the DIA – they may not necessarily represent the true centre of all sites.

LEGEND

R – Registered Site, **I** - Insufficient Information, **S** - Stored Data, L - Lodged awaiting assessment, **IA** - Information Assessed, **O** – Access Open, **C** - Closed Access, **N** – File Not Restricted.

REVIEW OF RELEVANT SITE FILES

Site ID 4495 - Margaret River

This site was first recorded by Smith & McDonald as a mythological site in a survey of the Ten Mile Brook Dam for West Australian Water Corporation in 1989. In this report the Aboriginal informants noted "While it was reported, the Margaret River was thought to once have had a *Waugal*, the Ten Mile Brook was not reported to have any significance". (McDonald 1989:14)

In a survey undertaken for a housing development at Sussex Location 972, 412 and Lot 1 Burnside, the Margaret River was also reported to have mythological associations to a dreamtime ancestor known as "Wooditch". This ancestor was known to have created the Margaret River by casting a magic stick. In this report other Aboriginal consultants reported the Margaret River to have a *Waugal* (McDonald 1989:30-2). As a result of these reports the Margaret River was assessed by the ACMC as a site under Section 5b and a determination of its significance made under Section 39.2(b) and 39.2(c) and placed upon the permanent register on the 7/8/2001.

In February 2004 and October 2004 Brad Goode and Associates conducted Aboriginal Heritage Survey's for a Proposed Waste Water Treatment Plan on Lot 667 Riverslea Estate and Housing Sub-Division on Lot 27 Bussell Highway. During these survey's the Darch Brook and its tributaries and all the other tributaries of the Margaret River were identified by the Aboriginal community as being of significance in the same terms as the Margaret River in association with the Wooditch mythology and of generalised significance in association with the *Waugal* beliefs. Resulting from this report all the tributaries were added to the Margaret River's sites extent which has been determined as 30m from the normal high water mark of all these water channels.

In relation to our current report, this site has been identified to bisect the project area and therefore will be affected by Main Roads proposal to construct the Margaret River East Perimeter Roads bridge. As such this work will require ministerial consent under Section 18 of the West Australian Aboriginal Heritage Act (1972) for consent to use the land that may contain an Aboriginal site.

Ministerial consent required to proceed with bridges and culverts under the AHA.

Site ID 4494 - Rosa Brook Road

This site was first recorded by McDonald Hales & Associates in November 1989. The site which was recorded as a meeting place (corroboree ground) and is located somewhere along Rosa Brook Road. The informants could not accurately locate the site but it was thought to be east of the Ten Mile Brook Dam.

Additional information has since been recorded in 2006 by Brad Goode and Paul Greenfeld in a restricted format for males only. The consultants have confirmed that this place will not affect the road corridor as it is currently planned.

The sites verification team have assessed that there was insufficient information to list this report as a site and accessioned the site to **'Stored Data'.- no further obligations under the AHA.**

REVIEW OF RELEVANT ETHNOGRAPHIC REPORTS

Goode, B et al. 2003, *Report on South West Yarragadee-Blackwood Groundwater Area Aboriginal Cultural Values Survey,* Prepared for the Department of Environment, Waters and Rivers Commission, Bunbury WA

This report documents consultations with the South West Boojarah Native Title Claim group with regards to the values that they attach to all water resources within their native title claim area. This report puts forward Aboriginal community view that water is of pivotal significance from both a religious and domestic perspective. In this report the South West Boojarah group argues that all watercourses that are hydro logically connected are of the same spiritual essence and therefore should be considered by heritage management professionals as a single site with regards to the Aboriginal Heritage Act (1972). The Margaret River and its tributaries were identified as such a site by this claim group.

Goode B, 2004a, *An Aboriginal Heritage Survey of Proposed Lot 667, Riverslea Estate, Margaret River, and Western Australia*, Prepared for Koltasz Smith & Partners on behalf (Lester Group Pty Ltd.) of the Greendene Development Corporation.

This report was commissioned by Koltasz Smith & Partners, town planners and project managers, on behalf of Lester Group Pty Ltd with regards to the construction of a sewerage pumping station to service the Riverslea Estate and other associated housing estates in the area. The results of this survey identified the Darch Brook a tributary of the Margaret River to be a component of Site ID 4495 'Margaret River'. The Darch Brook and its associated ephemeral creeks and wetlands were considered by the Aboriginal community to be of the same spiritual essence (the *Waugal*) as the Margaret River and therefore as the same site. As a result of this survey the community requested that the Lester Group Pty Ltd relocate the proposed sewerage pumping station away from the wetlands that associate with the Darch Brook. A four meter Buffer was given to be adequate protection between the pumping station and the edge of the affected wetland adjacent and within lot 667.

Goode B, 2004b, *An Aboriginal Heritage Survey of Lot 27 Bussell Highway, Margaret River, Western Australia,* Prepared for Koltasz Smith & Partners on behalf of Balwyn Margaret River Pty Ltd, a Lester Group Ltd Company

This report was commission by Koltasz Smith & Partners on behalf of Lester Group Pty Ltd (Greendene Developments) with regards to the development of Lot 27 Bussell Highway for housing. The proposed development survey area is located adjacent to the Darch Brook to the east and the Bussell Highway to the west, on the south side of the Margaret River Township. The Darch Brook, which is a tributary of the Margaret River and a component of Site ID 4495, borders the development area. There are a number of ephemeral creeks and wetlands within lot 27 that flow into the Darch Brook. As a result of this survey the community consultation process identified that the watercourses contained within Lot 27 are also to be considered components of Site ID 4495 Margaret River. It was recommended that the DIA register these watercourses as such. This registration would include and supersede Site ID 21038 Water Course (Waugly Site), which was previously recorded by Jeremy Maling in 2003.

Goode, B 2006, *An Aboriginal Heritage Survey for the Margaret River Water Supply Upgrade, Western Australia,* A report prepared for the Water Corporation

This report was commissioned by the Water Corporation for a proposed upgrade to the Margaret River Town Water Supply. It was reported that the Margaret River Site ID 4495 was located to the north and adjacent to the proposed project; however a number its tributaries including the Darch Brook would be intersected by the proposed pipeline and therefore will be

affected by the Water Corporations proposal. The Aboriginal community were prepared to support a Section 18 request with their preferred method of crossing being to run the pipe within exiting concrete structures crossing tributaries of the Margaret River and the Darch Brook.

As an addition of this report, Mr Brad Goode and Mr Paul Greenfeld on behalf of the sites custodian Mr Wayne Webb recorded additional information in regards to Site ID 4494 Rosa Brook Road (Margaret River Lore Ground). This information was reported to the DIA in a restricted format.

Maling, J 2003, *Archaeological and Ethnographic Site Identification Survey Under the Aboriginal Heritage Act (1972) of a Proposed High Level Transfer Main at Margaret River, WA: With representatives of the South West Boojarah, Isaacs and Harris Families,* A report prepared by Australian Interaction Consultants on behalf of the Water Corporation.

This report was commissioned by the Water Corporation with regards to a high pressure water main that was needed in order to service Riverslea Estate and other housing developments within the area. The outcomes of this survey identified two sites, Site ID 21037 and Site ID 21038, to be located adjacent to the proposed pipeline, which runs parallel to an ephemeral creek running east from the intersection of the Bussell Highway and Boodjidup Road to the Darch Brook. The Aboriginal informants from the South West Boojarah Native Title Claim group expressed opposition to the proposed pipeline installation through this area, as they believe it would adversely affect the watercourse identified as Site ID 21038.

McDonald, Hales and Associates 1989, *An Archaeological and Ethnographic Survey of the Ten Mile Brook Dam Site Rosa Brook Road, Margaret River, Western Australia*, Prepared for the Water Authority of Western Australia

This report was commissioned by the Water Authority of Western Australia in regards to the construction of the proposed Ten Mile Brook Dam Site on the Ten Mile Brook. During the survey up to 12 members of the Busselton Aboriginal community conducted a details inspection of the project area and did not identify any Aboriginal Heritage sites to be located within the area proposed for the Dam. With regards to the significance of the Ten Mile Brook, the report noted that while the Margaret River was once noted to have a *Waugal* the Ten Mile Brook was not reported to have any significance (ibid 14). During the survey the informants believed that a ceremonial ground existed within the region but during the field work the informants failed to relocate the site. The consensus of the informants was that this site was likely to be located further west along Rosa Brook Road.

McDonald, Hales & Associates 2000, *Report of an Aboriginal Heritage Survey of the Proposed Margaret River East Bypass,* Prepared for SMEC Australia upon behalf of Main Roads WA

In May 2000 McDonald & Hales conducted an Aboriginal Heritage Survey for the Margaret River East Bypass. The results of this survey identified that the Margaret River Site ID 4495 would be impacted upon and that Site ID 4494 Rosa Brook Road could not be accurately located from the information held at the DIA. This survey also mentioned that an unnamed creek that crossed Darch Road was reported by the Aboriginal consultants to have cultural significance, in that it was an Aboriginal run. This run was reported to contain an abundance of foods and other resources. As a result of this report if it was necessary for any works to affect this creek then the works, should be monitored by an Archaeologist and Aboriginal community members.

The report of this creek is likely to be the Darch Brook or Wild Dog Gully, which also runs through our current survey area on the south west side. No mention was made in McDonalds report of this creek having any mythological associations, however it was noted by the Aboriginal consultants that it was a drainage feature of the Margaret River and thus of the same significance. Site ID 4494 Rosa Brook Road could not be located during fieldwork. The Aboriginal consultants who participated in this survey had no knowledge of this site in this survey. The site was described in the 1989 report as a meeting place for tribal groups, a battleground or a corroboree ground. No other spatial information is known, thus the DIA have formally placed a 10km box over the site which is located somewhere along Rosa Brook Road. The site has since be rerecorded by Goode and Greenfeld in 2006, the site is 500m east of the south east boundary of our current study area and will not be affected by Main Roads proposed work.

OUTCOMES OF ARCHIVAL RESEARCH

Archival research for this project has confirmed that only Site ID 4495 Margaret River will be directly affected where the Main Highway crosses the Margaret River adjacent to Riverslea Drive (324097mE & 6241887mN) and where the connection to town with John Archibald Drive crosses the Darch Brook (323560mE & 6240553mN), ministerial consent will be required to proceed.

Ministerial consent required to proceed with bridges and culverts under the AHA.

IDENTIFICATION OF SPOKESPEOPLE

THE RIGHT TO SPEAK ON HERITAGE ISSUES

Various authors have discussed the contemporary problem of who in the Aboriginal Community has the authority to speak on heritage issues within an area. O'Connor et al. (1989:51) suggest that when this question is posed to people in Aboriginal Australia, answers are usually framed by such terms as 'the traditional owners', i.e., those people who are defined by place of birth i.e. descent. Myers presents a broader and more contemporary view of 'ownership' based upon descent and association:

> An estate, commonly a sacred site, has a number of individuals who may identify with it and control it. They constitute a group solely in relationship to this estate. Identification refers to a whole set of relationships a person can claim or assert between himself or herself and a place. Because of this multiplicity of claims, land holding groups take essentially the form of bilateral, descending kindred. Membership as a recognised owner is widely extended (cited in Machin 1993:22).

Myers then goes on to further clarifies the current perception of 'ownership' when he states:

> ....such rights exist only when they are accepted by others. The movement of the political process follows a graduated series of links or claims of increasing substantiality, from mere identification and residual interest in a place to actual control of its sacred association. The possession of such rights as recognised by others, called 'holding' (kanyininpa) a country, is the product of negotiation (Ibid.).

While the notion of descent is clearly an important criterion within Myers analysis, it must be seen in terms of the contemporary Nyungar situation. Nyungar tradition in the south west has been seriously eroded since colonisation, lines of descent have been broken and previously forbidden and mixed marriages have interconnected many Nyungar groups who would not have traditionally had a close association (Ibid.). Consequently, in contemporary times the criteria of historical 'association' seem to be important in regards to the 'right to speak' on heritage issues within an area:

> Traditional subsistence no longer sufficed to support Aboriginals so they combined this with menial work on farms and over time new relationships to land developed. As a consequence, the more recent history associated with their involvement with European agriculture and labour patterns is often more relevant than the pre-contact mode of attachment to an old way of life and the roots of the identity as original owners of the land. Biographical associations are often tied to post-settlement labour patterns and identification. These can predominate. This is part of a dynamic process of ethnicity, identity and tradition (Machin 1995:11).

O'Connor, et al. (1989) identified several criteria for determining contemporary community spokes people. A spokesperson must have a long-term association with an area, usually as a young person, and had extensive contact with a member or members of the 'pivotal generation of the culture transmitters'; those people whom, as children themselves, had contact with people who could pass on their traditional knowledge. A spokesperson must also demonstrate knowledge of the region's natural resources, its hunting, fishing and camping grounds, its local water sources, and the flora. This is important because a person without this knowledge is unlikely to be seen by their fellow Nyungars as truly being from that country, despite having been born or lived in that area. In some cases, people from outside a specific region have established themselves by political activism. They are accepted by their fellow Nyungar because they may have participated in mainstream white pursuits, such as advanced education, or legal and political careers, that have empowered them within the broader community. As such, these people are a valuable resource to the local Aboriginal Community. The people consulted in this survey fulfil at least one of these criteria.

NATIVE TITLE CLAIMS OVER THE SURVEY AREA

Currently, there are two registered Native Title applications and two unregistered applications that overlay the project area, lodged with the Register of Native Title Claims and the Schedule of Applications held by the Commonwealth Native Title Tribunal. The Schedule of Applications includes registered applications, unregistered applications, and applications still undergoing the registration test.

- **Harris Family WC96/41 WAD6085/98 (Registered)**
  Applicants: Mrs Minnie Van Leeuwin

- **South West Boojarah #2 WC06/4 WAD253/06 (Registered)**

  Applicants: Mr William Webb, Mr Donald Hayward, Mr Bertram Williams, Mr William Thompson, Ms Margaret Culbong, Ms Barbara Corbett-Councillor Stammner, Ms Wendy Williams.

- **Single Noongar Claim (Area 2) WC03/7 WAD6012/03 (unregistered)**
  Applicants: Anthony Bennell, Alan Blurton, Alan Bolton, Martha Borinelli, Robert Bropho, Glen Colbung, Ken Colbung, Donald Collard, Clarrie Collard-Ugle, Albert Corunna, Shawn Councillor, Dallas Coyne, Dianna Coyne, Margaret Colbung, Edith De Giambattista, Rita Dempster, Aden Eades, Trevor Eades, Doolan-Leisha Eattes, Essard Flowers, Greg Garlett, John Garlett, Ted Hart, George Hayden, Reg Hayden, John Hayden, Val Headland, Eric Hayward, Jack Hill, Oswald Humphries, Robert Isaacs, Allan Jones, James Khan, Justin Kickett, Eric Krakouer, Barry McGuire, Wally McGuire, Winnie McHenry, Peter Michael, Theodore Michael, Samuel Miller, Diane Mippy, Fred Mogridge, Harry Narkle, Doug Nelson, Joe Northover, Clive Parfitt, John Pell, Kathleen Penny, Carol Petterson, Fred Pickett, Rosemary Pickett, Phillip Prosser, Robert Riley, Lomas Roberts, Bill Reidy, Mal Ryder, Ruby Ryder, Charlie Shaw, Iris Slater, Barbara Stamner-Corbett, Harry Thorne, Angus Wallam, Charmaine Walley, Joseph Walley, Richard Walley, Trevor Walley, William Warrell, William Webb, Beryl Weston, Bertram Williams, Gerald Williams, Richard Wilkes, Mervyn Winmar, Andrew Woodley, Humphrey Woods, Dianne Yappo, Reg Yarran, Saul Yarran, Myrtle Yarran.

- **Single Noongar Claim (Area 1) WC03/6 WAD6006/03 (unregistered)**
  Applicants: Anthony Bennell, Alan Blurton, Alan Bolton, Martha Borinelli, Robert Bropho, Glen Colbung, Donald Collard, Clarrie Collard-Ugle, Albert Corunna, Shawn Councillor, Dallas Coyne, Dianna Coyne, Margaret Colbung, Edith De Giambattista, Rita Dempsters, Aden Eades, Trevor Eades, Doolan-Leisha Eattes, Essard Flowers, Greg Garlett, John Garlett, Ted Hart, George Hayden, Reg Hayden, John Hayden, Val Headland, Eric Hayward, Jack Hill, Oswald Humphries, Robert Isaacs, Allan Jones, James Khan, Justin Kickett, Eric Krakouer, Barry McGuire, Wally McGuire, Winnie McHenry, Peter Michael, Theodore Michael, Samuel Miller, Diane Mippy, Fred Mobridge, Harry Narkle, Doug Nelson, Joe Northover, Clive Parfitt, John Pell, Kathleen Penny, Carol Peterson, Fred Pickett, Rosemary Pickett, Phillip Prosser, Bill Reidy, Robert Riley, Lomas Roberts, Mal Ryder, Ruby Ryder, Charlie Shaw, Iris Slater, Barbara Corbett Stamner Councillor, Harry Thorne, Angus Wallam, Charmaine Walley, Joseph Walley, Richard Walley, Trevor Walley, William Webb, Beryl Weston, Bertram Williams, Gerald Williams, Richard Wilkes, Andrew Woodley, Humphrey Woods, Dianne Yappo, Reg Yarran, Saul Yarran, Myrtle Yarran, K. Colbung (dec).

SELECTION OF SPOKESPEOPLE FOR THIS SURVEY

The selection of spokespeople for this survey was based on advice given from South West Aboriginal Land and Sea Council (SWALSC) by Mr Kevin Fitzgerald, South West Boojarah working party member Mr Jack Hill and applicant Ms Barbara Corbett and Harris Family applicant Mrs Mini Van Leeuwin. The consultant's previous experience in conducting Heritage survey's in the region for more than a decade has also greatly aided the selection of knowledgeable and appropriate spokespeople who represent those with both traditional and historical interests within the area. As a result of this pre-consultation process, the following Aboriginal people were selected to participate in the survey:

South West Boojarah WC06/4 Native Title Claim group:

Ms Samantha Nannup resides in Busselton, and is the daughter of Mr Harry Nannup (below) and represented her father in this survey. Mr Harry Nannup was born in Pinjarra to parents Mr Joseph Nannup (Busselton) and Ms Dulcie Hart and who has familial hereditary ties to the Blackwood catchment area (Nannup). Mr Harry Nannup sits upon the working party of the South West Boojarah and Gnaala Karla Booja Native Title claim groups to represent his family's interests.

Mr Wayne Webb is a member of the SWB Native Title Claim group and lives in Walpole. Mr Webb's maternal grandmother was Evelyn May Hill of Bridgetown. Her father was Charles Hill of Busselton. Charles Hill's mother was Elizabeth Dawson from Busselton; her mother was Edian (Fanny Brockman) who married Elijah Dawson an English settler of Wonnerup. Mr Webb's father's side of the family are descendants of the Isaacs from Margret River. Mr Webb has been involved in Aboriginal heritage surveys as an archaeological assistant for nearly 20 years and is widely respected as a competent and knowledgeable field archaeologist. Mr Webb was nominated by the consultant and SWB working party.

Ms Gloria Hill was born in North Fremantle to her mother Ms Ellen Hill (above). Ms Gloria Hill was 'stolen' and raised at the Mt Magnet Mission called '*Tardun*'. Upon leaving the mission Ms Hill then returned to her family in Busselton at the age of 15 and lived in a shack on Mr Keith Rose' farm at Marybrook. Ms Hill worked for Mrs Brockman at Newtown Park and also raised her three children in Busselton.

Mr Jack Hill is a working party member at SWALSC and former applicant to the South West Boojarah Native Title Claim. Mr Hill was born in Manjimup the son of Les (born in Busselton) and Gloria Hill, and the grandson of Mr Edward 'Ted' Hill and Ms Mary Isaacs who were born in Karridale and Busselton. Mr Hill is a member of the Gnuraren Aboriginal Corporation of Busselton, the Lake Jasper Juvenile Justice Project and also sits on the executive committee of SWALSC. Mr Hill has held a number of government positions throughout his life including; the Ministry of Justice, Family and Children's Services and the Australian Bureau of Statistics.

Mr David Pell was born in Busselton to his mother Mrs Rosie Pell who is Mrs Ellen Hill's sister and Mr Jack Hill's first cousin. Mr Pell's brother John Pell sits upon the working party for the SWB Native Title claim.

Harris Family WC96/041 Native Title Claim group:

Mrs Minnie Van Leeuwin *(nee Harris)* was born in Busselton to parents Ms Edith Anderson (1898) and Mr Tim Harris Junior (1896) who was born at Cattle Chosen, which was the original Bussell farm on the Vasse at settlement. Mr Tim Harris' parents were Mr Timothy Harris Snr (1840) and Ms Caroline Mullane (1852). Mrs Tim Harris' parents were Mr Ebenezer Harris and *Nulangood* (apical ancestor), a traditional Nyungar recorded at Busselton at settlement. Ms Caroline Mullane's mother was *Yeats*, a traditional Nyungar born in Busselton in 1830. Mrs Van Leeuwin and her family consider that they speak for the country west of Capel to Margaret

River and Augusta. Mrs Van Leeuwin was not able to attend the meeting however is the primary applicant for the Harris Family Native Title Claim and the Elder of the Harris family. All meeting participants detailed below have the same familial hereditary ties to the area as Mrs Minnie Van Leeuwin.

Ms Carrie Harris was born in Margaret River and a sister to Mrs Mini Van Leeuwin. Ms Carrie Harris has worked for the Department of Community Services in Perth, Katherine and Alice Springs before returning to live in Perth. Ms Carrie Harris shares the same ancestral ties to Busselton as the rest of the family. Ms Harris was selected to participate in this survey by the consultant and Mrs Van Leeuwin.

Mrs Dorothy Blurton *(nee Harris)* was born in Busselton and is a sister of Mrs Minnie Van Leeuwin (above). Mrs Blurton currently lives in Busselton.

Mr Mark Blurton is a son of Mrs Dorothy Blurton (above) and has lived in Busselton his whole life. Mark attended to support his mother.

Ms Wendy Harris was born in Busselton to parents Mr Norman Harris (brother to Mrs Minnie Van Leeuwin), from Busselton, and Mrs Shirley Harris nee Corbett. On her mother's side Ms Harris' grandparents are Ms Pearl Newell and Mr Frank Corbett. Mrs Harris completed her junior and senior education in Busselton and now lives in the metropolitan area. Ms Harris has a Bachelor of Applied Science, a Bachelor of Social Work, a graduate certificate in Child Protection Practice, a Diploma of Counselling and over 30 years in the human service industry.

Mr Travis Narkle is a son of Ms Wendy Harris (above) and is a member of the Harris family native title claim group and was consulted to support his mother.

COMMUNITY CONSULTATION

AIMS

- To establish contact with Aboriginal people who retain traditional or current knowledge pertaining to the region.
- To determine if there are any sites of significance, as defined by section 5 of the AHA, within the project area.
- To record any ethnographic information provided about identified sites.
- To generate consensual recommendations from the Aboriginal community representatives in regards to any section 18 requests and to record management strategies for identified ethnographic and archaeological sites.

METHOD

The Nyungar informants selected were contacted by phone, briefed as to the requirements of the survey and onsite meetings were arranged in Margaret River. At the meetings the informants were orientated to the project plans by a description of the works from Mr John Szeliga (Project Manager) with the aid of a large aerial photograph map clearly identifying the survey corridor within which the proposed Margaret River East Perimeter Road is to be constructed.

During the survey the informants were driven to accessible sections of the eastern and western boundaries of the survey corridor and the crossings on the Margaret River and the Darch Brook. At these locations further discussions were conducted as to the effect that this work would have on the cultural values of the sites and any issues identified were recorded by the anthropologist in a note book, coordinates taken on a Garmin CX 60s and photos taken on a digital camera.

COMMUNITY CONSULTATION PROCESS

On the 17th April 2012, Mr Brad Goode (anthropologist) and assistant Ms Melissa Lamanna met with members of the South West Boojarah Native Title Claim group, Mr Wayne Webb, Mr David Pell, Ms Gwenda Chapman and Ms Gloria Hill in Margaret River.

Mr Phillip Prosser, Ms Samantha Nannup, Mr Jack Hill and Mr Bill Webb were also nominated as participants in the survey but failed to attend. Mr Jack Hill and Ms Samantha Nannup advised by phone that they would attend the survey with the Harris family the following day. The others nominated that did not attend did not provide any advice.

To begin the consultation the group travelled to the crossing point upon the Margaret River. Here Mr John Szeliga (Project Manager Main Roads) briefed the group with regards to the technical details of the road design and provided an overview of where the project had come to since the initial heritage survey in 2007.

Here Mr Szeliga advised that Main Roads had now designed a dual carriageway road alignment within the 2007 survey corridor. He advised that the road will extend approximately 11km commencing at the Department of Environment and Conservation offices on Bussell Highway at Bramley, 2kms north of Margaret River, thence extending in a south eastern direction through a State pine plantation and then crossing the Margaret River near the confluence with the Darch Brook. After crossing the Margaret River the road extends directly south through farmland and then swings west, crossing the Darch Brook. A spur road to connect with John Archibald Drive heads west, whilst the main By-Pass Road then crosses Rosa Brook Road and Darch Road, running south to Bussell Highway, 950m south of the Rosa Brook Road intersection.

Mr Szeliga stated that the width of the survey corridor varied from 30m at short spurs to 80m generally along the alignment, extending to 200m at the crossing of the Margaret River where two crossings called the ‘Black and Blue’ bridge alignments are proposed.

Mr John Szeliga further advised that Main Roads are currently planning for T-section bridges across the Margaret River (40m span) and pipe culverts bridges across the Darch Brook (323605mE & 6240564mN) to connect the By-Pass with John Archibald Drive.

Figure 2: Inserts show the SWB native title claim group inspecting the 'Black Option' to bridge the Margaret River. View looking from the north side of the river.

Mr Szeliga advised that while these plans are now well advanced they are yet to be settled as geotechnical issues and other compliances such as noise abatement need to be determined prior to selecting a final design and in the case of the Margaret River crossing a final option, either the Blue option (324086mE & 6241968mN) or Black option (324059mE & 6241899mN) to bridge the Margaret River (see plans Appendix 3).

In regards to these bridge options Mr Szeliga stated that there are advantages and disadvantages with each;

- The Blue option would require a longer bridge, more clearing, rock breaking, cut and fill, but would be further away from housing, the confluence of the Darch Brook, and was lower in the landscape, diminishing more traffic noise.

- The Black option was cheaper to build, would require less clearing and earth works but was close to housing and would generate much more noise.

Mr Szeliga advised that both Bridge options would likely require a pylon within the rivers bed or alternatively 2 pylons upon the embankments of the river as the crossing is approximately 45m wide. T-section bridges in Western Australia can only be built to span 40m.

Mr Szeliga said that at present geotechnical and noise abatement studies would inform Main Roads of the final choice, however the Black option was the current preference due to costs associated with excavating a large amount of rock at the Blue option.

The Nyungar group were asked to comment upon the affects that this proposal would have upon the cultural values associated with the site. The group were also asked to select the best option to cross the Margaret River and why this would be best in cultural terms.

Mr David Pell stated that he would not like to see pylons driven into the bed of the Margaret River for a bridge. Mr Pell said that it is a definitive Nyungar value not to place blockages within water courses, especially large flowing rivers such as this one. The rest of the group stated that they supported this view and that the final bridge design should have pylons either side of the channel and the bridge or abutments should not restrict the water flow in the river.

In terms of the options Mr Wayne Webb advised that he would prefer the Blue option as he believed that pollution mitigation measures to control run off into the river from the roads would be better as the alignment runs straight down to the river rather than the black option which runs more adjacent exposing a wider shore line.

Mr Webb and several others in the group also preferred the Blue option because it was further away from the houses and due to the finished height of the road being lower in the landscape would be aesthetically more pleasing. All agreed that maintenance of aesthetic values of Aboriginal sites was as important as environmental preservation. All agreed that a lower, less visual road and bridge would be better in this respect.

The only other issues raised were a request for employment opportunities and requests for cultural monitors should either option proceed. The group advised that the bridge should be named after *Wooditchup* the Nyungar name for the Margaret River. All agreed to support a notice for ministerial consent under a section 18 application should Main Roads proceed.

Figure 3: The Darch Brook crossing, view to the east towards the proposed By-Pass road

The group then inspected the crossing of the Darch Brook, where it is proposed to connect the By-Pass to John Archibald Road.

Here Mr Szeliga advised that a 40m wide clearing corridor running along the south side of a fence line would be required. He advised that the actual road would be much narrower and that box culverts or round pipes would be installed beneath the road to facilitate the waters flow.

Mr Szeliga said that geotechnical studies conducted for this crossing has informed that a 2m excavation and replacement of silty sub stratum would be needed to construct a small bridge of this nature. Following the construction the whole area would be rehabilitated.

The Nyungar group were asked to comment and were also asked if they would support a notice under section 18 of the AHA to do this work.

All members of the group stated that while they do not sanction such disturbances to water courses and in particular within the bed, that they understand that there is no other way of bridging the brook without a costly span bridge which would still require pylons, and clearing. Upon this basis all agreed that the work and consent notice should proceed provided that all effort is made to minimise the disturbance during the work and that full rehabilitation is conducted such as what can be seen at the bridge in Riverslea Estate.

On the 18th April 2012, Mr Brad Goode and assistant Ms Melissa Lamanna met with members of Harris Family native title claim group in Margaret River. The group were briefed as were the previous by Mr John Szeliga.

Figure 4: Mr John Szeliga briefing the Harris Family native title claim group at the Darch Brook crossing joining the By-Pass to John Archibald Road, view to the northeast.

The group first inspected the crossing of the Margaret River. Here the ‘for’ and ‘against’ arguments with regards to ‘Black or Blue’ options for bridge alignments were explained. The details regarding the Darch Brook culverts were also explained. The overall road project and the recommendations from the previous survey were explained.

As many of the group were elderly and unable to walk only some members of the group inspected each crossing location, the rest were briefed with maps. Following the inspection, a thorough debrief took place with the entire group.

As a result of the consultations little ethnographic comment was made.

All stated that they would not support pylons in the Margret River and would prefer a bridge design that would span the river. All however stated, but that they would not oppose the section 18 consent to build the bridges.

All stated that they preferred the Blue Alignment as it reduced the noise levels for the residents.

No comment was made regarding the Darch Brook and no other sites, places or issues regarding affects to cultural values were made.

All requested that employment opportunities be made available to Nyungar people should the project proceed.

COMMUNITY CONSULTATION OUTCOMES

During the consultations preference was also given to the 'Blue Alignment' crossing the Margaret River. This alignment was preferred due to this design being seen by the Nyungar representatives as having less potential to pollute the river with runoff from roads.

During the consultations the informants further requested employment opportunities, in particular in regards to rehabilitation work. All requested that rehabilitation use species with local provenance. All advised that rehabilitation done along the Darch Brook within the Riverslea Estate was a good example of what should be done after bridges and culverts are constructed.

All consulted during this survey requested that employment opportunities be made available to Nyungar people and requests for cultural monitors should either option proceed. The group advised that the bridge should be named after *Wooditchup* the Nyungar name for the Margaret River.

No other issues were raised during the survey and it was advised the Nyungar community would support the proposal and wish to seek ministerial consent in order to proceed.

RECOMMENDATIONS

As a result of the above consultations, the following recommendations are made:

It is recommended that as there are no new sites identified under Section 5 of the AHA that the project can continue to a final design for construction without reference to further heritage survey requirements.

In regards to Site ID 4495 Margaret River, **it is recommended** that Main Roads construct a bridge that will minimise disturbance to the embankments and restriction of the flow of water in order to protect the values associated with this site and that this work will require consent under Section 18 of the AHA to proceed. It must be noted that all watercourses that are tributaries of the Margaret River (i.e. Darch Brook) within the survey corridor are components of the site and that any planned impact on these tributaries will also require section 18 clearance under the 'Act'.

It is the recommendation of the above claimants consulted that Main Roads adopt the 'Blue Alignment' for crossing the Margaret River. This option was perceived to best protect the river from runoff pollution and was seen as less disturbing to human values as it is further east of houses.

It is recommended that Main Roads give consideration to the requests by the Nyungar community to be able to monitor any works that affects the Margaret River and its tributaries.

Main Roads should also endeavour to connect the vegetation islands that are located centrally throughout the survey corridor, as the Nyungar community have identified them as significant for bird habitat.

It is recommended that Main Roads give due consideration to the Nyungar community request that a kangaroo fence be erected between the road alignment and vegetation corridors. It was further requested that wildlife underpasses be installed to maintain the connections between vegetation corridors.

It is recommended that Main Roads develop an Aboriginal Cultural Heritage Management Plan (CHMP) to advise construction crews of what is required should Aboriginal skeletal remains be unearthed during construction. In the event that skeletal material is discovered during earthworks the following protocol is recommended:

3. Any earthworks occurring in the area stops immediately;
4. The Western Australian Police Service is contacted.

In the event it is an Aboriginal set or partial set of remains:

4. The Department of Indigenous Affairs are contacted.
5. The Nyungar community is informed and consulted regards appropriate management of the area
6. If the remains cannot be left in situ then the proponents would need to seek ministerial consent pursuant to a section 18 application under the AHA to exhume and relocate the material in keeping with the wishes of the Elders who have custodial rights in the area.

It is finally recommended that all cultural heritage management strategies and any conditions attached as a result of ministerial consent should be detailed within this CHMP and that this plan should inform all construction activities associated with the project.

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REPORT ON AN ARCHAEOLOGICAL SURVEY OF PROPOSED BUSSELL HIGHWAY (HO43) MARGARET RIVER BYPASS

Prepared for GHD Pty Ltd on behalf of Main Roads Western Australia

By Jacqueline Harris & Wayne Webb

APRIL 2012

EXECUTIVE SUMMARY

An archaeological investigation for Aboriginal heritage sites was commissioned by GHD on behalf of Main Roads Western Australia for a proposed Bussell Highway (HO43) Margaret River Bypass, east of Margaret River. The aim is to design a suitable alignment to mitigate transport conflicts and safety issues of the present highway through the Margaret River township and central business district as requested by the Shire of Augusta-Margaret River and local community.

The purpose of this road is to relieve the Town of Margaret River from traffic congestion and heavy vehicles passing thru the town during peak periods. The study area extends approximately 11km commencing at the Department of Environment and Conservation offices on Bussell Highway at Bramley, 2kms north of Margaret River, thence extending in a south eastern direction. The route traverses a State pine plantation and then crosses the Margaret River near the Darch Brook. It extends directly south through farmland and then swings west, crossing the Darch Brook to connect with John Archibald Drive, then crosses Rosa Brook Road and Darch Road to Bussell Highway, 950m south of Rosa Brook Road. Included are two short spurs. The width of the corridor varied from 30m wide at short spurs to 80m generally along the alignment, extending to 200m at the crossing of the Margaret River where the Black and Blue alignments are proposed.

An online search of the site register at Heritage and Culture Division, Department of Indigenous Affairs, was undertaken on 21 December 2012. The search defined one ethnographic site lay within the project area whilst one ethnographic heritage place lay in proximity to the corridor.

The survey design was formulated using a combination of predictive and systematic transects throughout the project area with particular emphasis on devegetated and riverine locations. The survey was undertaken on 28-29 March 2012 and conducted by Jacqueline Harris, senior archaeologist and Wayne Webb, a Bibbulman/Wardandi representative and senior field assistant and Toni Webb, a senior field assistant.

The sample survey of the proposed development area to identify any archaeological sites comprised three persons walking abreast, spaced 15-20m apart where possible. In addition, predictive intensive transects were conducted at any areas of site potential such as devegetated areas, ephemeral and permanent water sources. The overall sampling percentage of the project area is estimated to be around 45% with the addition of predictive sampling. Ground visibility within the paddocks was high at around 50% due to dried grasses amid patches of exposed ground but declined markedly in pine plantations to 5% where furrowed ground was covered in a dense carpet of pine needles.

The project area was composed of pine plantations and undulating fields of pasture, vines and horse paddocks. The survey area breaks is composed of 34.5% pine plantation, 63.7% farmland and 1.8% natural forest. The area was disturbed by wholesale clearing for pine plantations, DEC buildings, numerous forest tracks, bush walking tracks, transmission line that dissects the area, farm tracks, fences and gates, farm buildings, vineyard and residential development.

No archaeological site was located within the project area in the course of the survey. No archaeological sites or heritage places were previously registered within the project area. Therefore there are no archaeological barriers present to effect the proposed development.

The most likely areas where archaeological sites, in particular, artefact scatters or burials, may occur are banks of rivers, lakes, creeks, swamps and exposed sandy deposits. The removal or excavation of large quantities of sediment increases the risk of disturbing archaeological sites that may lie beneath the ground surface. It is recommended that GHD on behalf of Main Roads WA inform any project personnel of their obligation to report any archaeological material,

should this be encountered during earthmoving, as outlined under Section 15 of the Aboriginal Heritage Act 1972.

If GHD on behalf of Main Roads WA locate an archaeological site in the process of survey or ground excavation, it is recommended that work cease in the immediate area. Any skeletal material should be reported to Department of Indigenous Affairs and the Western Australian Police Service. Any artefactual material should be reported to Heritage and Culture Division, Department of Indigenous Affairs.

INTRODUCTION

PURPOSE

An archaeological investigation for Aboriginal heritage sites was commissioned by GHD on behalf of Main Roads Western Australia for a proposed Bussell Highway (HO43) Margaret River Bypass, east of Margaret River. The aim is to design a suitable alignment to mitigate transport conflicts and safety issues of the present highway through the Margaret River township and central business district as requested by the Shire of Augusta-Margaret River and local community.

The scope of services was provided in a written document to Brad Goode & Associates by Mr John Szeliga, Senior Project Manager, Main Roads Western Australia.

The objective of the investigation was to establish if any archaeological sites were located in the vicinity of the proposed study area and determine any effects the proposal may have over such sites. A report was required several weeks after completion of fieldwork.

STUDY AREA

Margaret River is located 272 kms south of Perth on Bussell Highway. The study area extends approximately 11km commencing at the Department of Environment and Conservation offices on Bussell Highway at Bramley, 2kms north of Margaret River, thence extending in a south eastern direction. The route traverses a State pine plantation and then crosses the Margaret River near the Darch Brook. It extends directly south through farmland and then swings west, crossing the Darch Brook to connect with John Archibald Drive, then crosses Rosa Brook Road and Darch Road to Bussell Highway, 950m south of Rosa Brook Road. Included are two short spurs. The width of the corridor varied from 30m wide at short spurs to 80m generally along the alignment, extending to 200m at the crossing of the Margaret River where the Black and Blue alignments are proposed.

ENVIRONMENT

Climate

Margaret River lies within the south-west region of Western Australia which is characterised as a warm temperate Mediterranean climate with hot, dry summers and mild, wet winters. The mean January temperature is 22.6°C and mean July temperature is 10.3°C. The region is a winter rainfall zone with annual rainfall ranging from 650mm to 1500mm, most of which falls between May and September. Evaporation averages 1400mm per annum. During winter the prevailing winds are the north-westerlies and westerlies associated with lows and cold front activity. In summer the winds are from the southeast and east in the morning with an afternoon sea breeze from the southwest (Beard 1981).

Geology & Topography

The study area lies within the Leeuwin-Naturaliste Ridge that hugs the coast and extends from Cape Naturaliste to Irwin Inlet. According to Beard (1981), the geology of the Leeuwin-Naturaliste Ridge is characterised by a north-south trending horst of Precambrian granite and granulite forming hills rising to 200m. Most of the outcrop is obscured by laterite and sand on the inland side, and by dune and calcarenite on the western, seaward side. The coast has a rugged retrograding shoreline with small sandy bays between promontories of granite and limestone. Soils are calcarenous sands on the seaward slope; on the inland side the soils are acid grey earths, sometimes containing ironstone gravels, and some sandy yellow mottled soil.

Vegetation

The vegetation follows the geographical position with the area lying within the Boranup System of the Warren Botanical Subdistrict (Beard 1981). The complex geology and topography of the study area results in a mosaic of vegetation that is also influenced by proximity to the coast and varying levels of exposure. On the exposed slopes of the ridge, a heath thicket of *Pimelea ferruginea* dominates. Peppermint, *Agonis flexuosa* and/or banksia spp form the overstorey in low woodland, low forest or open woodland formation. Jarrah, *Eucalyptus marginata*, may be present on leached sands and develop into jarrah marri forest off the coastal limestone.

ARCHAEOLOGICAL RESEARCH

DESKTOP STUDY

An online search of the site register at Heritage and Culture Division, Department of Indigenous Affairs, was undertaken on 21st December 2012 in order to determine if there were any Aboriginal Heritage sites or heritage places that would affect the project proposal. The search defined one ethnographic site lay within the project area whilst one ethnographic heritage place lay in proximity to the corridor.

Table 2: Summary of Aboriginal Sites and Heritage Places within the region of the project area.

Site ID	Name	Status	Access	Restriction	Location (GDA94 Zone 50)* mE	mN	Site Type
Registered Aboriginal Sites							
4495	Margaret River	R	O	N	334424	6245429	Myth
Other Heritage Places							
4494	Rosa Brook Road (Margaret River Lore Ground)	S	C	N	NA	NA	Ceremonial

***** Please note: Coordinates are indicative locations that represent the centre of sites as shown on maps produced by the DIA – they may not necessarily represent the true centre of all sites.

LEGEND

R – Registered Site, **I** - Insufficient Information, **S** - Stored Data, **L** - Lodged awaiting assessment, **IA** - Information Assessed, **O** – Access Open, **C** - Closed Access, **N** – File Not Restricted.

REVIEW OF HERITAGE SURVEY REPORTS

Lilley, I 1993, Recent research in southwestern Western Australia, *Australian Archaeology*. No. 36, pp 34-41.

A systematic research programme locating and recording surface and stratified sites was conducted in Margaret River Valley between Ellen and Boodjidup Brooks. The area is characterized by three distinctive environmental zones: a retreating coastal margin on mobile sands; a coastal hinterland; and Blackwood Plateau.

The survey methods included six persons undertaking transects at 50m width. Waterholes and sedgelands on major water courses were examined closely but vegetation was dense and thorny at these locations. Visibility varied from 25% to 75%. On coastal areas where the vegetation is impenetrable the few tracks and eroding areas in the fore dunes were surveyed.

Survey along the coast found sparse and discontinuous surface material such as granite manuports, mollusc shells and flaked quartz and calcrete. Only at Ellen Brook was material concentrated. A sample from a cluster of shells was dated to 4400 years BP. Six caves and four groups of rockshelters were examined but only three were considered suitable for test pitting. One only of these, Rainbow Cave, revealed cultural material.

Evidence from Rainbow Cave indicated the shelter was used between 800 and 400 BP years by people who engaged in bi-polar quartz flaking, consumed small to medium mammals and a small amount of fish and shellfish. The results suggest that mid to late Holocene activity in Leeuwin-Naturaliste area concentrated on coastal margins and near coastal transition zones and meat procurement focused on terrestrial game not marine and estuarine resources. No evidence for continuity between mid and late Holocene was found but is assumed.

The reason for the sparseness of archaeological material at even the Ellen Brook site, Lilley suggests could be a mid-Holocene high sea level stand that would affect finds on the immediate coast and/or ongoing gradual erosion, lack of visibility and access. But erosion he adds should assist visibility in the forested areas by exposing rather than obscuring sites. Perhaps the forests area was used more so as hunting grounds and therefore remains archaeologically invisible. Lilly counters that the population may have been small as suggested by ethno-historical accounts unlike that of the Swan coastal plain that offered richer resources and wetlands. Perhaps a small population was the product of early colonial days of post-contact stress and dislocation. The fact that Aborigines disregarded littoral resources in the wider southwest is explained by a lack of suitable estuaries in the area. Most of the Leeuwin-Naturaliste area lies within a vast belt of jarrah forest that is argued to have been difficult to access and poor in resources.

Dortch, J 1995, *Late Pleistocene and recent Aboriginal Subsistence at Tunnel Cave and Witchcliffe Rock Shelter, Naturaliste Region, Southwestern Australia*, Centre for Archaeology, UWA, Manuscript.

Limestone cave deposits provide diverse archaeological evidence for Pleistocene and recent Aboriginal occupation in the Naturaliste region. Investigations at Tunnel Cave and Witchcliffe Rock Shelter substantiate records revealed at Devil's Lair in 1970s and Rainbow Cave in 1990. Many of these caves provide abundant artefacts, faunal remains, hearths and occupation surfaces.

Twelve radiocarbon dates from Tunnel Cave suggest the rate of deposition varied with occupation and indicated recurrent use of the site during the last glacial maximum. In the upper layer a hearth is dated to 1400 BP years. In levels 4-5B artefacts and faunal remains are dated between 8,000 and 12,000. Layer 7 is rich in hearths and dated between 17,400 and 16,000 while the basal level is dated at 22, 400.BP years. Cultural material recovered from Tunnel Cave includes artefacts and faunal remains, ochre, emu shell, freshwater and marine shells and two human milk teeth, one dated to 8000 and the other 19,000 years BP.

Witchcliffe Rock Shelter contained similar occupation levels to Tunnel Cave but was dated between 400 and 700 years BP. While flakes and bone were present there was also plant material and fish bones and scales.

Analysis of the faunal material indicates that both human and carnivores contributed to the remains but those associated with artefacts suggest human agent. The large macropod and small wallaby were considered human prey species which was similar to Devil's Lair findings.

Few fragments of marine shell at Tunnel cave indicate that at 17,000 BP years people visited the shoreline at the last glacial maximum when the cave was 30km inland. Other evidence for regular use of the Late Pleistocene coastal plain is the presence of fossiliferous chert which constitutes 90% of the assemblage. The source of chert has since been inundated from mid Holocene sea-level rise.

Dortch, C E & Dortch, J 1997, *Aboriginal occupation in the limestone caves and rockshelters of the Leeuwin-Naturaliste Region, Western Australia: research background and archaeological perspective*, Western Australian Naturalist 21: 191-206.

Few of the hundreds of Southwest artefact scatters can be firmly dated and fewer than a dozen sites have occupation deposits featuring abundant faunal remains associated with artefacts and charcoal. Four of these sites are located in the southwest corner of Leeuwin-Naturaliste Region. Radiocarbon dates from Devil's Lair show that occupation intermittingly occurred between 31,000 to 6,500BP years. This evidence was supplemented by evidence from Tunnel Cave and other regional caves.

Radiocarbon dates so far obtained show a gap of several 1000 years between the late Pleistocene at Devil's Lair and Tunnel Cave and mid Holocene at Rainbow Cave and Witchcliffe Rock Shelter. It is uncertain whether the gap of 6000 years (8000-13000BP years) at Tunnel Cave is significant or why Witchcliffe Rock Shelter was only occupied during the past few hundred years. Several open air sites, Dunsborough and Ellen Brook, extend over the 4-5,000 year range when caves and rockshelters do not appear to have been utilized as much. Evidence at open sites such as Arumvale suggest mid to late Holocene occupation from the presence of geometric microliths and Ellen Brook and Rainbow Cave show historic evidence of occupation with the presence of glass artefacts. Ethnohistoric accounts also support occupation at contact. The long sequence of occupation from late Pleistocene to mid Holocene coincides with low sea levels when the regions western coast was 10 to 40kms further west. This is reaffirmed with the presence of Eocene fossiliferous chert within assemblages that was quarried from outcrops on the emergent shelf.

Apart from the caves and open sites mentioned there are few other examples suggesting hunting and gathering activities on or near Leeuwin-Naturaliste Region. Despite many surveys few sites have been recorded in the lower reaches of Blackwood River valley 10-30kms east of Devil's Lair and Tunnel Cave or the western end of Scott Coastal Plain to the southeast. This scarcity of evidence may reflect the nature of the terrain rather than a real lack of sites as most open sites may be buried in colluvial sediments or dunes or hidden by dense vegetation. The authors think that prehistoric land use in Leeuwin-Naturaliste Region must include the habitats that once existed on the continental shelf to the west, north and south of the present coastline, low lying wetland and woodland on southern Swan and Scott coastal plain and the forested Blackwood river valley.

Greenfeld, P 2002, *Archaeological survey of roadside corridor along Caves Road (Busselton to Augusta), and Bussell Highway (Augusta to Margaret River),* Prepared for Main Roads WA.

The project area concerned 100m each side of the centreline of Caves Road and Bussell Highway with a deviation at Yallingup. Fourteen previously recorded sites were relocated and six new archaeological sites were located. The survey included driving the entire route and examining 30% with pedestrian transects undertaken in areas of good visibility, presence of yellow Spearwood sands and dependent upon the number of previous surveys having been conducted in the area.

McDonald, Hales & Associates 1995, *National Estates Grant Programme Aboriginal Sites in the Lower Southwest Heritage Study*, Prepared for Gnuraren Aboriginal Corporation.

This project comprised both a desktop study and survey of Cape Naturaliste to Cape Leeuwin extending eastwards to north of Capel to Lake Jasper. The archaeological findings suggest a level of non random associations between site location and environmental context. Sites were located in almost every environmental context. High artefact densities were recorded in open blowout depressions, ridgetops and level well-drained ground. The highest densities were

recorded in open vegetation zones including coastal and wetland complexes, woodlands and open forest. Interpretation of the location and site data suggests that a difference in density and composition was a function of varying levels of residential mobility patterns.

Australian Interaction Consultants 2007, *Work Area Clearance Heritage survey report of a proposed Telstra fibre optic cable route, Margaret River, Western Australia,* Prepared for Diamond Communications Pty Ltd.

The survey area comprised a fibre optic cable route along the Busselton Margaret River power easement to Margaret River. It ran along gazetted roads, through forest and freehold farms. The methodology comprised vehicular and pedestrian transects. The easement contained graded areas of gravel without vegetation and fringed by forest or tea tree regrowth. A walk and cycle track were adjacent to the river amid debris from gravel and grading. Surface visibility was medium to low due to thick high vegetation. No archaeological sites were located as a result of disturbance by power line excavations and maintenance of fire breaks, farming and landscaping and poor visibility.

Goode, B & Guilfoyle, D 2008, *An Aboriginal heritage survey for the Margaret River recycled water reuse scheme, Western Australia,* A report prepared for Ascent Engineering on behalf of the Shire of Augusta-Margaret River.

The proposed pipeline begins at the Treatment Plant and follows a firebreak through a pine plantation south before following a track bordering native forest to the west and following tracks through the forest to the Margaret River Weir crossing. The pipeline then follows a disused gravel road and heads in two directions. The eastern arm travels south along a laneway and then heading south, passes through a park heading south-west. The pipeline then crosses into the Rapids Landing Estate before turning east for a short distance to its termination point. The western arm follows to the west, then travels south-south-west before heading west along Forrest Road and Wallcliffe Road to the Margaret River Golf Club.

The survey methodology involved pedestrian transects by two archaeologists spaced ten metres apart. The entire survey area was traversed and it is estimated that some 80% of the ground surface was surveyed. Small areas outside of, but adjacent to, the proposed development area (e.g. granite outcrops, exposed ground in densely vegetated forest) were also assessed. Ground surface visibility was generally good across the survey area; however, the area was impacted by extensive disturbances. Much of the northern half of the route followed existing cleared tracks and pipeline routes, while the southern half was characterized by paved roads and housing and other developments (recreational centre, town park and power station).

No archaeological sites were located. The lack of cultural material is attributed to two main factors– limited survey area and previous disturbances (clearing).

ARCHAEOLOGICAL CONTEXT

A considerable amount of research has been conducted in the southwest corner of Western Australia (see Dortch 1977, Hallam 1986, Ferguson 1985, Pearce 1982) and as a consequence the archaeological patterning of the region is well developed. The project area is located within the woodlands of the southwest.

Ethnographic and archaeological surveys on the Swan Coastal Plain have confirmed the concentration of Aboriginal occupation around wetlands, swamps, rivers and estuaries (O'Connor et al 1995). This pattern was originally proposed by Hallam (1986) on the coastal plain around Perth and further enforced by subsequent research. An anomaly to this archaeological patterning, however, was suggested by Veth & Moore (1989), after an extensive survey of Scott Coastal Plain which failed to locate any archaeological material, suggesting a very low occupation density for the low-lying swampy plain.

A variety of ethno-historical sources describe the activities of Aboriginal people on the coastal plain, their subsistence techniques and semi-permanent camps about wetlands during summer. Several sources have noted that people dispersed in winter to hunt in the forested uplands, yet there is scant information pertaining to this part of the subsistence cycle. On the basis of ethno-historical evidence, Hallam (1979) has proposed that the forest was little exploited and the less dense woodland further inland was targeted by Aboriginal groups.

An alternative model has been proposed by Anderson (1984) and Pearce (1982) based on studies carried out in jarrah forests where they propose that the resources of the forest were widely exploited by highly mobile hunting groups but these groups did not establish large camp sites. Both recorded numerous small artefact scatters, comprised predominantly of quartz tools and debitage. In the South Canning Forest Anderson estimated a density of 1.7 sites per square kilometre while Pearce found a density of 1 site per square kilometre in Collie. Anderson also noted the particular problems concerning low visibility and poor access inherent in the survey of forests.

Excavations were undertaken in jarrah forests by Pearce (1982) and Anderson (1984) where datable organic material was recovered. A sandy site on the edge of a swamp at Collie established occupation at 5810 ± 330BP in the deepest part of the forest; a cave at Boddington yielded a date of 3230 ± 170 BP (Pearce 1982); while Anderson recovered a date of 1280 ± 80 BP at North Dandalup.

One of the earliest evidence for prehistoric occupation of the South-West of Australia is an alluvial terrace site at Upper Swan, located 25 km north-east of Perth and dated at 38,000 B.P. years (Pearce and Barbetti, 1981). Two other sites in the south-west have also yielded Pleistocene dates, Devil's Lair near Margaret River and Helena River. The length of occupation at the limestone cave at Devil's Lair ranges from 47,000 years B.P. to 6,500 years B.P. while Helena River yields an early date of 29,000 B.P. years from the basal level as well as a mid-Holocene date of 4,000 B.P closer to the surface (Dortch 1977, 2002, Schwede 1990). In addition, Dortch (1975) located a silcrete quarry and manufacturing site on the Darling Plateau at Northcliffe. His excavations revealed extensive use of geometric microliths from prior to 6,000 B.P. until 3,000 B.P.

West of the project area, Lilley (1993) surveyed the coastal plain and forest uplands around Margaret River but failed to find any archaeological material in the forest and few sites on the coastal plain. He concludes that the faint archaeological signature of the region is the result of low population densities caused by a relatively impoverished resource base, particularly in jarrah forests. He considers that the technical problems inherent in the region of low site survival rates, poor access and low surface visibility, while contributing factors in site surveys, nevertheless do not effect the outcome of an actual scarcity of archaeological sites in the area.

Southeast of the project area Ferguson (1985) produced an occupation model for the far southwest predicting extensive use of uplands during earlier times of cooler, drier climate and less dense forest. With increased rainfall and subsequent increase in forest density during the early Holocene, Ferguson proposed sparser occupation in the forest uplands and increased occupation of the coastal plain and interior woodlands.

Research into occupation patterns on the coastal plain, woodland and jarrah forest of the Perth region can be transposed to the lower south-west because of the similar environmental and geomorphic features. A large data base on site locations and assemblages exists as a result of a systematic study of the Swan Coastal Plain undertaken by Hallam (1986) in the 1970s and early 1980s. Hallam's objective was to explain the changing occupation patterns of prehistoric Aboriginal populations. Using numbers and types of sites within ecological zones as a means of

comparison, Hallam describes the patterning and nature of archaeological assemblages from the littoral zone, through the coastal sandplain to the foothills and Darling Scarp.

Hallam concludes that Aboriginal occupation was focused around lakes and swamps of the Bassendean Sands and Pinjarra Plains and these occupation sites double numerically in the last few hundred years before European contact. A broad chronology was developed based on the presence of certain indicators within the assemblage. The presence of fossiliferous chert indicates the Early Phase, backed pieces and flat adzes the Middle Phase, quartz chips the Late Phase and glass or ceramic, the Final Phase. Schwede (1990), in a more recent analysis of quartz debitage, finds these chronological markers problematic, in particular, the Late Phase and concludes that all phases were rich in quartz assemblages.

From such research, a predictive model of site type and location can be projected for the project area. There is a high probability that any sites located will be scatters of less than 10 artefacts and manufactured from quartz. These sites will occur adjacent to a water source and be situated on or near tracks or cleared areas. It is necessary, however, to take into account the high level of disturbance caused by intensive farming by European colonists in the C19th and C20th that may have largely obliterated or camouflaged archaeological sites.

SITE SIGNIFICANCE

If any sites are located a scientific assessment is made of its significance. The significance of an archaeological site is determined by its ability to address regional and site-specific research questions and by its representativeness (Bowdler 1984). Significance is a mutable quality, changing as more sites are recorded, research questions are answered or new research directions arise. Broad research questions that sites in the Southwest may address include:

a) the antiquity of colonisation of the southwest zone;
b) social and technological changes that may have occurred in the mid-Holocene;
c) specific patterns of occupation in regional zones; and
d) dating of industrial sequences in the region.

SURVEY METHODOLOGY

The field survey was conducted using 1:50,000 topographic map, a 1:5000 aerial map and a series of cadastral maps demarcating the proposed project area. The survey design was formulated using a combination of predictive and systematic transects throughout the project area with particular emphasis on devegetated and riverine locations.

The survey was undertaken on 28-29 March 2012 and conducted by Jacqueline Harris, senior archaeologist and Wayne Webb, a Bibbulman/Wardandi representative and senior field assistant and Toni Webb, a senior field assistant.

The sample survey of the proposed development area to identify any archaeological sites comprised three persons walking abreast, spaced 15-20m apart where possible. In addition, predictive intensive transects were conducted at any areas of site potential such as devegetated areas, ephemeral and permanent water sources. The overall sampling percentage of the project area is estimated to be around 45% with the addition of predictive sampling. Ground visibility within the paddocks was high at around 50% due to dried grasses amid patches of exposed ground but declined markedly in pine plantations to 5% where furrowed ground was covered in a dense carpet of pine needles.

SURVEY AREA

The project area was composed of pine plantations and undulating fields of pasture, vines and horse paddocks. Much of the proposed bypass centres on a race running between paddocks. The survey area breaks is composed of 34.5% pine plantation, 63.7% farmland and 1.8% natural

forest. The latter forest is composed of regrowth within a previously cleared jarrah marri forest on a steep sloping hill. The northern section of the alignment runs along the original Busselton Highway where the original tar mixed with pebbles still exists but in fragmented form. Granite, laterite and quartz are the natural stone of the area. Jarri, marri, balga, zamia, acacia, bracken, peppermint trees were the dominant vegetation species present.

The area was disturbed by wholesale clearing for pine plantations, DEC buildings, numerous forest tracks, bush walking tracks, transmission line that dissects the area, farm tracks, fences and gates, farm buildings, vineyard and residential development.

FIELD SURVEY RESULTS

No archaeological site, as defined by Section 5 of the Aboriginal Heritage Act 1972, was located within or in close proximity to the project area in the course of the survey. No isolated artefacts were located. It is considered that the survey techniques employed in the field survey were sufficient to have located any major archaeological site present on the surface. The ground visibility was moderate on farmland but very low within the pine plantations.

CONCLUSIONS

DISCUSSION

The survey area consisted of an undulating terrain of predominantly farmland, followed by pine plantations at different stages of formation as well as a minute area of a natural but partially cleared forest. The area was disturbed by clearing for pine plantations, DEC buildings, numerous forest tracks and bush walking tracks, transmission line, farm tracks, fences and gates, farm buildings, vineyard and residential development.

The archival results indicate that there is moderate potential for artefact scatter sites to be discovered within the project area. Because artefact scatter sites are frequent close to major rivers, creeks, lakes and swamps and there is a permanent fresh water supply within the project area and several ephemeral sources there is a modicum of probability that artefact scatters may occur at exposed sandy devegetated areas or be uncovered following the removal of overlying sands by wind erosion or developers excavating and clearing the land.

It is highly unlikely that a scarred tree is present in the study area as the only remnant forest has been selectively cleared and the occasional remnant cluster of trees and narrow riverside strips have been examined during the survey. There is a low amount of natural stone outcropping in the project area so there is some potential for quarry sites to be present. There is limited potential for skeletal remains to be present as there are minimal deep sand deposits that are not intermixed with rock and laterite.

The archaeological record for the Leeuwin Naturaliste region is a dichotomy. Research has indicated that numerous consultancy surveys in the area have been undertaken in the region and those that have occurred have rarely identified sites. Yet the academic research also indicates that selected caves on the rock shelter system sustain a long and rich cultural prehistory as do a number open scatters that contain complex assemblages. These sites demonstrate the region was occupied by Aboriginal people from around 47,000 years ago. The presence and nature of these artefacts and deposits suggest the region was utilized by Aboriginal people over time with short and long term camping and opportunistic forays in forests for hunting and gathering purposes.

Lilley (1993) identifies this scarcity of sites over the whole area as a product of Mid Holocene high sea level stand, gradual erosion and lack of visibility and access with the forests used for low impact hunting and gathering activities. He also suggests a small population may have been the contributor to the low number of sites or a lack of suitable estuaries off the coast to encourage exploitation. Perhaps the explanation that best fits the Leeuwin Naturaliste scenario

is that the lack of quantative evidence reflects the terrain where sites may be buried in colluvial dunes or hidden in dense vegetation (Dortch & Dortch 1997).

The reasons given for the limited number of sites located in regional surveys are often ground disturbance from infrastructure, farming and clearing, taphonomic factors and poor visibility from dense ground cover and vegetation rather than a result of Aboriginal settlement patterns. The present survey contained all these features while ground visibility varied from a moderate to a low degree throughout the survey. Archaeological research in forest and farmland areas suggests artefact scatter sites are frequently found in disturbed ground, particularly in areas where, prior to disturbance, there is low visibility. Archaeological sites nevertheless require some land integrity for the sites to have any provenance and, thus, scientific significance.

RECOMMENDATIONS

No archaeological site was located within the project area in the course of the survey. No archaeological sites or heritage places were previously registered within the project area. Therefore there are no archaeological barriers present to effect the proposed development.

The most likely areas where archaeological sites, in particular, artefact scatters or burials, may occur are banks of rivers, lakes, creeks, swamps and exposed sandy deposits. The removal or excavation of large quantities of sediment increases the risk of disturbing archaeological sites that may lie beneath the ground surface. It is recommended that GHD on behalf of Main Roads WA inform any project personnel of their obligation to report any archaeological material, should this be encountered during earthmoving, as outlined under Section 15 of the Aboriginal Heritage Act 1972.

If GHD on behalf of Main Roads WA locate an archaeological site in the process of survey or ground excavation, it is recommended that work cease in the immediate area. Any skeletal material should be reported to Department of Indigenous Affairs and the Western Australian Police Service. Any artefactual material should be reported to Heritage and Culture Division, Department of Indigenous Affairs.

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APPENDIX 1: SITES REGISTER SEARCH

Search Criteria

2 sites in a search polygon. The polygon is formed by these points (in order):

MGA Zone 50	
Northing	Easting
6244239	322469
6244227	322655
6243756	322841
6243465	323467
6243582	323845
6243446	323925
6243260	323584
6241773	324396
6241154	324743
6238719	324774
6238050	324086
6238019	322364
6238527	322364
6238539	323045
6238960	323051
6238973	323275
6238508	323491
6238502	324117
6238812	324427
6240460	324402
6240429	323231
6240683	323250
6240683	324427
6243337	322990
6243021	322556
6243108	322407
6244239	322463
6244239	322469

Disclaimer

Aboriginal sites exist that are not recorded on the Register of Aboriginal Sites, and some registered sites may no longer exist. Consultation with Aboriginal communities is on-going to identify additional sites. The AHA protects all Aboriginal sites in Western Australia whether or not they are registered.

Copyright

Legend

Restriction

N	No restriction
M	Male access only
F	Female access

Access

C	Closed
O	Open
V	Vulnerable

Coordinate Accuracy

Accuracy is shown as a code in brackets following the site coordinates.

[Reliable]	The spatial information recorded in the site file is deemed to be reliable, due to methods of capture.
[Unreliable]	The spatial information recorded in the site file is deemed to be unreliable due to errors of spatial data capture and/or quality of spatial information reported.

Status

L - Lodged		ACMC Decision Made
Information lodged, awaiting assessment	→	R - Registered Site I - Insufficient information S - Stored Data

Spatial Accuracy

Index coordinates are indicative locations and may not necessarily represent the centre of sites, especially for sites with an access code “closed” or “vulnerable”. Map coordinates (Lat/Long) and (Easting/Northing) are based on the GDA 94 datum. The Easting / Northing map grid can be across one or more zones. The zone is indicated for each Easting on the map, i.e. '5000000:Z50' means Easting=5000000, Zone=50.

Sites Shown on Maps

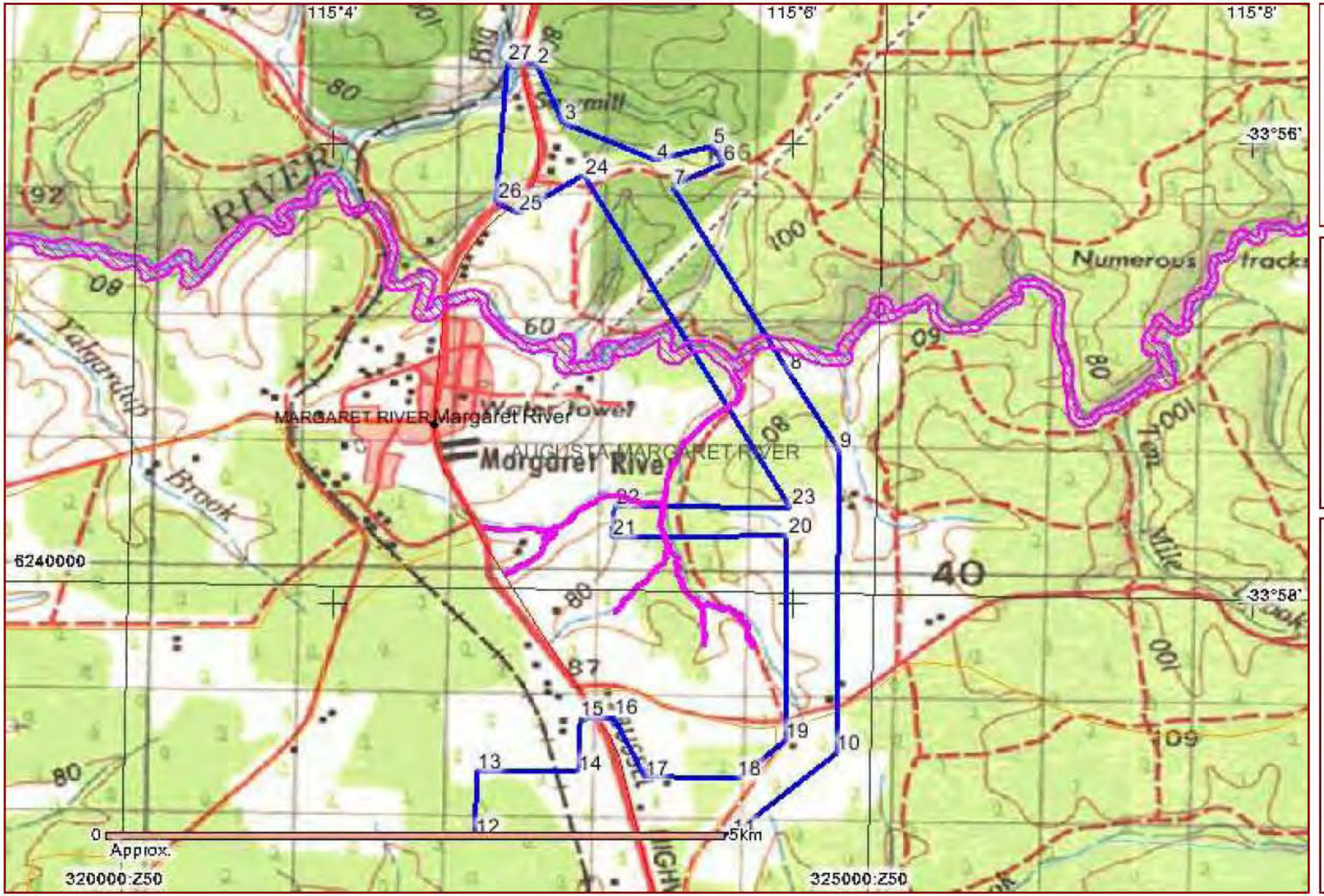
Site boundaries may not appear on maps at low zoom levels

List of 1 Registered Aboriginal Sites with Map

Site ID	Status	Access	Restriction	Site Name	Site Type	Additional Info	Informants	Coordinates	Site No.
4495	R	O	N	Margaret River.	Mythological	[Other: WAUGAL (FORMER]	*Registered Informant names available from DIA.	334424mE 6245429mN Zone 50 [Reliable]	S02614

Aboriginal Heritage Inquiry System

Aboriginal Sites Database



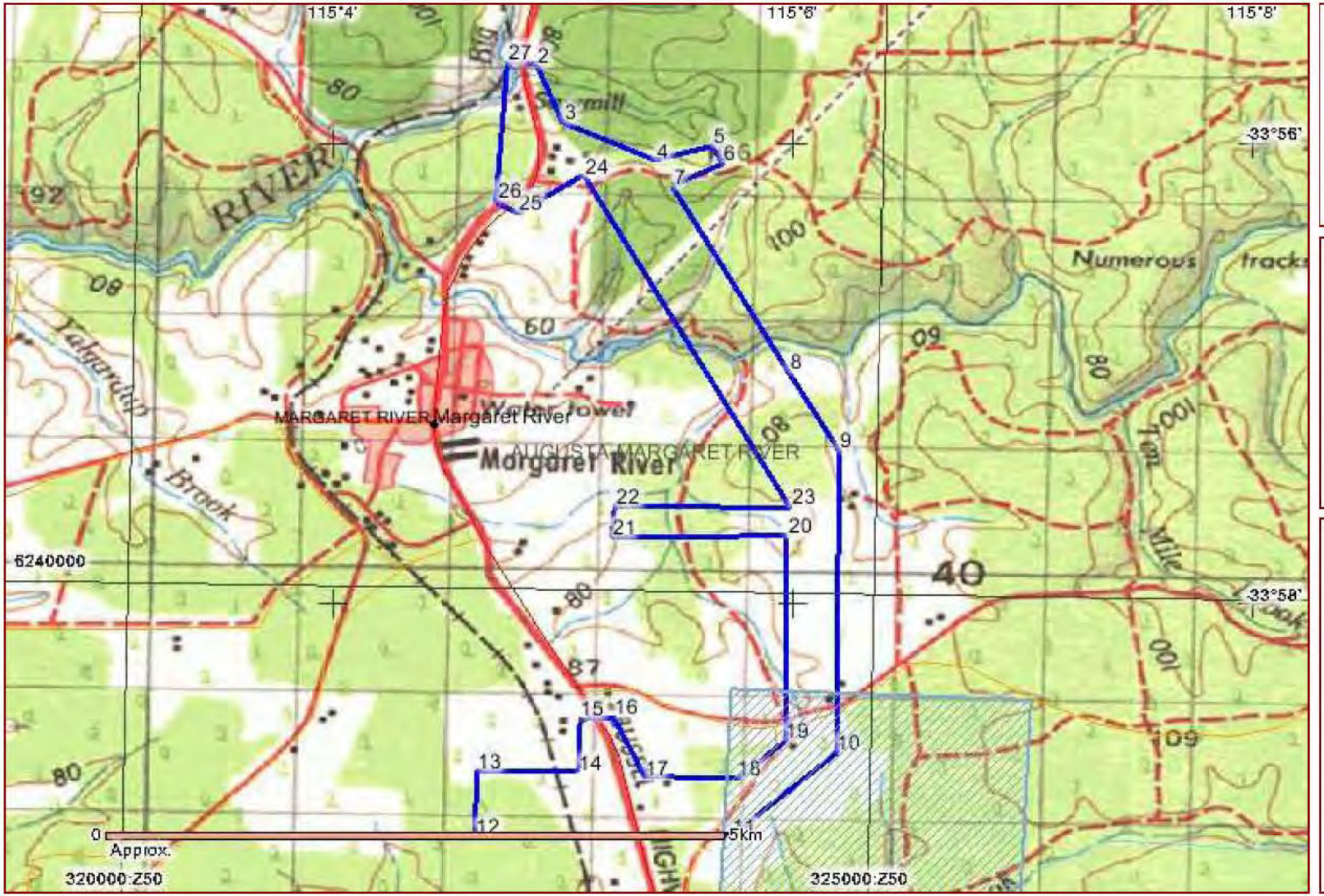
Legend

Selected Heritage Sites

- Registered Sites
- Town
- Map Area
- Search Area

List of 1 Other Heritage Places with Map

Site ID	Status	Access	Restriction	Site Name	Site Type	Additional Info	Informants	Coordinates	Site No.
4494	S	C	M	Rosa Brook Road (Margaret River Lore Ground)	Ceremonial	Meeting Place, Camp, [Other: Battle ground]	*Registered Informant names available from DIA.	Not available for closed sites	S02613



Legend

Selected Heritage Sites

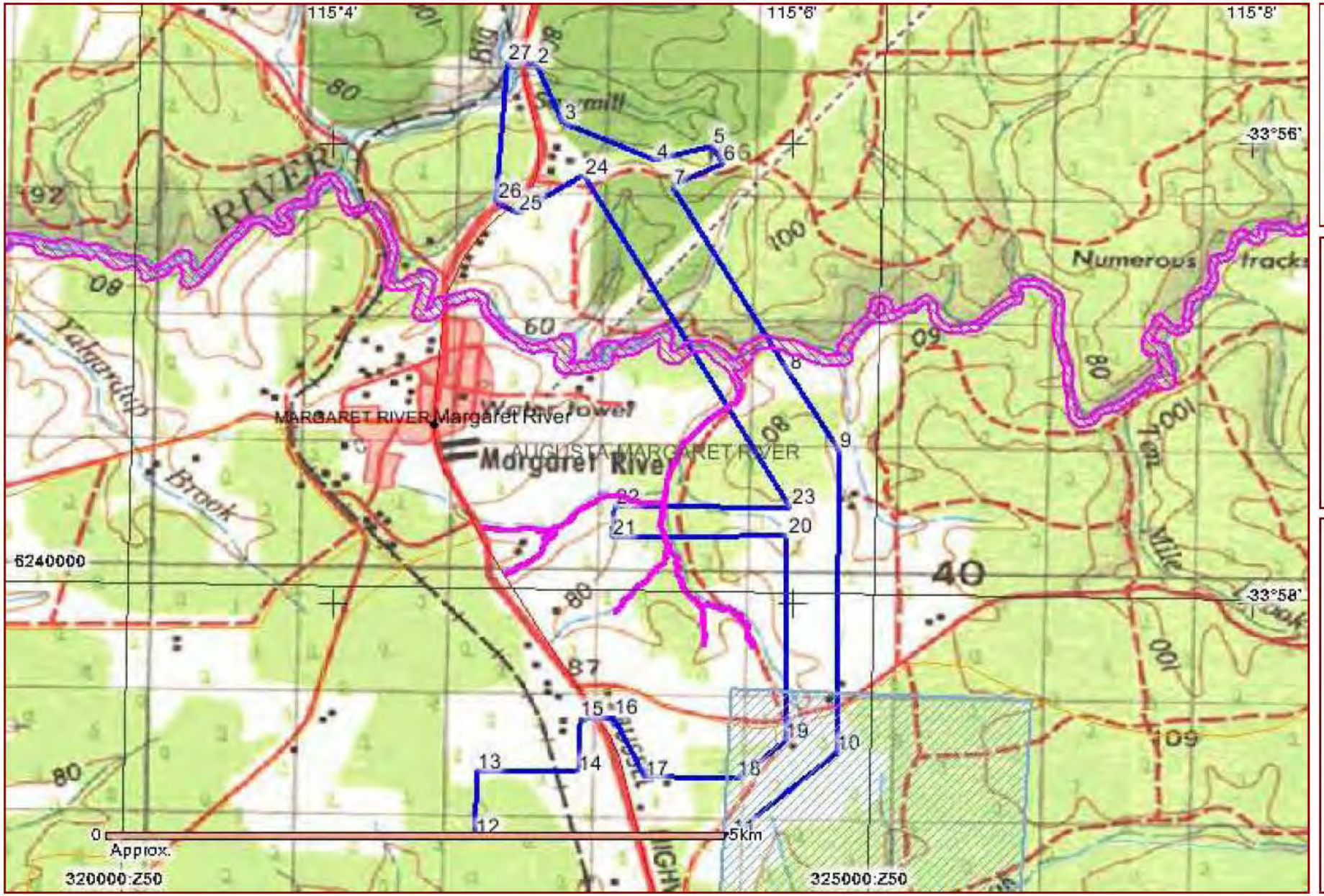
Other Heritage Places

Town

Map Area

Search Area

Map Showing Registered Aboriginal Sites and Other Heritage Places



Legend

Selected Heritage Sites

- Registered Sites
- Other Heritage Places
- Town
- Map Area
- Search Area

APPENDIX 2: LETTER OF ADVICE

Brad Goode & Associates Pty Ltd
Consulting Anthropologist
Heritage Assessments

79 Naturaliste Terrace
DUNSBOROUGH WA 6281
(08) 9755 3716
bradnlee@westnet.com.au
ACN: 134 732 040
ABN: 41 134 732 040

17th April 2012

We the undersigned have been consulted by Brad Goode & Associates for GHD Pty Ltd, on behalf of Main Roads in regards to the Margaret River Bypass. We would like to make the following recommendations in relation to the Western Australian Aboriginal Heritage Act (1972).

South West Boojarah WC06/4 Native Title Claim Group		
~~Bill~~ Webb GWENDA (NOW) Chapman	17.4.2012	
Jack Hill	17.4.2012	
~~Phil Prosser~~	~~17.4.2012~~	
David Pell	17.4.2012	
Gloria Hill	17.4.2012	
~~Samantha Nannup~~ Samantha Nannup	~~17.4.2012~~	
Wayne Webb	17.4.2012	

Brad Goode & Associates Pty Ltd
Consulting Anthropologist
Heritage Assessments

79 Naturaliste Terrace
DUNSBOROUGH WA 6281
(08) 9755 3716
bradnlee@westnet.com.au
ACN: 134 732 040
ABN: 41 134 732 040

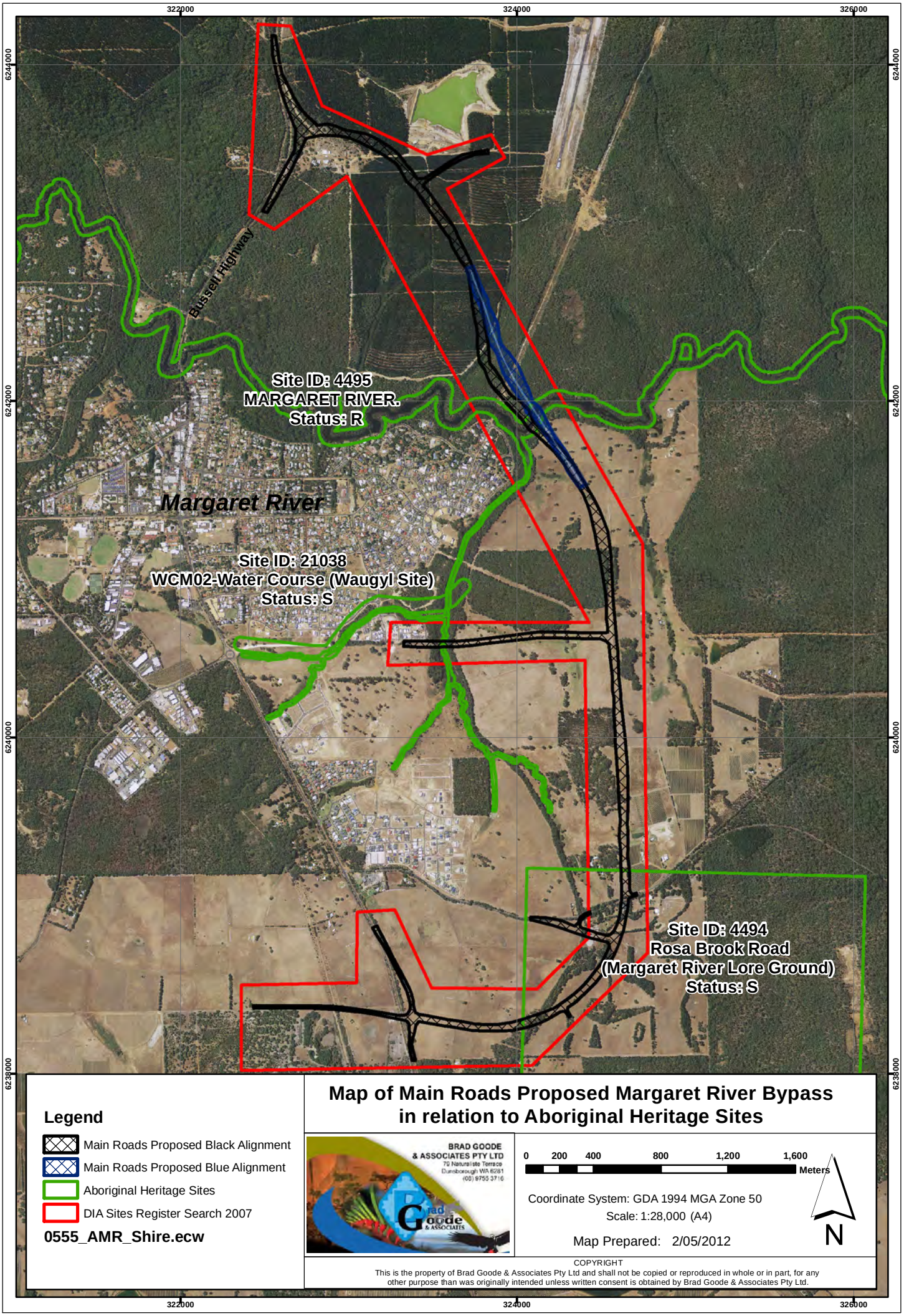
18th April 2012

We the undersigned have been consulted by Brad Goode & Associates for GHD Pty Ltd, on behalf of Main Roads in regards to the Margaret River Bypass. We would like to make the following recommendations in relation to the Western Australian Aboriginal Heritage Act (1972).

* Support S-13 to cross MR with Blue option preferred.
* Support S-13 to cross North Brook
* Do not want Pylons in the river
* Request monitor/employment/training

Harris Family WC96/041 Native Title Claim Group		
Mini Van Leeuwin	18.4.2012	Mini Van Leeuwin
Carrie Harris	18.4.2012	C Harris
Dorothy Blurton	18.4.2012	D Blurton
~~Keith~~ Harris (NEE TRAVIS NARKLE)	18.4.2012	TRAVIS NARKLE
Wendy Harris	18.4.2012	Wendy Harris

APPENDIX 3: MAPS OF THE PROJECT AREA IN RELATION TO ABORIGINAL HERITAGE SITES



Legend

- Main Roads Proposed Black Alignment
- Main Roads Proposed Blue Alignment
- Aboriginal Heritage Sites
- DIA Sites Register Search 2007

0555_AMR_Shire.ecw

Map of Main Roads Proposed Margaret River Bypass in relation to Aboriginal Heritage Sites

BRAD GOODE
& ASSOCIATES PTY LTD
79 Naturaliste Terrace
Dunsborough WA 6281
(08) 9755 3716

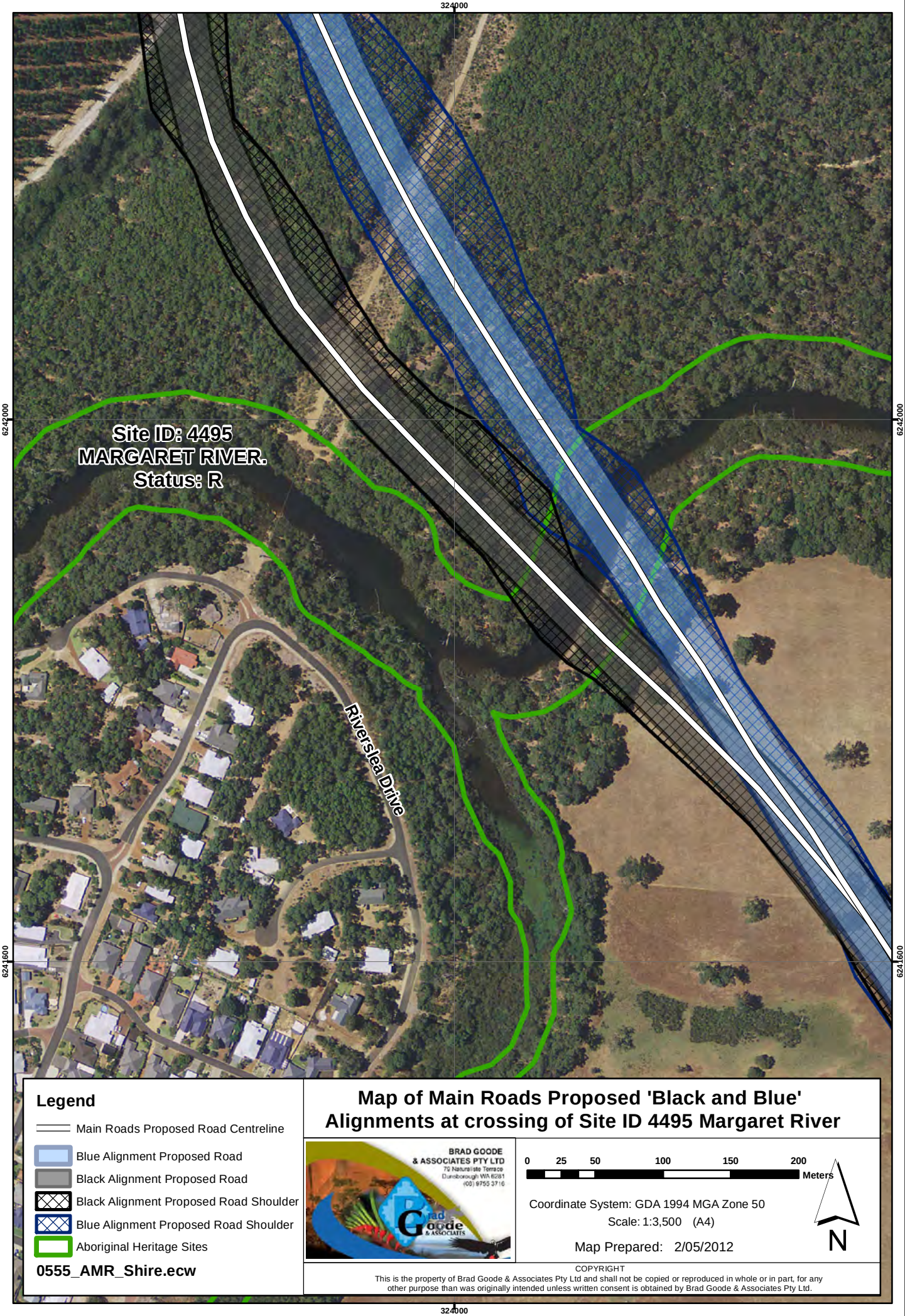
0 200 400 800 1,200 1,600 Meters

Coordinate System: GDA 1994 MGA Zone 50

Scale: 1:28,000 (A4)

Map Prepared: 2/05/2012

N



Legend

- Main Roads Proposed Road Centreline
- Blue Alignment Proposed Road
- Black Alignment Proposed Road
- Black Alignment Proposed Road Shoulder
- Blue Alignment Proposed Road Shoulder
- Aboriginal Heritage Sites

0555_AMR_Shire.ecw

Map of Main Roads Proposed 'Black and Blue' Alignments at crossing of Site ID 4495 Margaret River

BRAD GOODE
& ASSOCIATES PTY LTD
79 Naturaliste Terrace
Dunsborough WA 6281
(08) 9755 3716

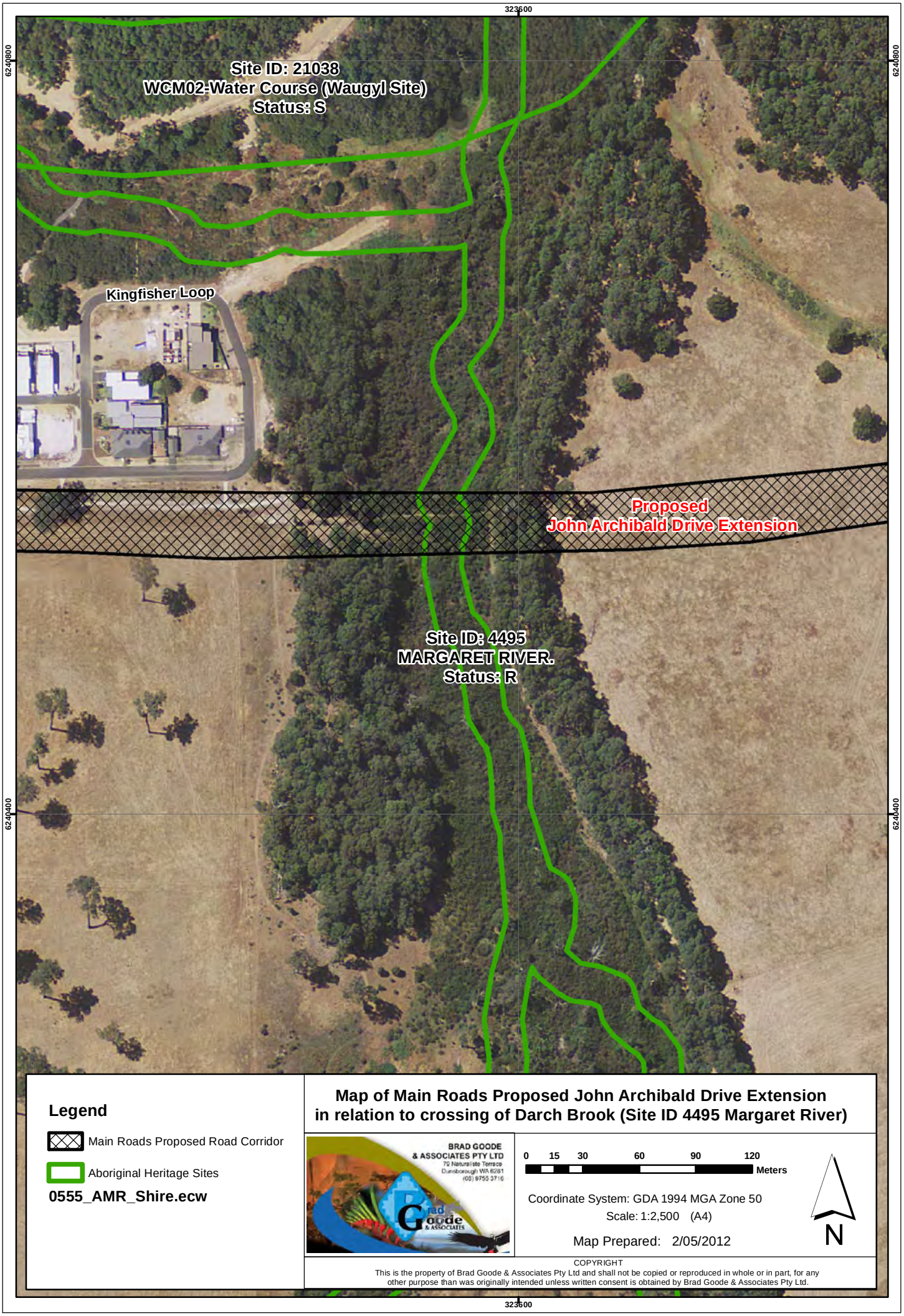
0 25 50 100 150 200 Meters

Coordinate System: GDA 1994 MGA Zone 50

Scale: 1:3,500 (A4)

Map Prepared: 2/05/2012

N



Legend

Main Roads Proposed Road Corridor

Aboriginal Heritage Sites

0555_AMR_Shire.ecw

Map of Main Roads Proposed John Archibald Drive Extension in relation to crossing of Darch Brook (Site ID 4495 Margaret River)

BRAD GOODE
& ASSOCIATES PTY LTD
79 Naturaliste Terrace
Dunsborough WA 6281
(08) 9755 3716

0 15 30 60 90 120 Meters

Coordinate System: GDA 1994 MGA Zone 50

Scale: 1:2,500 (A4)

Map Prepared: 2/05/2012

N

APPENDIX 4: BRIDGE AND CULVERT DESIGN DRAWINGS

Appendix G – Assessment against 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 majority of the proposed alignment traverses through cleared agricultural land which contains some individual stands and patches of mature Jarrah and Marri trees. The alignment also traverses pine plantations, native bushland, conservation reserve, and existing roads and private properties. 5.2 ha of the alignment contains remnant vegetation in good to very good condition. The dominant vegetation community within the project area is Jarrah (*Eucalyptus marginata*) and Marri (*Corymbia calophylla*) Open Forest with Peppermint (*Agonis flexuosa*) dominant along rivers and drainage lines. No Priority Ecological Communities (PECs) have been recorded within the project area. No Priority listed fauna were recorded in the study area during the field survey, although five Priority fauna species have previously been recorded within 5 km (NatureMap, 2011). Three fauna species listed as Vulnerable under the EPBC Act and Schedule 1 under the WC Act were recorded within the Project Area during the field survey (Baudin's Black Cockatoo, Western Ringtail Possum and Forest Red-tailed Black Cockatoo) No Threatened flora were recorded in the study area during the field survey, although one Priority flora species *Gastrolobium formosum* (P3) was recorded, with a targeted search in Spring 2012 identifying approximately 400 individuals at a cover of 70%. Additionally, approximately 200 plants at a similar cover were identified on the banks of the Margaret River, within 50 m of the Project Area, indicating that the species occurs at similar densities and is not confined to the Project Area. Vegetation within the project area is considered to represent moderate species diversity, with a total of 168 taxa from 52 families recorded, of which 34 are introduced species. The vegetation has had a combination of previous disturbances including large-scale clearing, roads/tracks and logging. Given the relatively small size of the project area and the availability of similar vegetation in the surrounding area, the loss of vegetation within the project area is unlikely to significantly reduce the biodiversity of the local area.	The proposal may be at variance to the principle.
(b)	Native vegetation should not be cleared if it comprises the whole or part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous Western Australia.	The desktop queries identified twelve EPBC Act and WC Act threatened species and a further five marine and/or migratory bird species as potentially occurring within the study area. Six additional DEC listed Priority fauna species have been recorded within 5 km of the Project. Three fauna species listed as Vulnerable under the EPBC Act and Schedule 1 under the WC Act were recorded within the Project Area during the field survey, including Baudin's Black Cockatoo, Western Ringtail Possum and Forest Red-tailed Black Cockatoo. Additionally, the Southern Brush-tailed Phascogale which is also listed as Vulnerable and in Schedule 1, was recorded in the nearby Lot 2150. There is potential that this species also occurs within remnant	The proposal may be at variance to the principle.

Principle Number	Principle	Assessment	Outcome
		vegetation within the alignment. Within the Project Area there is a total of 4.64 ha of potential Black Cockatoo feeding habitat. There are 41 trees (Jarrah/Marri/eucalypt stags) within the Project Area which contain nesting hollows suitable for Black Cockatoo breeding. A further 171 trees were identified as a size suitable for the development of nesting hollows (>500 mm DBH) within the next 100 years. During the field survey three Western Ringtail Possums were observed active at night along riparian vegetation in the northern section of the alignment. Two dreys (resting platforms in trees) were also recorded in this area. Droppings were also recorded along Margaret River in the riparian vegetation and in the valley of Lot 2150. One hundred and twenty-three large Eucalypts were recorded within the alignment with hollows suitable for this species. The area of habitat that Western Ringtail Possums may utilise is approximately 0.86ha.	
(c)	Native vegetation should not be cleared if it includes, or is necessary for the continued existence of, rare flora.	No Threatened flora species listed under the WC Act or EPBC Act have been recorded within the project area.	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.	There are no known Threatened Ecological Communities (TECs) within 5 km of the project area. No TECs were recorded within the project area during the field survey.	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 vegetation within the project area is described as predominantly Beard vegetation association 3, with a small section in the north of the project area described as Beard vegetation association 1. The Mattiske vegetation complexes within the Project Area include Cowaramup (C1), Cowaramup (CW1) and Wilyabrub (W1). The extent of the vegetation complexes C1 and CW1 are considered to be *Depleted*, i.e. between 30% and 50% of pre-European extent remaining. The extent of the vegetation complex W1 and Beard vegetation associations 1 and 3 are considered of *Least Concern*, i.e. intact, with over 50% of the pre-European extents remaining. The Beard and Mattiske vegetation associations and complexes present in the study area all	The proposal is not at variance with the Principle.

Principle Number	Principle	Assessment	Outcome
		retain more than the threshold level (30%) recommended in the National Objectives Targets for Biodiveristy Conservation, below which species loss appears to accelerate exponentially at an ecosystem level (Commonwealth of Western Australia, 2001). Furthermore, the study area does not occur within an extensively cleared landscape as approximately 67% of pre-European vegetation extent remains in the Shire of Augusta-Margaret River. Main Roads have proposed to offset the loss of vegetation as a result of the proposed project.	
(f)	Native vegetation should not be cleared if it is growing in or in association with a watercourse or wetland.	There are no listed significant wetlands or watercourses within the project area. However, the Project Area traverses a section of the Margaret River and Darch Brook. Vegetation associated with these waterways includes Jarrah-Marri-Peppermint Forest and Closed Scrub of *Melaleuca* spp. over mixed Sedgeland. Water flow within these waterways will be maintained and where possible no diversion of watercourses be carried out. Direct impact on riparian vegetation and associated habitat should be avoided wherever possible. Vegetation retention within drainage lines will help prevent erosion and flooding and prevent potential deleterious impacts on downstream areas.	The proposal is 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.	The soils within the project area consist of loamy gravels, duplex sandy gravels, semi-wet soils and grey deep sand duplexes with some granite outcropping. Soil erosion and water erosion may occur on these soils, particularly along the river and creeklines. The clearing of native vegetation may cause some alteration to the health of adjacent lands including the introduction/spread of dieback, soil erosion and runoff and weed dispersal. The dieback assessment identified dieback within the transmission line easement, with the remnant vegetation to the north and south of this line being downslope. Consequently, dieback is likely to have infiltrated these areas of the State Forest and Bramley National Park. Main Roads has experience at addressing these issues on other projects and given appropriate management, the Project is unlikely to result in appreciable land degradation. Specific management actions will be implemented for the management of dieback, runoff, erosion, invasive species (weeds) and fire, with these incorporated into the CEMP.	The proposal is unlikely to be at variance with the Principle.
(h)	Native vegetation should not be cleared if the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby	There are no Environmentally Sensitive Areas (ESAs) within or in close proximity to the study area. North of the Margaret River crossing, the alignment traverses Keenan State Forest and timber reserve and lies adjacent to the Bramley National Park. This section of the alignment was excluded from the National Park by request from Main Roads and the Shire of Augusta-	The proposal may be at variance with the Principle

Principle Number	Principle	Assessment	Outcome
	conservation area.	Margaret River, although 0.54 ha of the National Park will require excision. The proposed road will create a barrier for fauna movement between the western and eastern boundaries of the alignment within the National Park. However Main Roads have proposed to create wildlife corridors along the alignment to facilitate the movement of fauna between conservation areas. To reduce potential impacts associated with clearing within the section of remnant vegetation within and/or adjacent to the Bramley National Park, specific management actions for flora and fauna, dieback, erosion and invasive species (weeds) and fire should be incorporated in to the CEMP.	
(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.	The Project Area traverses the Margaret River and Darch Brook, and as such there is a risk of runoff with additional sediment entering these waterways during construction. A CEMP will be prepared which includes management actions to address these potential impacts. Detail design should include consideration of water management such that there is no direct runoff to the water courses, and to stabilising the banks of the watercourse following construction. The groundwater salinity in the area is low. Given the scale of the proposed clearing, and the fact that the majority of the Project Area has been cleared for agriculture, it is unlikely to result in a deterioration of underground water quality.	The proposal is unlikely to be at variance with the Principle
(j)	Native vegetation should not be cleared if the clearing of the vegetation is likely to cause, or exacerbate, the intensity of flooding.	A large proportion of the project area is presently cleared for agricultural purposes or consists of planted/introduced species. Given the nature of the soil within the project area and the scale and linear nature of the proposed clearing, it is not considered likely to cause, or exacerbate, the intensity of flooding. Any potential impacts will be managed through design and in the CEMP.	The proposal is not at variance with the Principle.

Appendix H – Noise Assessment Reports

Margaret River Bypass

Lloyd George Acoustics
PO Box 717
Hillarys WA 6923
T: 9300 4188 F: 9300 4199
E: daniel@lgacoustics.com.au W: www.lgacoustics.com.au

Transport Noise Assessment

Margaret River Bypass

Reference: 12042120-01

Report: 12042120-01

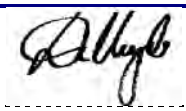
Lloyd George Acoustics Pty Ltd

ABN: 79 125 812 544

PO Box 717
Hillarys WA 6923

Offices:	Ocean Reef	Padbury	Scarborough	Waterford
Phone:	9300 4188	9401 7770	9245 3223	9313 3655
Fax:	9300 4199	9401 7770	9300 4199	9300 4199
Email:	daniel@lgacoustics.com.au	terry@lgacoustics.com.au	mike@lgacoustics.com.au	rebecca@lgacoustics.com.au
Mobile:	0439 032 844	0400 414 197	0438 201 071	0427 388 876

Member of the Association of Australian Acoustical Consultants – (AAAC)

Prepared By:	Daniel Lloyd 
Position:	Project Director
Verified	Terry George 
Date:	25 October 2012

CONTENTS

APPENDICES

1 INTRODUCTION

This assessment has been undertaken to determine the future traffic noise levels at noise sensitive receivers located adjacent to the proposed Margaret River Bypass. The project area is in shown in *Figure 1.1.*

Three options are assessed. The first two options relate to a variation in the dual-carriageway alignment, as shown within the red square in *Figure 1.1.* The black lines represent Alignment 1, and the blue lines represent Alignment 2. The third option is a single carriageway road that broadly follows the Alignment 2.

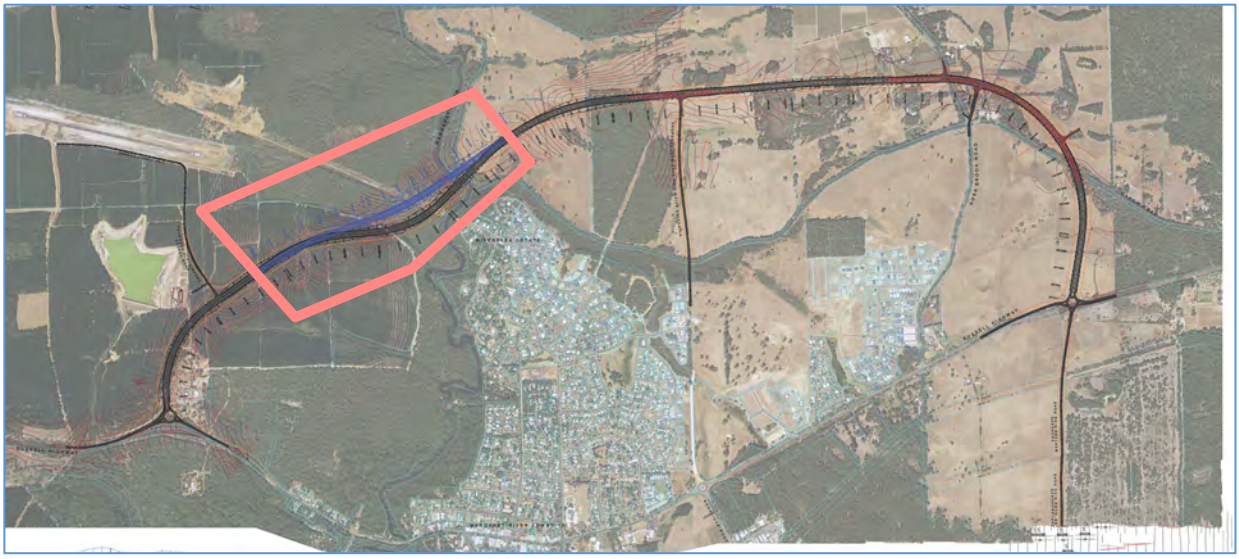


Figure 1.1 Project Area

For each option, consideration has been given to the expected traffic volumes on the proposed bypass assuming the following scenarios:

- Soon after Bypass opening (2014);
- Future (2031) traffic volumes assuming "low development" of the Margaret River region; and
- Future (2031) traffic volumes assuming "full development" of the Margaret River region.

The results of the assessment are compared against the criteria contained within *State Planning Policy 5.4 Road and Rail Transport Noise and Freight Considerations in Land Use Planning.* Where these criteria are exceeded, noise mitigation options and the effectiveness of these options in broad terms are provided.

Appendix B contains a description of some of the terminology used throughout this report.

2 CRITERIA

When constructing a new transport corridor adjacent to existing or future planned noise sensitive premises, the relevant noise level criteria in Western Australia is the *State Planning Policy 5.4 Road and Rail Transport Noise and Freight Considerations in Land Use Planning* (hereafter referred to as the Policy) produced by the Western Australian Planning Commission (WAPC).

The Policy's outdoor noise criteria are shown below in *Table 2.1*. These criteria apply at any point 1-metre from a habitable façade of a noise sensitive premises and in one outdoor living area.

Table 2.1 – Outdoor Noise Criteria

Period	Target	Limit
Day (6am to 10pm)	55 dB $L_{Aeq(\textbf{Day})}$	60 dB $L_{Aeq(\textbf{Day})}$
Night (10pm to 6am)	50 dB $L_{Aeq(Night)}$	55 dB $L_{Aeq(Night)}$

The 5 dB difference between the *target* and *limit* is referred to as the *margin*.

In the application of the noise criteria to new major road infrastructure projects, the objective of the Policy is that the new infrastructure be designed and constructed so that the noise emissions are at a level that—

- provides an acceptable level of acoustic amenity for existing noise-sensitive land uses and for the planning of new noise-sensitive developments;
- is consistent with other planning policies and community expectations; and
- is practicably achievable.

For transport infrastructure projects within the scope of this policy, a noise assessment should be conducted in accordance with the guidelines, to predict future noise levels resulting from the project and to identify relevant noise mitigation measures.

If a transport infrastructure project will emit transport noise levels that meet the noise target, no further measures are required under this policy. Otherwise, transport infrastructure providers should design mitigation measures to achieve the noise *limit* of $L_{Aeq(Day)}$ 60 dB and $L_{Aeq(Night)}$ 55 dB, when assessed at one metre from the façade at ground floor level.

Transport infrastructure providers are also required to consider design measures to meet the noise *target* of $L_{Aeq(Day)}$ 55 dB and $L_{Aeq(Night)}$ 50 dB and to implement these measures where reasonable and practicable.

If a new major road infrastructure project is to be constructed in the vicinity of a future noise-sensitive land use, mitigation measures should be implemented in accordance with this part of the policy. For this purpose, a proposed noise-sensitive land use is any noise sensitive development that is subject to an approved detailed area plan, subdivision approval or development approval, such that the transport infrastructure provider is able to adequately design noise mitigation measures to protect that development. In these instances, the infrastructure provider and developer are both responsible for ensuring that the objectives of this policy are achieved, and a mutually beneficial noise management plan, including individual responsibilities, should be negotiated between the parties.

It is recognised that in some cases it may not be practicable to achieve the noise criteria. In these circumstances reference should be made to section 5.8 of the Policy and the guidelines. Section 5.8 of the Policy states:

This policy applies a performance-based approach to the management and mitigation of transport noise. It is recognised that in a number of instances it may not be reasonable and practicable to meet the noise target criteria. Where transport noise is above the target level, measures are

expected to be implemented that best balance reasonable and practicable considerations, such as noise benefit, cost, feasibility, community preferences, amenity impacts, safety, security and conflict with other planning and transport policies. In these cases the community should also be consulted to assist in identifying best overall solutions. The guidelines assist in outlining ways in which some reasonable and practicable limitations can be addressed in a manner that also minimises transport noise.

It is further acknowledged that there may also be situations in which the noise limit cannot practicably be achieved, especially in the case of major redevelopment of existing transport infrastructure. Similarly, it may not be practicable to achieve acceptable indoor noise levels if the new development is located very close to the transport corridor. In these situations the primary focus should be on achieving the lowest level of noise, with other reasonable and practicable considerations being secondary to this objective.

In cases where the noise limit or indoor noise criteria cannot practicably be met, longer term strategies for land use planning, transport policy and vehicle emissions should be considered to minimise transport noise impact over time.

3 METHODOLOGY

Noise measurements and modelling have been undertaken in accordance with the requirements of the Policy as described below in *Sections 3.1 and 3.2*.

3.1 Site Measurements

Noise monitoring was undertaken at three (3) locations in order to:

- Quantify the existing noise levels;
- Determine the differences between different acoustic parameters ($L_{A10,18hour}$, $L_{Aeq\ (Day)}$ and $L_{Aeq\ (Night)}$); and
- Calibrate the noise model.

Sound pressure levels were measured in accordance with Australian Standard 2702-1984: *Acoustics - Method For Measurement of Road Traffic Noise*. For measurement locations adjacent to a building, the logger was positioned at one metre from the façade of interest and the microphone height was 1.4 metres above ground floor level. The logger was also placed at least one metre from any corner of the building.

The instrumentation used was ARL Ngara noise data loggers, pictured below in *Figure 3.1*. The ARL Ngara noise data loggers comply with the instrumentation requirements of *Australian Standard 2702-1984 Acoustics – Methods for the Measurement of Road Traffic Noise*. Each logger was field calibrated before and after the measurement session and found to be accurate to within +/- 1 dB. Lloyd George Acoustics holds current NATA laboratory calibration certificate for the loggers.

Noise loggers were set-up to obtain 5 full weekdays between 14 and 18 May 2012. The measurement locations are detailed below and shown in *Figure 3.2*.

Logger 1 167 Rosa Brook Road, Margaret River;

Logger 2 40 Riverslea Drive, Margaret River;

Logger 3 Bussell Hwy – Approximately 3 km north of Margaret River.

From the hourly measurements, the $L_{A10,18\ hour}$, $L_{Aeq,24\ hour}$, $L_{Aeq\ (Day)}$ and $L_{Aeq\ (Night)}$ values were determined for each complete measurement day. These results were averaged and the mean level reported. The noise data collected was verified by inspection and professional judgement. Where hourly data was considered atypical, an estimated value was inserted and highlighted by bold italic lettering in the data sheet.

Figure 3.1 – Automatic Noise Data Logger

Figure 3.2 – Location of Noise Data Loggers

3.2 Noise Modelling

The computer programme *SoundPLAN 7.1* was utilised, incorporating the *Calculation of Road Traffic Noise* (CoRTN) algorithms, modified to reflect Australian conditions. The modifications included the following:

- Vehicles were separated into heavy (Austroads Class 3 upwards) and non-heavy (Austroads Classes 1 & 2) with non-heavy vehicles having a source height of 0.5 metres above road level and heavy vehicles having two sources, at heights of 1.5 metres and 3.6 metres above road level, to represent the engine and exhaust respectively. By splitting the noise source into three, allows for less barrier attenuation for high level sources where barriers are to be considered. Note that corrections are applied to the exhaust of –8.0 dB (based on *Transportation Noise Reference Book, Paul Nelson, 1987*) and to the engine source of –0.8 dB, so as to provide consistent results with the CoRTN algorithms for the no barrier scenario.

- An adjustment of –1.7 dB has been applied to the predicted levels based on the findings of *An Evaluation of the U.K. DoE Traffic Noise Prediction*; Australian Road Research Board, Report 122 ARRB – NAASRA Planning Group 1982.

Predictions are made at heights of 1.4 metres (single storey residence) and at 1.0 metre from a building facade (resulting in a + 2.5 dB correction due to reflected noise).

Various input data are included in the modelling such as ground topography, road design and traffic volumes, etc. These model inputs are discussed below.

3.2.1 Ground Topography, Road Design & Cadastral Data

Main Roads provided 3-dimentional topographical and road design data. The contours were at 1 metre intervals and covered the road design and noise sensitive premises of concern.

3.2.2 Traffic Data

Traffic data includes:

- Traffic Volumes –

  Traffic volumes representing the "soon after bypass opening" and "future" scenarios are shown in *Figures 3.3 to 3.5.* The future scenarios relate to the year 2031 and assume either low or full development of the Margaret River region. The traffic volumes were obtained from Main Roads.

- Vehicle Speed –

  The vehicle speeds used in the noise modelling are as follows:

  Bypass Speed 110 km/h

  Rosa Brook Rd 70 km/h

Figure 3.3 Traffic Volumes (x10) Assuming Soon After Bypass Opening (2014)

Figure 3.4 Future (2031) Traffic Modelled Volumes (x10) Assuming "Low Development"

Figure 3.5 Future (2031) Traffic Modelled Volumes (x10 for daily flow) Assuming "Full Development"

- Road Surface –

The difference in noise emission between road surface types, when compared to Dense Graded Asphalt, is shown below in *Table 3.1*. The road surface for the proposed bypass is assumed to be 14mm Chip Seal.

Table 3.1 – Noise Relationship Between Different Road Surfaces

Road Surfaces						
Chip Seal			Asphalt			
14mm	10mm	5mm	Dense Graded	Novachip	Stone Mastic	Open Graded
+3.5 dB	+2.5 dB	+1.5 dB	0.0 dB	-0.2 dB	-1.0 dB	-2.5 dB

3.2.3 Ground Attenuation

The ground attenuation has been assumed to be 0.0 (0%) within the road reserve, 1.0 (100%) for other areas. Note 0.0 represents hard reflective surfaces such as bitumen and water and 1.00 represents absorptive surfaces such as grass.

3.2.4 Parameter Conversion

The CoRTN algorithms used in the *SoundPlan* modelling package were originally developed to calculate the $L_{A10,18hour}$ noise level. The Policy however uses $L_{Aeq\ (Day)}$ and $L_{Aeq\ (Night)}$. The relationship between the parameters varies depending on the composition of traffic on the road (volumes in each period and percentage heavy vehicles). For this project, the results of the measured noise levels adjacent to Bussell Highway (Location 3) where used to convert these parameters.

4 RESULTS

4.1 Noise Monitoring

The results of the noise monitoring are summarised below in *Table 4.1* and shown graphically in *Figures 4.1 to 4.3*.

Table 4.1 – Measured Average Noise Levels – Monitoring Locations

Location	Average Weekday Noise Level, dB		
	$L_{A10,18hour}$	$L_{Aeq\ (Day)}$	$L_{Aeq\ (Night)}$
1. 167 Rosa Brook Road	42	44	32
2. 40 Riverslea Drive	46	48	38
3. Bussell Highway*	70	69	58

* Used to calibrate future traffic.

The average difference between the $L_{Aeq\ (Day)}$ and $L_{Aeq\ (Night)}$ for the existing Bussell Highway is 11 dB. This same difference has been assumed to exist in future years. As such, it is the daytime noise levels that will dictate compliance with the Policy since these are at least 5 dB higher than night-time levels. The parameter conversion from $L_{A10,18hour}$ to $L_{Aeq\ (Day)}$ as described in Section 3.2.4, is -0.7 dB.

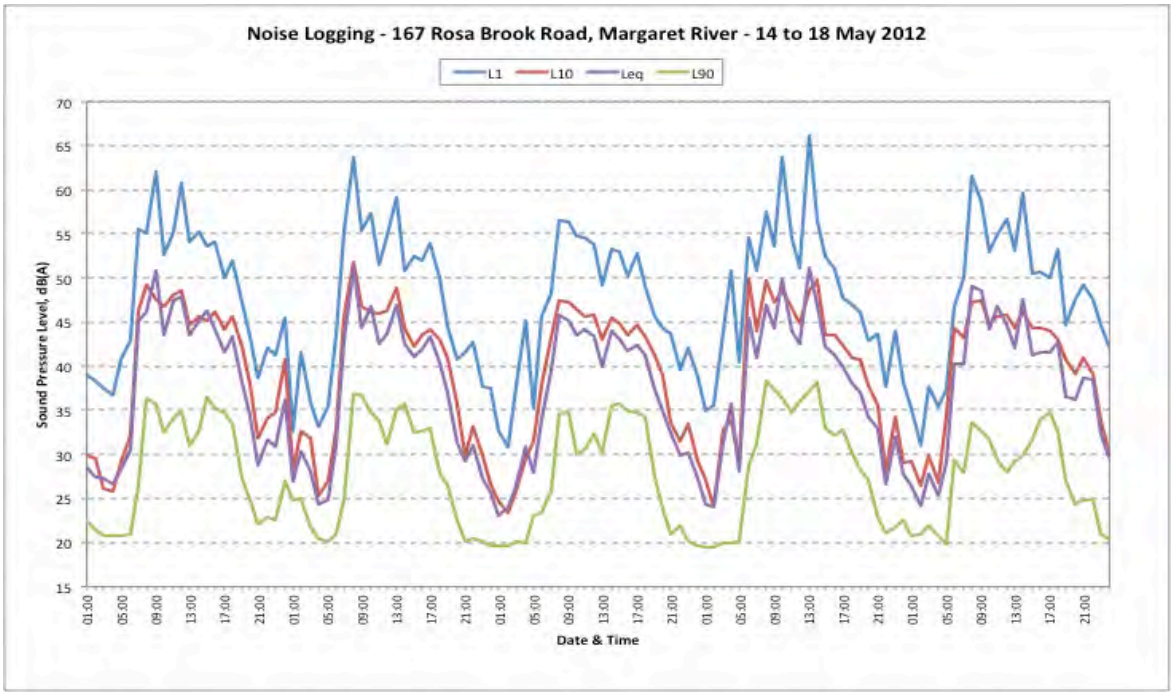


Figure 4.1 Results for Rosa Brook Road

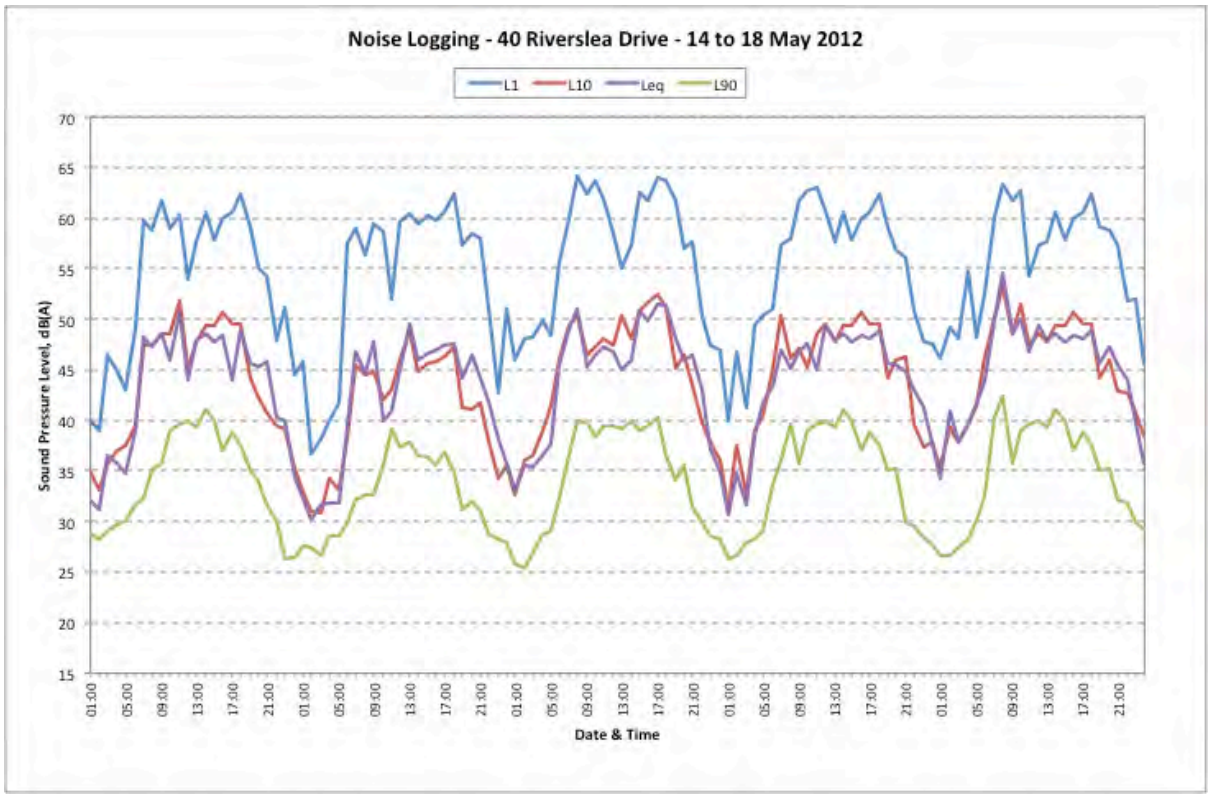


Figure 4.2 Results for Riverslea Drive

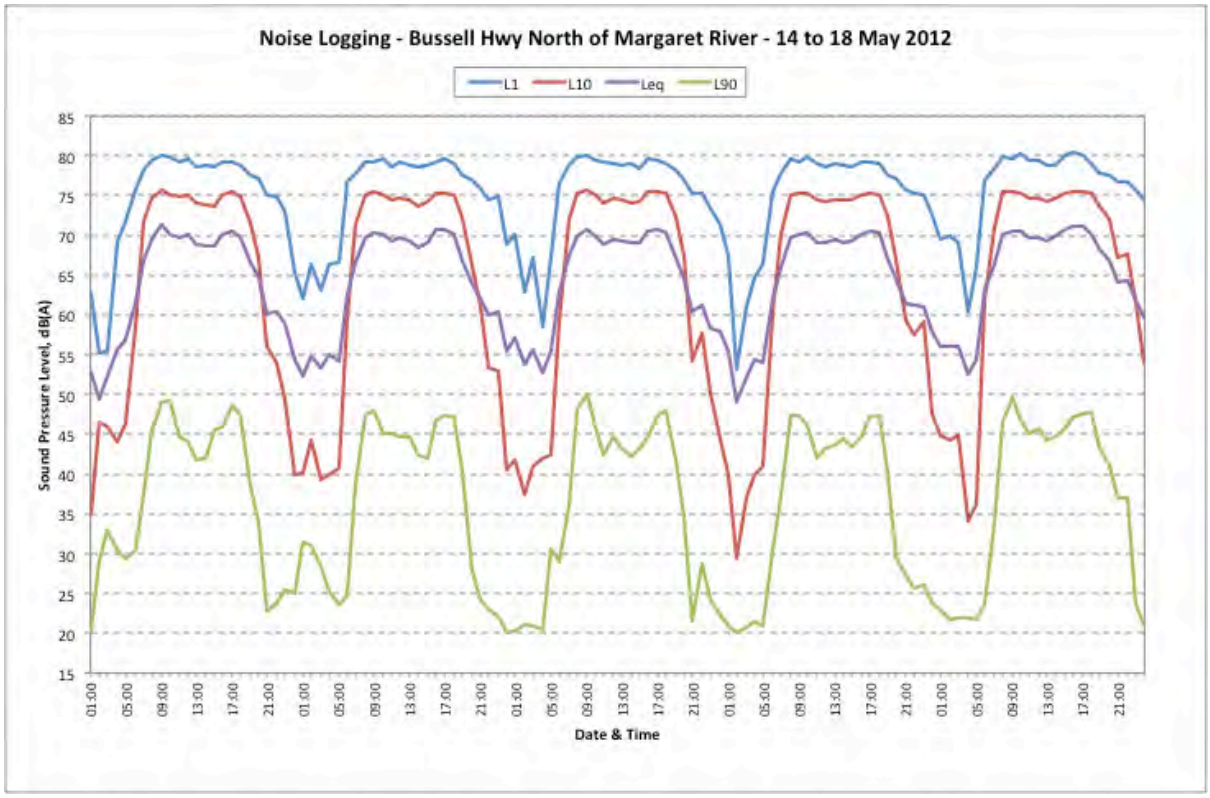


Figure 4.3 Results for Bussell Highway

4.2 Noise Modelling

The results of the noise modelling to each receiver location, shown in *Figures 4.4 and 4.5*, are presented in *Tables 4.2 to 4.4.* The cells shaded blue shows receivers predicted to be within the margin between the Policy's *target* and *limit* criteria and the cells shaded yellow show receivers predicted to be above the Policy's *limit* criteria. Noise level contour plots for each scenario are shown in *Figures 4.6 to 4.14* respectively.

Table 4.2 – Noise Prediction Results for Alignment Option 1 (Dual Carriageway)

Rec No	Traffic Noise Level $L_{Aeq,day}$ dB			Rec No	Traffic Noise Level $L_{Aeq,day}$ dB			Rec No	Traffic Noise Level $L_{Aeq,day}$ dB		
	Soon After	Low Dev	Full Dev		Soon After	Low Dev	Full Dev		Soon After	Low Dev	Full Dev
1	49	51	55	10	51	53	57	19	53	55	58
2	52	55	58	11	48	51	54	20	52	53	57
3	54	57	60	12	48	50	54	21	54	55	59
4	55	57	61	13	42	45	48	22	54	55	59
5	55	58	61	14	44	46	50	23	54	56	59
6	55	58	61	15	46	48	52	24	55	57	60
7	55	57	61	16	53	55	58	25	48	50	54
8	52	55	58	17	57	58	62	26	49	51	55
9	54	57	61	18	56	58	61	27	48	51	55

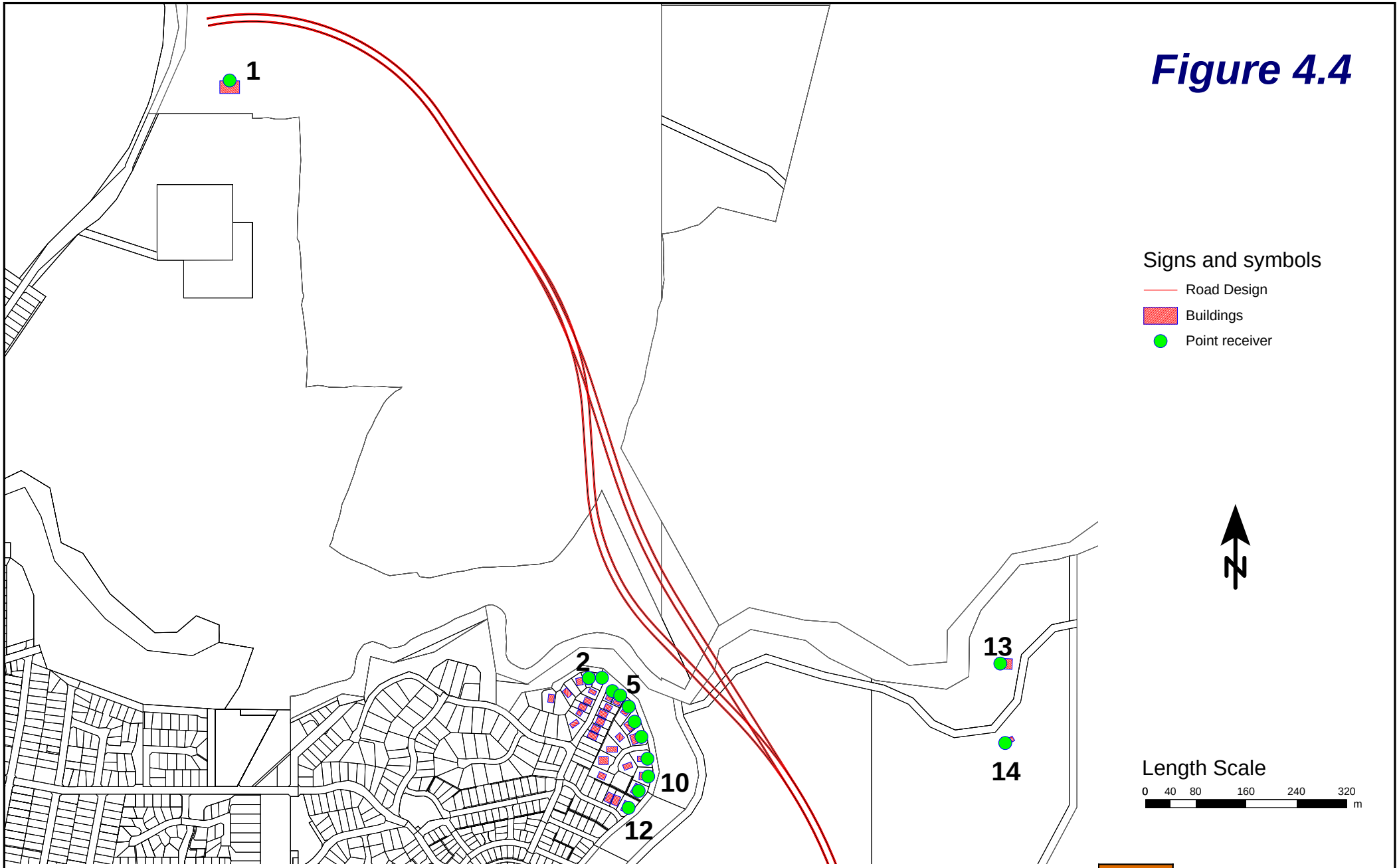
Table 4.3 – Noise Prediction Results for Alignment Option 2 (Dual Carriageway)

Rec No	Traffic Noise Level $L_{Aeq,day}$ dB			Rec No	Traffic Noise Level $L_{Aeq,day}$ dB			Rec No	Traffic Noise Level $L_{Aeq,day}$ dB		
	Soon After	Low Dev	Full Dev		Soon After	Low Dev	Full Dev		Soon After	Low Dev	Full Dev
1	49	51	55	10	50	53	56	19	53	55	58
2	47	49	53	11	48	51	54	20	52	53	57
3	50	53	56	12	48	50	54	21	54	55	59
4	51	53	57	13	43	45	49	22	54	55	59
5	51	54	57	14	44	46	50	23	54	56	59
6	52	54	58	15	46	48	51	24	55	57	60
7	52	54	58	16	53	55	58	25	48	50	54
8	51	54	57	17	57	58	62	26	49	51	55
9	52	55	58	18	56	58	61	27	48	51	55

Table 4.4 – Noise Prediction Results for Single Carriageway

Rec No	Traffic Noise Level $L_{Aeq,day}$ dB			Rec No	Traffic Noise Level $L_{Aeq,day}$ dB			Rec No	Traffic Noise Level $L_{Aeq,day}$ dB		
	Soon After	Low Dev	Full Dev		Soon After	Low Dev	Full Dev		Soon After	Low Dev	Full Dev
1	49	51	55	10	51	53	57	19	53	55	58
2	47	49	53	11	49	51	55	20	51	53	57
3	50	53	57	12	48	50	54	21	53	55	58
4	51	53	57	13	42	45	48	22	53	55	58
5	52	54	58	14	44	46	50	23	54	55	59
6	52	55	58	15	46	48	52	24	55	57	60
7	52	55	58	16	54	55	59	25	48	50	54
8	51	54	57	17	57	59	62	26	49	51	55
9	52	55	59	18	57	58	62	27	49	51	55

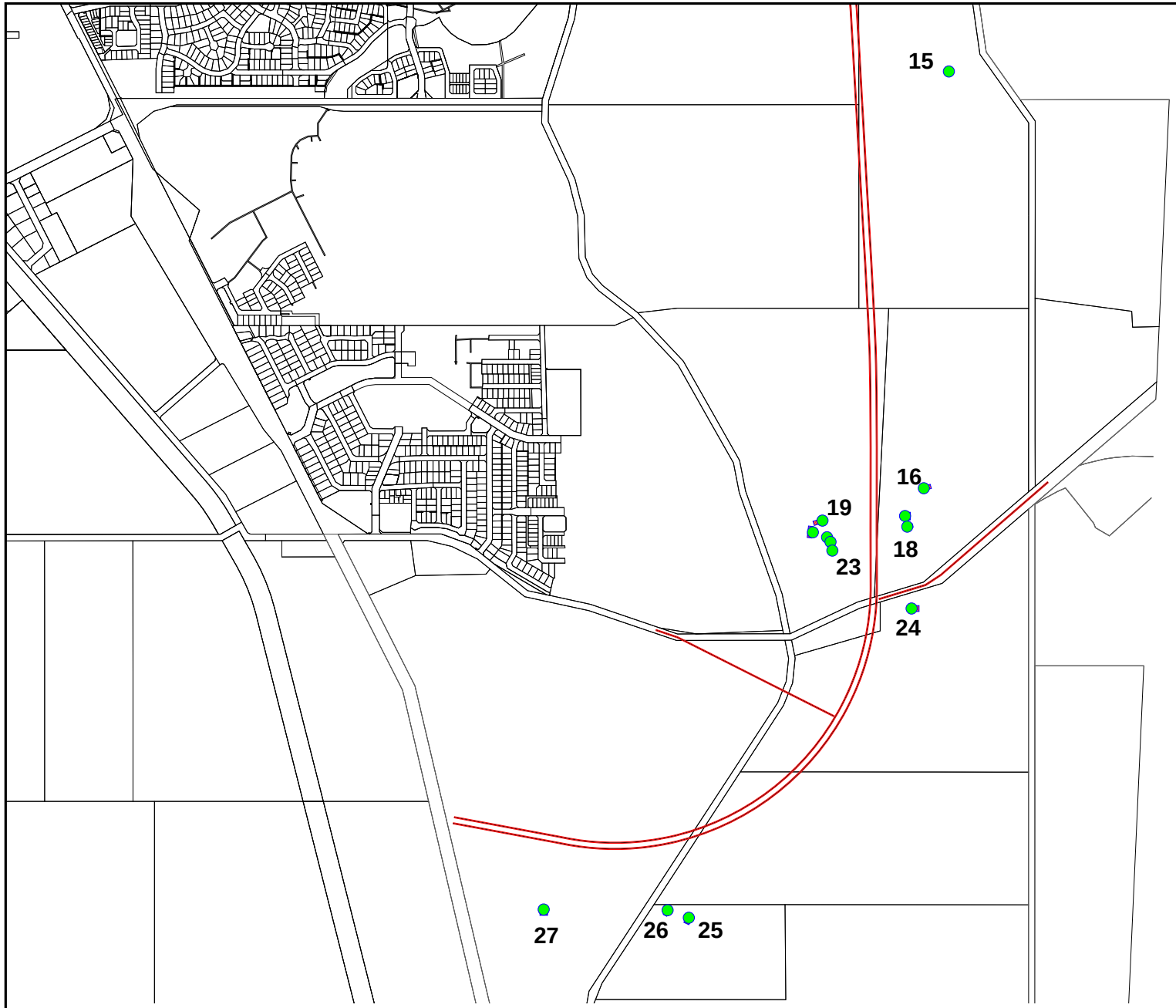
Figure 4.4



Margaret River Bypass Project - Northern Receiver Locations

Lloyd George Acoustics
by Daniel Lloyd
daniel@lgacoustics.com.au
(08) 9300 4188

Figure 4.5



Signs and symbols

- Road Design
- Buildings
- Point receiver

N

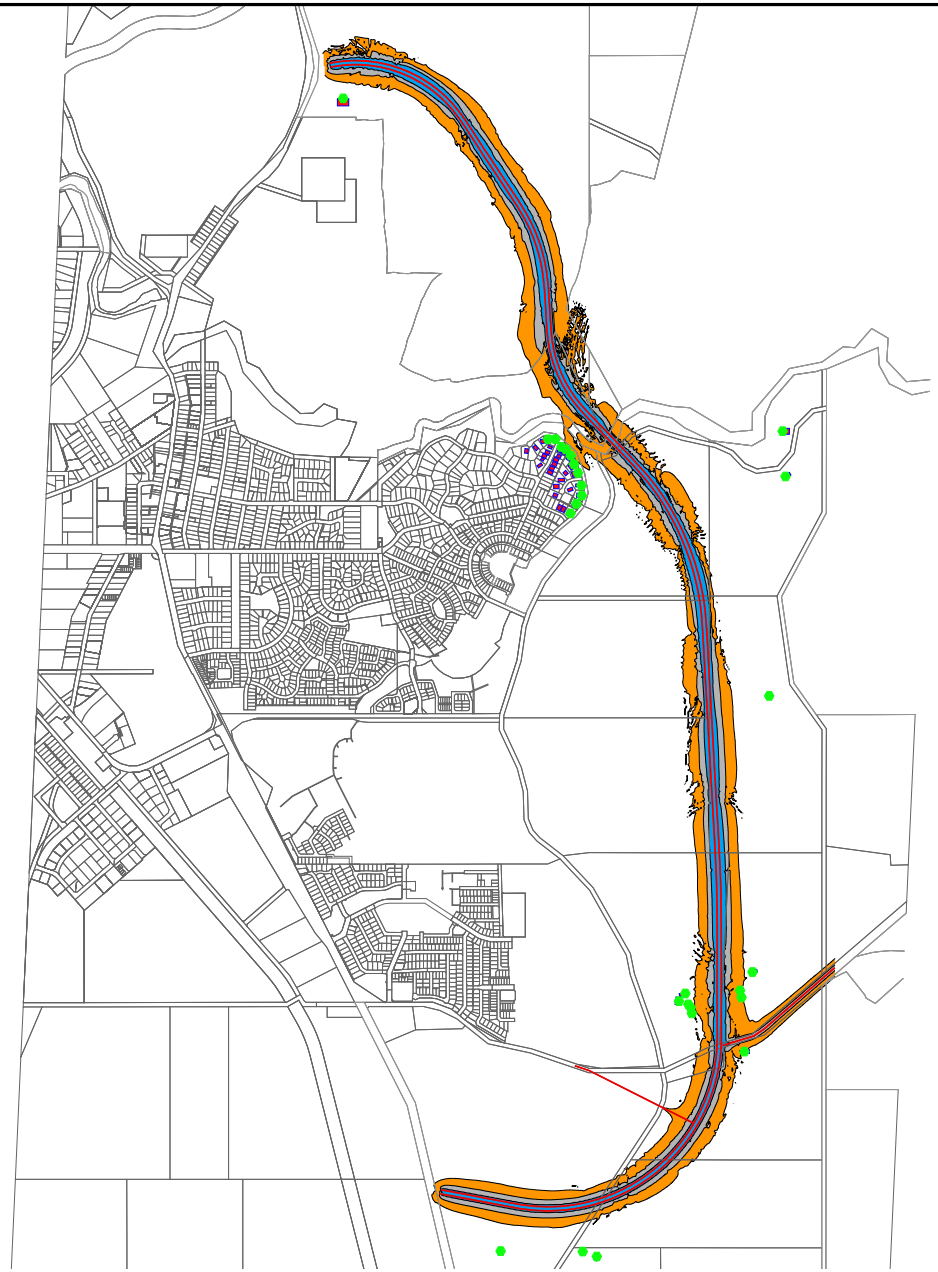
Length Scale

0 40 80 160 240 320 m

Margaret River Bypass Project - Southern Receiver Locations

Lloyd George Acoustics
by Daniel Lloyd
daniel@lgacoustics.com.au
(08) 9300 4188

Figure 4.6



Traffic Noise level
$L_{Aeq,(day)}$ dB

	<=	55	Below Target
55 <	<=	60	Above Target - Below Limit
60 <	<=	65	Above Limit
65 <			

N

Signs and symbols

- Road Design
- Buildings
- Point Receiver

Length Scale

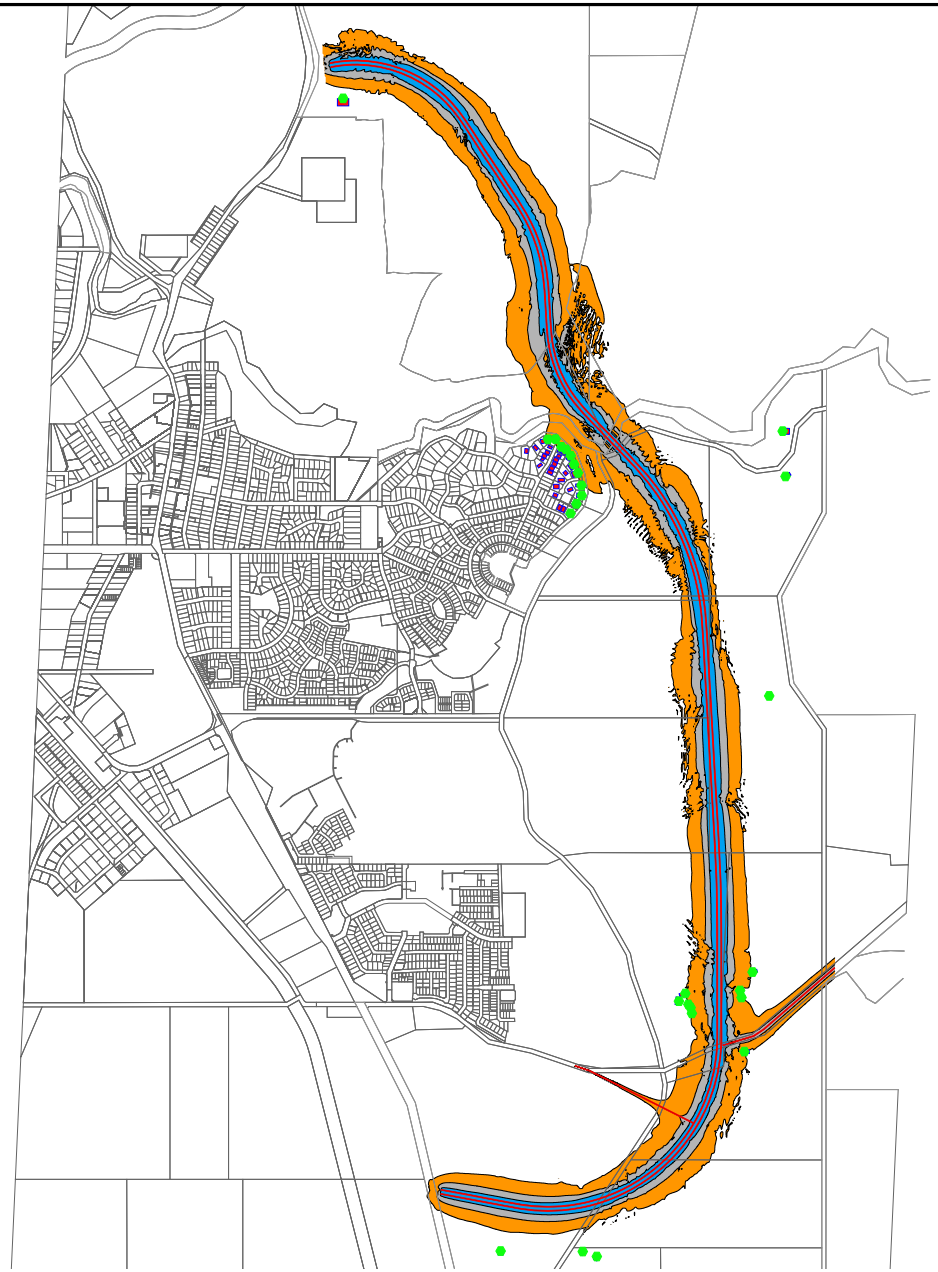
0 40 80 160 240 320 m

Margaret River Bypass - Alignment 1 Dual Carriageway - Soon After Road Opening

$L_{Aeq,(day)}$ Noise Level Contours - Without Noise Mitigation

Lloyd George Acoustics
by Daniel Lloyd
daniel@lgacoustics.com.au
(08) 9300 4188

Figure 4.7



Traffic Noise level
$L_{Aeq,(day)}$ dB

	<=	55	Below Target
55 <	<=	60	Above Target - Below Limit
60 <	<=	65	Above Limit
65 <			

N

Signs and symbols

- Road Design
- Buildings
- Point Receiver

Length Scale

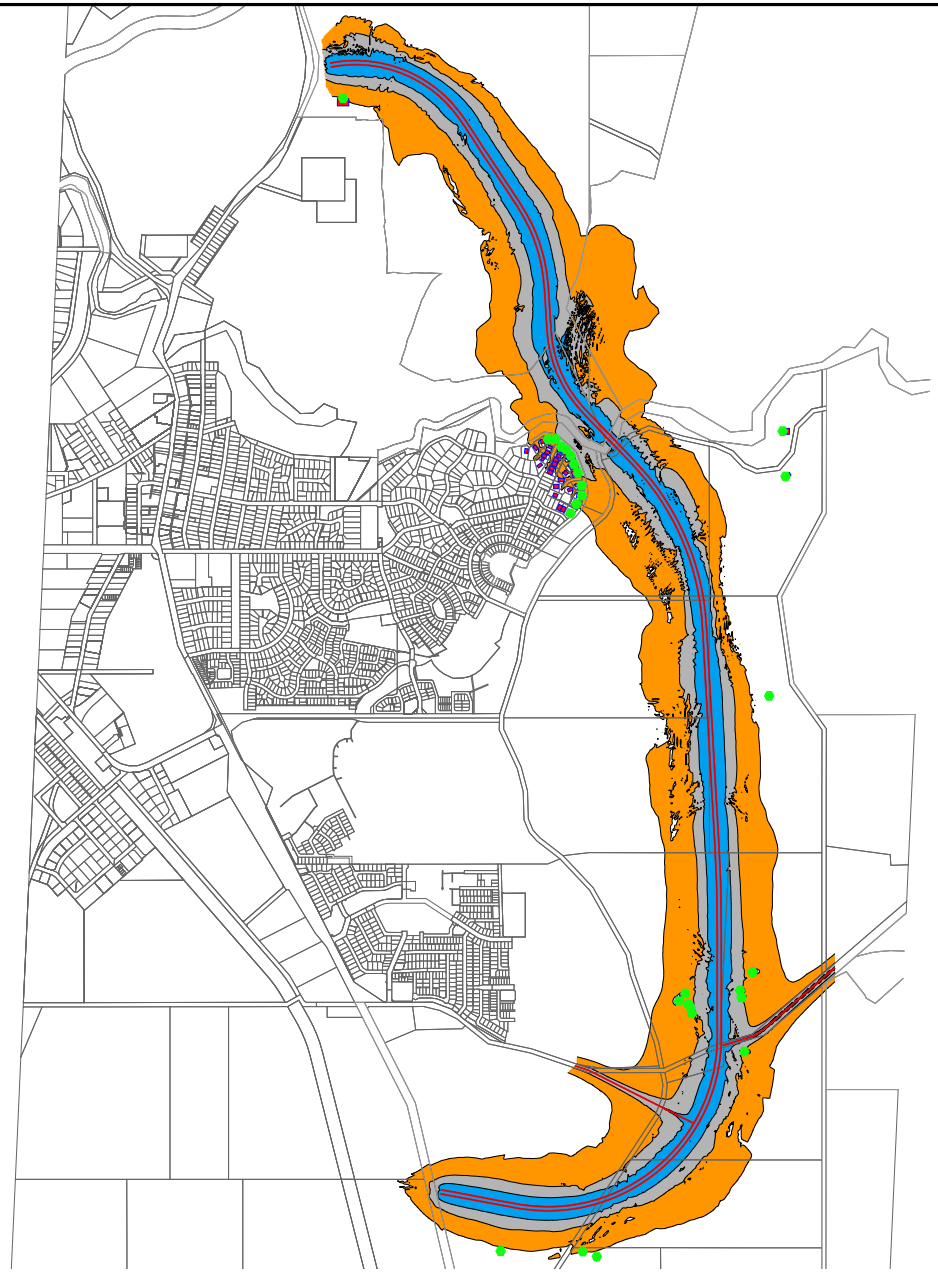
0 40 80 160 240 320 m

Margaret River Bypass - Alignment 1 Dual Carriageway - Future Traffic Volumes - Low Development

$L_{Aeq,(day)}$ Noise Level Contours - Without Noise Mitigation

Lloyd George Acoustics
by Daniel Lloyd
daniel@lgacoustics.com.au
(08) 9300 4188

Figure 4.8



Traffic Noise level
$L_{Aeq,(day)}$ dB

	<=	55	Below Target
55 <	<=	60	Above Target - Below Limit
60 <	<=	65	Above Limit
65 <			

Signs and symbols

- Road Design
- Buildings
- Point Receiver

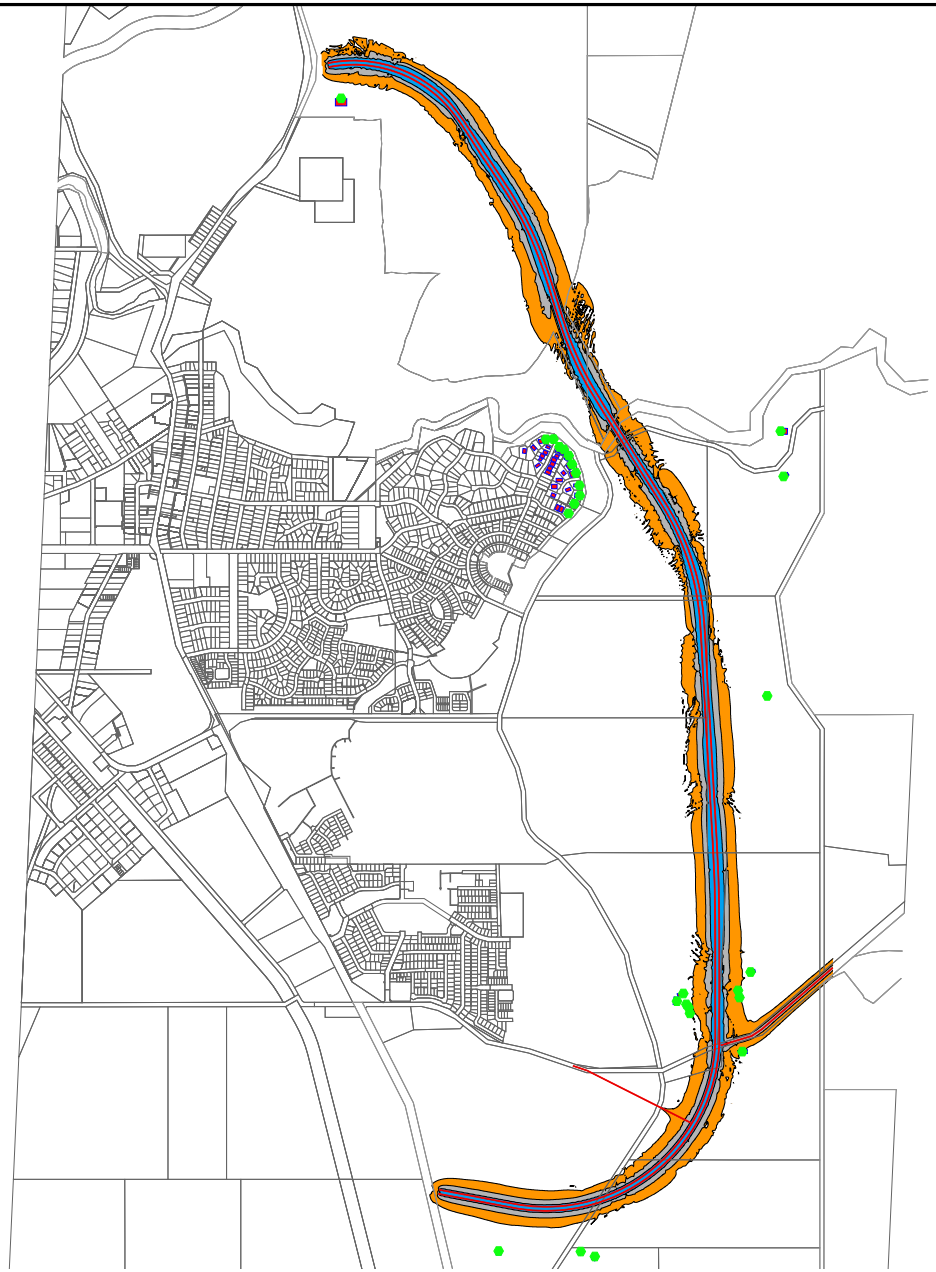
Length Scale

0 40 80 160 240 320 m

Margaret River Bypass - Alignment 1 Dual Carriageway - Future Traffic Volumes - Full Development
$L_{Aeq,(day)}$ Noise Level Contours - Without Noise Mitigation

Lloyd George Acoustics
by Daniel Lloyd
daniel@lgacoustics.com.au
(08) 9300 4188

Figure 4.9



Traffic Noise level
$L_{Aeq,(day)}$ dB

	<=	55	Below Target
55 <	<=	60	Above Target - Below Limit
60 <	<=	65	Above Limit
65 <			

N

Signs and symbols

- Road Design
- Buildings
- Point Receiver

Length Scale

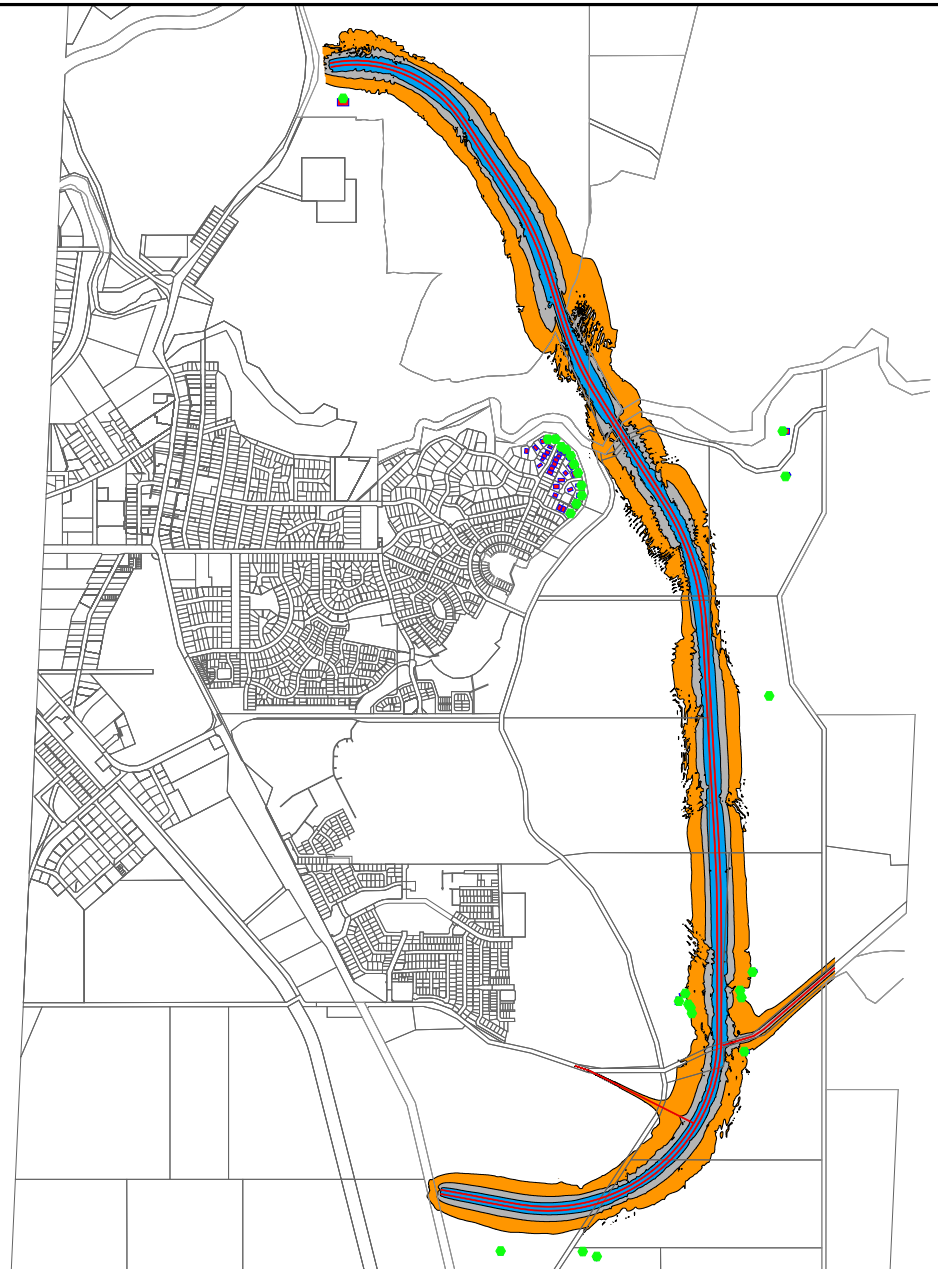
0 40 80 160 240 320 m

Margaret River Bypass - Alignment 2 Dual Carriageway - Soon After Road Opening

$L_{Aeq,(day)}$ Noise Level Contours - Without Noise Mitigation

Lloyd George Acoustics
by Daniel Lloyd
daniel@lgacoustics.com.au
(08) 9300 4188

Figure 4.10



Traffic Noise level
$L_{Aeq,(day)}$ dB

	<=	55	Below Target
55 <	<=	60	Above Target - Below Limit
60 <	<=	65	Above Limit
65 <			

Signs and symbols

- Road Design
- Buildings
- Point Receiver

Length Scale

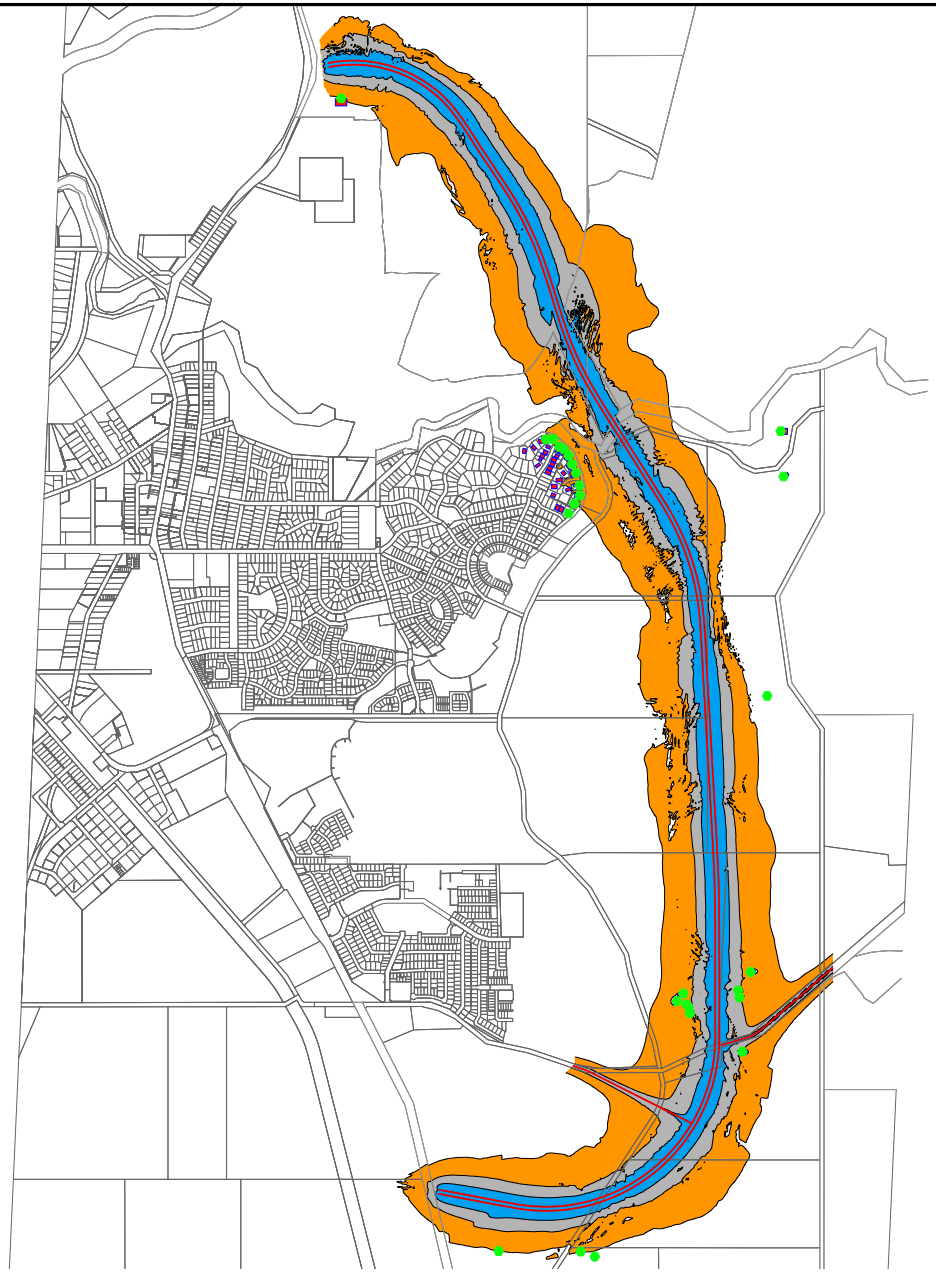
0 40 80 160 240 320 m

Margaret River Bypass - Alignment 2 Dual Carriageway - Future Traffic Volumes - Low Development

$L_{Aeq,(day)}$ Noise Level Contours - Without Noise Mitigation

Lloyd George Acoustics
by Daniel Lloyd
daniel@lgacoustics.com.au
(08) 9300 4188

Figure 4.11



Traffic Noise level
$L_{Aeq,(day)}$ dB

	<=	55	Below Target
55 <	<=	60	Above Target - Below Limit
60 <	<=	65	Above Limit
65 <			

N

Signs and symbols

- Road Design
- Buildings
- Point Receiver

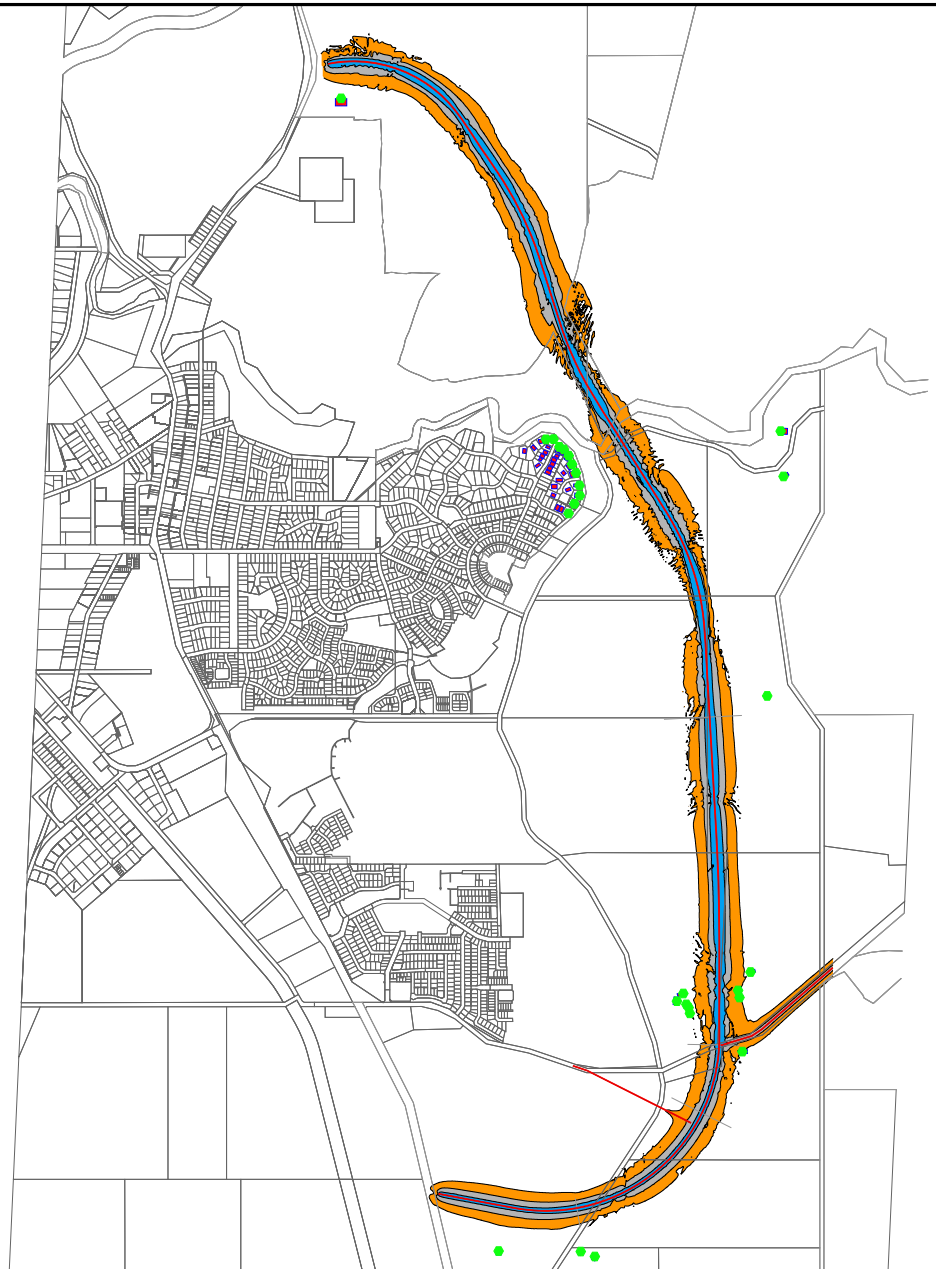
Length Scale

0 40 80 160 240 320 m

Margaret River Bypass - Alignment 2 Dual Carriageway - Future Traffic Volumes - Full Development
$L_{Aeq,(day)}$ Noise Level Contours - Without Noise Mitigation

Lloyd George Acoustics
by Daniel Lloyd
daniel@lgacoustics.com.au
(08) 9300 4188

Figure 4.12



Traffic Noise level
$L_{Aeq,(day)}$ dB

	<=	55	Below Target
55 <	<=	60	Above Target - Below Limit
60 <	<=	65	Above Limit
65 <			

N

Signs and symbols

- Road Design
- Buildings
- Point Receiver

Length Scale

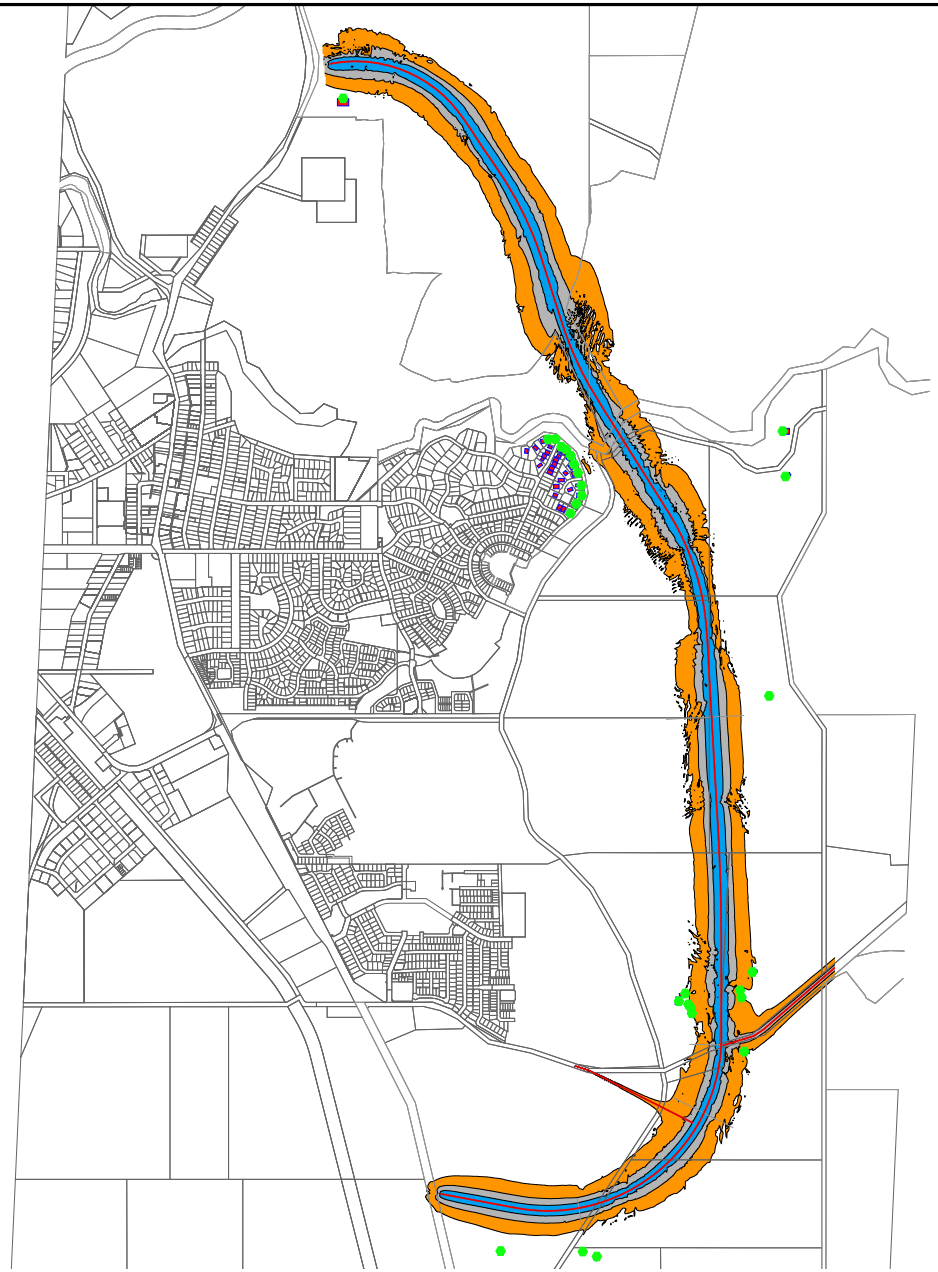
0 40 80 160 240 320 m

Margaret River Bypass - Single Carriageway - Soon After Road Opening

$L_{Aeq,(day)}$ Noise Level Contours - Without Noise Mitigation

Lloyd George Acoustics
by Daniel Lloyd
daniel@lgacoustics.com.au
(08) 9300 4188

Figure 4.13



Traffic Noise level
$L_{Aeq,(day)}$ dB

	<=	55	Below Target
55 <	<=	60	Above Target - Below Limit
60 <	<=	65	Above Limit
65 <			

N

Signs and symbols

- Road Design
- Buildings
- Point Receiver

Length Scale

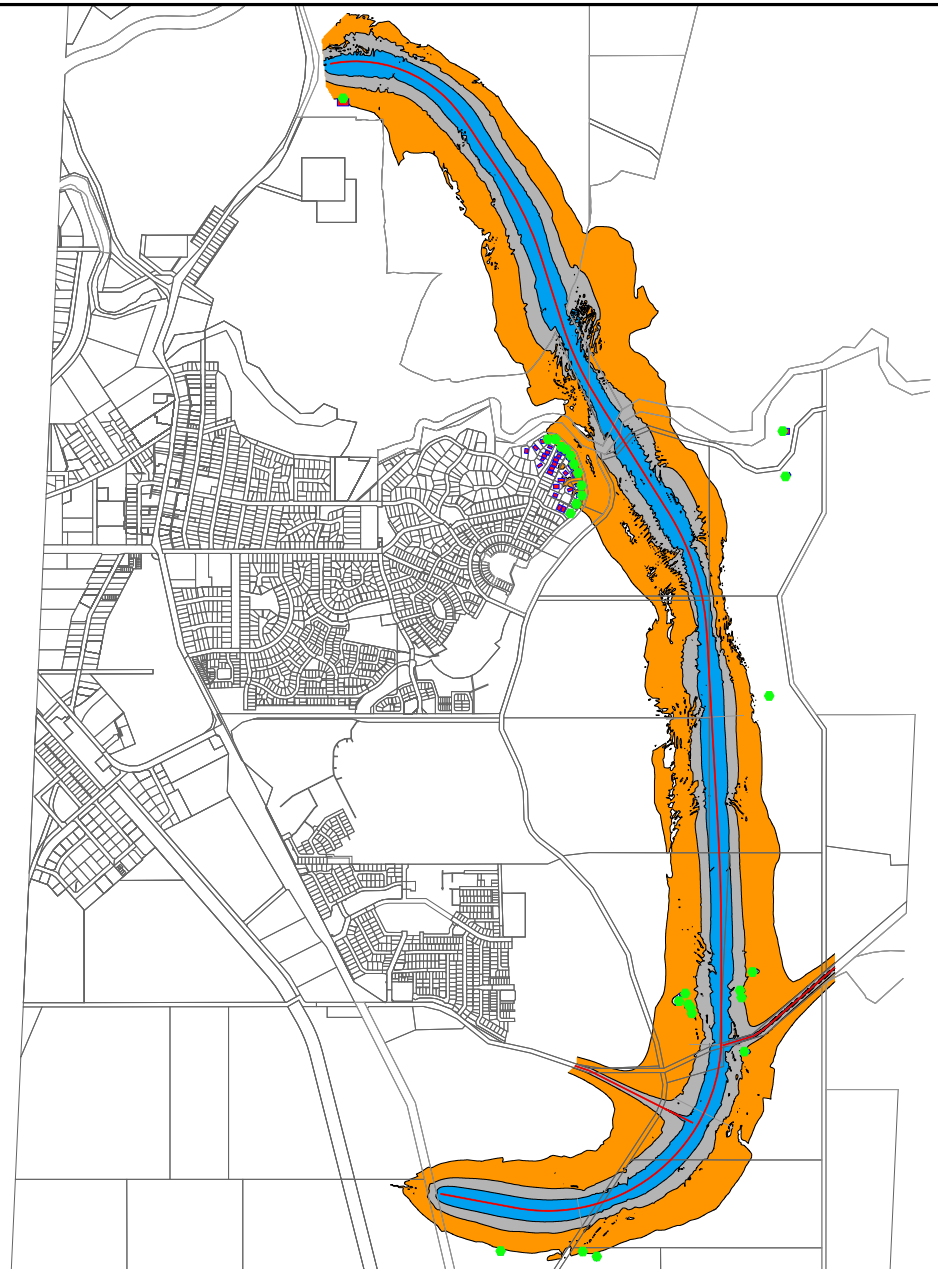
0 40 80 160 240 320 m

Margaret River Bypass - Single Carriageway - Future Traffic Volumes - Low Development

$L_{Aeq,(day)}$ Noise Level Contours - Without Noise Mitigation

Lloyd George Acoustics
by Daniel Lloyd
daniel@lgacoustics.com.au
(08) 9300 4188

Figure 4.14



Traffic Noise level
$L_{Aeq,(day)}$ dB

	<=	55	Below Target
55 <	<=	60	Above Target - Below Limit
60 <	<=	65	Above Limit
65 <			

N

Signs and symbols

- Road Design
- Buildings
- Point Receiver

Length Scale

0 40 80 160 240 320 m

Margaret River Bypass - Single Carriageway - Future Traffic Volumes - Full Development

$L_{Aeq,(day)}$ Noise Level Contours - Without Noise Mitigation

Lloyd George Acoustics
by Daniel Lloyd
daniel@lgacoustics.com.au
(08) 9300 4188

5 ASSESSMENT

Under the Policy, transport infrastructure providers are required to design the transport corridor to, where practicable, achieve the noise *limit* of $L_{Aeq(Day)}$ 60 dB and $L_{Aeq(Night)}$ 55 dB, when assessed at ground floor level, one metre from the facade of a noise sensitive premises. Transport infrastructure providers are also required to consider design measures to meet the noise *target* of $L_{Aeq(Day)}$ 55 dB and $L_{Aeq(Night)}$ 50 dB and to implement these measures where reasonable and practicable. Where the future noise level from a transport infrastructure project is predicted to meet the noise *target* at noise sensitive premises, no further measures are required. It should be noted that in line with the Policy, only future traffic volume scenarios are considered in this section of the report.

5.1 Alignment 1 – Dual Carriageway

Assuming the "low development" scenario for Margaret River, there are no receivers predicted to exceed the *limit* criteria and 10 receivers predicted to be within the margin between the *target* and the *limit*.

Assuming the "full development" scenario for Margaret River, there are seven receivers predicted to exceed the *limit* criteria and 11 receivers predicted to be within the margin between the *target* and the *limit*.

Under the policy, noise mitigation would only be required for the "full development" scenario and would only need to be considered for the "low development" scenario. It can be seen that one noise control option that should be considered, is the adoption of Alignment 2.

5.2 Alignment 2– Dual Carriageway

Assuming the "low development" scenario for Margaret River, there are no receivers predicted to exceed the *limit* criteria and four (4) receivers predicted to be within the margin between the *target* and the *limit*.

Assuming the "full development" scenario for Margaret River, there are two (2) receivers predicted to exceed the *limit* criteria and 15 receivers predicted to be within the margin between the *target* and the *limit*.

Therefore, under the policy, noise mitigation would only be required for the "full development" scenario and would only need to be considered for the "low development" scenario.

5.3 Single Carriageway

Assuming the "low development" scenario for Margaret River, there are no receivers predicted to exceed the *limit* criteria and three (3) receivers predicted to be within the margin between the *target* and the *limit*.

Assuming the "full development" scenario for Margaret River, there are two (2) receivers predicted to exceed the *limit* criteria and 15 receivers predicted to be within the margin between the *target* and the *limit*.

Therefore, under the policy, noise mitigation would only be required for the "full development" scenario and would only need to be considered for the "low development" scenario.

6 NOISE CONTROL OPTONS

For a new transport corridor, there are four main options for noise control under the Policy. These being:

- Road designed to minimise noise impacts (such as the corridor being in cut, or a significant distance from receivers);
- Quieter road surfacing;
- Noise barriers; and
- Facade protection to affected houses.

6.1 Road Design

This option is adequately covered by the consideration of using Alignment 2 in lieu of Alignment 1. It can be seen from the results tables that a significant reduction in traffic noise is achieved at some critical locations assuming this option.

6.2 Road Surfacing

The road design, as modelled, assumes a 14mm chip seal road surface. This would be considered as the noisiest (and cheapest) of the road surfaces and is used extensively for rural road networks due to its low maintenance costs and longevity.

By replacing the Chip Seal road surface with Dense Graded Asphalt in strategic areas, in particular where traffic noise is predicted to exceed the *target,* a reduction in traffic noise levels of up to 3.5 dB could be achieved. Using this noise control option would result in all receivers being below the *limit* for all of the "full development" scenarios.

Traffic noise could be decreased by a further 2.5 dB by using Open Graded Asphalt in lieu of Dense Graded Asphalt. However, provision of asphalt surfacing requires careful consideration of other engineering factors, including maintaining of adequate skid resistance with high speed zonings.

6.3 Noise Barriers

The use of noise barriers at strategic locations can result in significant reductions in traffic noise. However, the high costs, visual impacts and maintenance issues (particularly graffiti) require careful consideration in regards to whether this option is practicable. For this project, a noise wall of between 3 and 4 metres high would be required.

It should be noted that a combination of a quieter road surface and a noise barrier could be used to achieve the target criteria at all locations.

6.4 Facade Protection

The Policy allows for the use of facade protection where it is considered impracticable to reduce the noise levels using other noise control methods. The Policy Guidelines provide two facade protection packages and these are reproduced in *Appendix A*. However, it should be noted that this option is generally only used when new residential developments are constructed adjacent to existing or future transport corridors. The facade protection appropriate for a residence is dependant upon the receiving transportation noise level. For those receivers predicted to receive a noise level in the margin between the *target* and the *limit* criteria (shaded blue in *Tables 4.2 to 4.4*), "Package A" protection would be required. For those receivers predicted to receive a noise level above the *limit* criteria (shaded yellow in *Tables 4.2 to 4.4*), "Package B" protection would be required.

7 CONCLUSION

The analysis has shown that traffic future noise levels along the proposed Margaret River Bypass are predicted to exceed the criteria of the *State Planning Policy 5.4 Road and Rail Transport Noise and Freight Considerations in Land Use Planning* without noise mitigation measures.

The results of this assessment has shown that for the Alignment 1 dual carriageway option, the future traffic noise is predicted to be under the *limit* criteria at all noise sensitive receivers assuming the "low development" scenario for Margaret River and would exceed the *limit* criteria at seven noise sensitive receivers assuming the "full development" scenario for Margaret River.

For the Alignment 2 dual carriageway option, the future traffic noise is predicted to be under the *limit* criteria at all noise sensitive receivers assuming the "low development" scenario for Margaret River and would exceed the *limit* criteria at two noise sensitive receivers assuming the "full development" scenario for Margaret River.

For the single carriageway option, the future traffic noise is predicted to be under the *limit* criteria at all noise sensitive receivers assuming the "low development" scenario for Margaret River and would exceed the *limit* criteria at two noise sensitive receivers assuming the "full development" scenario for Margaret River.

Under the Policy, if the "low development" scenario for Margaret River is assumed, noise control should be considered with a view to achieving the target criteria at receivers. However, if the "full development" scenario is assumed, the road would need to incorporate noise control to ensure all receivers are below the *limit* criteria and further control considered to achieve the *target* criteria at receivers.

Overall, Alignment 2 and the Single Carriageway options would result in less noise impact to adjacent noise sensitive receivers.

Appendix A

Deemed-to-Satisfy Construction Standards

Noise insulation – "Deemed to Comply" packages for residential development

The following "deemed-to-comply" Packages outline noise insulation measures that are designed to ensure that the indoor noise standards in the Policy are achieved for residential developments in areas where outdoor noise levels will exceed the *target* noise levels by up to 8 dB(A).

The deemed-to-comply specifications are intended to simplify compliance with the noise criteria, and the relevant Package should be required as a condition of development. However, this should not remove the option to pursue alternative measures or designs. Departures from the deemed-to-comply specifications need to be accompanied by acoustic certification from a competent person, to the effect that the development will achieve the requirements of the Policy.

Superior construction standards, such as those specified in the "deemed-to-comply" packages, are now becoming more prevalent in residential buildings; and do not significantly increase the cost of building. A similar standard of construction has been recommended by the Western Australian Planning Commission for new housing in areas forecast to be seriously affected by aircraft noise.[1] That recommendation followed a comprehensive assessment of the efficacy and costs of noise attenuation measures, taking into account the recent changes in industry building standards as well as changes to the *Building Code of Australia*.

Where transport noise levels are more than 8 dB above the noise *target*, i.e. 3 dB above the noise *limit*, or where noise-sensitive development other than residential is proposed, a Detailed Assessment should be prepared by a competent person. The report should specify the level of noise reduction required and the noise insulation measures needed to comply with the Policy. The approval may require that the construction drawings be checked for compliance with the Detailed Assessment, and that follow-up verification be carried out to certify compliance.

[1] Statement of Planning Policy No 5.1, *Land Use Planning in the Vicinity of Perth Airport* and the accompanying report on *Aircraft Noise Insulation for Residential Development in the Vicinity of Perth Airport,* February 2004.

Package A: Noise levels within the *margin*

The following noise insulation package is designed to meet the indoor noise standards for residential developments in areas where noise levels exceed the noise target *but are within the* limit.

Area type	Orientation	**Package A measures**
Indoors		
Bedrooms	Facing road/rail corridor	• 6mm (minimum) laminated glazing • Fixed, casement or awning windows with seals • No external doors • Closed eaves • No vents to outside walls/eaves • Mechanical ventilation/airconditioning[2]
	Side-on to corridor	• 6mm (minimum) laminated glazing • Closed eaves • Mechanical ventilation/airconditioning
	Away from corridor	No requirements
Living and work areas[3]	Facing corridor	• 6mm (minimum) laminated glazing • Fixed, casement or awning windows with seals • 35mm (minimum) solid core external doors with acoustic seals[4] • Sliding doors must be fitted with acoustic seals • Closed eaves • No vents to outside walls/eaves • Mechanical ventilation/airconditioning
	Side-on to corridor	• 6mm (minimum) laminated glazing • Closed eaves • Mechanical ventilation/airconditioning
	Away from corridor	No requirements
Other indoor areas	Any	No requirements
Outdoors		
Outdoor living area[5]	Facing corridor	• Minimum 2.0m high solid fence (e.g. Hardifence, pinelap, or Colorbond) • Picket fences are not acceptable
	Side-on to corridor	
	Away from corridor	No requirements

[2] See section on Mechanical ventilation/airconditioning for further details and requirements.
[3] These deemed-to-comply guidelines adopt the definitions of indoor spaces used in AS 2107-2000. A comparable description for bedrooms, living and work areas is that defined by the Building Code of Australia as a "habitable room". The Building Code of Australia may be referenced if greater clarity is needed. A living or work area can be taken to mean any "habitable room" other than a bedroom. Note that there are no noise insulation requirements for utility areas such as bathrooms. The Building Code of Australia describes these utility spaces as "non-habitable rooms".
[4] Glazing panels are acceptable in external doors facing the transport corridor. However these must meet the minimum glazing requirements.
[5] The Policy requires that at least one outdoor living area be reasonably protected from transport noise. The protected area should meet the minimum space requirements for outdoor living areas, as defined in the Residential Design Codes of Western Australia.

Package B: Noise within 3 dB above the *limit*

The following noise insulation package is designed to meet the indoor noise standards for residential developments in areas where transport noise levels exceed the noise *limit* but by no more than 3 dB (See Table 1 in the Policy).

Area type	Orientation	Package B measures
Indoors		
Bedrooms	Facing road/rail corridor	• 10mm (minimum) laminated glazing • Fixed, casement or awning windows with seals • No external doors • Closed eaves • No vents to outside walls/eaves • Mechanical ventilation/airconditioning[6]
	Side-on to corridor	• 10mm (minimum) laminated glazing • Closed eaves • Mechanical ventilation/airconditioning
	Away from corridor	No requirements
Living and work areas[7]	Facing corridor	• 10mm (minimum) laminated glazing • Fixed, casement or awning windows with seals • 40mm (minimum) solid core external doors with acoustic seals[8] • Sliding doors must be fitted with acoustic seals • Closed eaves • No vents to outside walls/eaves • Mechanical ventilation/airconditioning
	Side-on to corridor	• 6mm (minimum) laminated glazing • Closed eaves • Mechanical ventilation/airconditioning
	Away from corridor	No requirements
Other indoor areas	Any	No requirements
Outdoors		
Outdoor living area[9]	Facing corridor	• Minimum 2.4m solid fence (e.g. brick, limestone or Hardifence) • Colorbond and picket fences are not acceptable
	Side-on to corridor	
	Away from corridor	No requirements

[6] See section on Mechanical ventilation/airconditioning for further details and requirements.

[7] These deemed-to-comply guidelines adopt the definitions of indoor spaces used in AS 2107-2000. A comparable description for bedrooms, living and work areas is that defined by the Building Code of Australia as a "habitable room". The Building Code of Australia may be referenced if greater clarity is needed. A living or work area can be taken to mean any "habitable room" other than a bedroom. Note that there are no noise insulation requirements for utility areas such as bathrooms. The Building Code of Australia describes these utility spaces as "non-habitable rooms".

[8] Glazing panels are acceptable in external doors facing the transport corridor. However these must meet the minimum glazing requirements.

[9] The Policy requires that at least one outdoor living area be reasonably protected from transport noise. The protected area should meet the minimum space requirements for outdoor living areas, as defined in the Residential Design Codes of Western Australia.

Mechanical ventilation/airconditioning

Where outdoor noise levels are above the "target", both Packages A and B require mechanical ventilation or airconditioning to ensure that windows can remain closed in order to achieve the indoor noise standards.

In implementing Packages A and B, the following need to be observed:

- evaporative airconditioning systems will not meet the requirements for Packages A and B because windows need to remain open;
- refrigerative airconditioning systems need to be designed to achieve fresh air ventilation requirements;
- air inlets need to be positioned facing away from the transport corridor where practicable;
- ductwork needs to be provided with adequate silencing to prevent noise intrusion.

Notification

Notifications on certificates of title and/or advice to prospective purchasers advising of the potential for noise impacts from road and rail corridors can be effective in warning people of the potential impacts of transport noise. Such advice can also bring to the attention of prospective developers the need and opportunities to reduce the impact of noise through sensitive design and construction of buildings and the location and/or screening of outdoor living areas.

Notification should be provided to prospective purchasers, and required as a condition of subdivision (including strata subdivision) for the purposes of noise-sensitive development or planning approval involving noise-sensitive development, where external noise levels are forecast or estimated to exceed the "target" criteria as defined by the Policy. In the case of subdivision and development, conditions of approval should include a requirement for registration of a notice on title, which is provided for under section 12A of the Town Planning and Development Act and section 70A of the Transfer of Land Act. An example of a suitable notice is given below.

Notice: This property is situated in the vicinity of a transport corridor, and is currently affected, or may in the future be affected, by transport noise. Further information about transport noise, including development restrictions and noise insulation requirements for noise-affected property, are available on request from the relevant local government offices.

Appendix B

Terminology

The following is an explanation of the terminology used throughout this report.

Decibel (dB)

The decibel is the unit that describes the sound pressure and sound power levels of a noise source. It is a logarithmic scale referenced to the threshold of hearing.

A-Weighting

An A-weighted noise level has been filtered in such a way as to represent the way in which the human ear perceives sound. This weighting reflects the fact that the human ear is not as sensitive to lower frequencies as it is to higher frequencies. An A-weighted sound level is described as L_A dB.

Sound Pressure Level (L_p)

The sound pressure level of a noise source is dependent upon its surroundings, being influenced by distance, ground absorption, topography, meteorological conditions etc and is what the human ear actually hears. Using the electric heater analogy above, the heat will vary depending upon where the heater is located, just as the sound pressure level will vary depending on the surroundings. Noise modelling predicts the sound pressure level from the sound power levels taking into account ground absorption, barrier effects, distance etc.

L_{Amax}

An L_{Amax} level is the maximum A-weighted noise level during a particular measurement.

L_{A1}

An L_{A1} level is the A-weighted noise level which is exceeded for one percent of the measurement period and is considered to represent the average of the maximum noise levels measured.

L_{A10}

An L_{A10} level is the A-weighted noise level which is exceeded for 10 percent of the measurement period and is considered to represent the "*intrusive*" noise level.

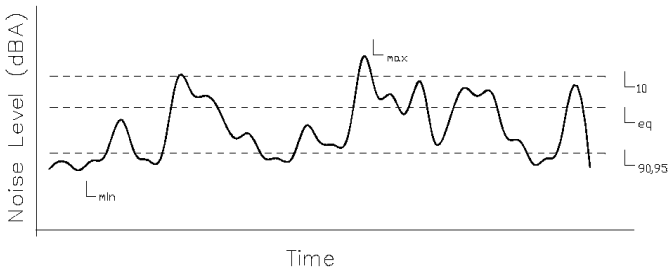
L_{Aeq}

The equivalent steady state A-weighted sound level ("equal energy") in decibels which, in a specified time period, contains the same acoustic energy as the time-varying level during the same period. It is considered to represent the "average" noise level.

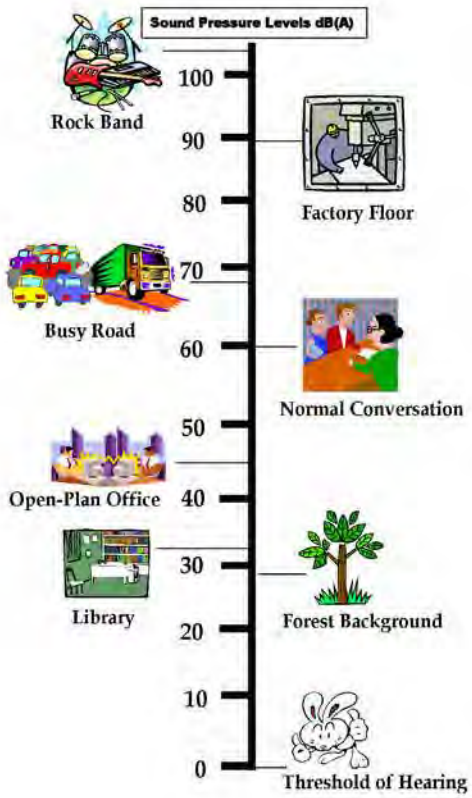
L_{A90}

An L_{A90} level is the A-weighted noise level which is exceeded for 90 percent of the measurement period and is considered to represent the "*background*" noise level.

Chart of Noise Level Descriptors



Typical Noise Levels



John Archibald Drive

Lloyd George Acoustics
PO Box 717
Hillarys WA 6923
T: 9300 4188 F: 9300 4199
E: daniel@lgacoustics.com.au W: www.lgacoustics.com.au

Transport Noise Assessment

John Archibald Drive, Margaret River

Reference: 12042120-03

Report: 12042120-03

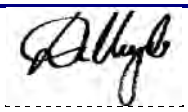
Lloyd George Acoustics Pty Ltd

ABN: 79 125 812 544

PO Box 717
Hillarys WA 6923

Offices:	Ocean Reef	Padbury	Scarborough	Waterford
Phone:	9300 4188	9401 7770	9245 3223	9313 3655
Fax:	9300 4199	9401 7770	9300 4199	9300 4199
Email:	daniel@lgacoustics.com.au	terry@lgacoustics.com.au	mike@lgacoustics.com.au	rebecca@lgacoustics.com.au
Mobile:	0439 032 844	0400 414 197	0438 201 071	0427 388 876

Member of the Association of Australian Acoustical Consultants – (AAAC)

Prepared By:	Daniel Lloyd 
Position:	Project Director
Verified	Terry George 
Date:	20 November 2012

CONTENTS

APPENDICES

1 INTRODUCTION

This assessment has been undertaken to determine the future traffic noise levels at noise sensitive receivers located adjacent to the proposed John Archibald Drive, in Margaret River. This road is to be developed as part of the proposed Margaret River Bypass project.

In line with the assessment undertaken for the proposed Margaret River Bypass, consideration has been given to the expected traffic volumes on John Archibald Drive assuming the following scenarios:

- Soon after Bypass opening (2014);
- Future (2031) traffic volumes assuming "low development" of the Margaret River region; and
- Future (2031) traffic volumes assuming "full development" of the Margaret River region.

The results of the assessment are compared against the criteria contained within *State Planning Policy 5.4 Road and Rail Transport Noise and Freight Considerations in Land Use Planning.* Where these criteria are exceeded, noise mitigation options and the effectiveness of these options in broad terms are provided.

Appendix B contains a description of some of the terminology used throughout this report.

2 CRITERIA

When constructing a new transport corridor adjacent to existing or future planned noise sensitive premises, the relevant noise level criteria in Western Australia is the *State Planning Policy 5.4 Road and Rail Transport Noise and Freight Considerations in Land Use Planning* (hereafter referred to as the Policy) produced by the Western Australian Planning Commission (WAPC).

The Policy's outdoor noise criteria are shown below in *Table 2.1*. These criteria apply at any point 1-metre from a habitable façade of a noise sensitive premises and in one outdoor living area.

Table 2.1 – Outdoor Noise Criteria

Period	Target	Limit
Day (6am to 10pm)	55 dB $L_{Aeq(\mathbf{Day})}$	60 dB $L_{Aeq(\mathbf{Day})}$
Night (10pm to 6am)	50 dB $L_{Aeq(Night)}$	55 dB $L_{Aeq(Night)}$

The 5 dB difference between the *target* and *limit* is referred to as the *margin*.

In the application of the noise criteria to new major road infrastructure projects, the objective of the Policy is that the new infrastructure be designed and constructed so that the noise emissions are at a level that—

- provides an acceptable level of acoustic amenity for existing noise-sensitive land uses and for the planning of new noise-sensitive developments;
- is consistent with other planning policies and community expectations; and

- is practicably achievable.

For transport infrastructure projects within the scope of this policy, a noise assessment should be conducted in accordance with the guidelines, to predict future noise levels resulting from the project and to identify relevant noise mitigation measures.

If a transport infrastructure project will emit transport noise levels that meet the noise target, no further measures are required under this policy. Otherwise, transport infrastructure providers should design mitigation measures to achieve the noise *limit* of $L_{Aeq(Day)}$ 60 dB and $L_{Aeq(Night)}$ 55 dB, when assessed at one metre from the façade at ground floor level.

Transport infrastructure providers are also required to consider design measures to meet the noise *target* of $L_{Aeq(Day)}$ 55 dB and $L_{Aeq(Night)}$ 50 dB and to implement these measures where reasonable and practicable.

If a new major road infrastructure project is to be constructed in the vicinity of a future noise-sensitive land use, mitigation measures should be implemented in accordance with this part of the policy. For this purpose, a proposed noise-sensitive land use is any noise sensitive development that is subject to an approved detailed area plan, subdivision approval or development approval, such that the transport infrastructure provider is able to adequately design noise mitigation measures to protect that development. In these instances, the infrastructure provider and developer are both responsible for ensuring that the objectives of this policy are achieved, and a mutually beneficial noise management plan, including individual responsibilities, should be negotiated between the parties.

It is recognised that in some cases it may not be practicable to achieve the noise criteria. In these circumstances reference should be made to section 5.8 of the Policy and the guidelines. Section 5.8 of the Policy states:

This policy applies a performance-based approach to the management and mitigation of transport noise. It is recognised that in a number of instances it may not be reasonable and practicable to meet the noise target criteria. Where transport noise is above the target level, measures are expected to be implemented that best balance reasonable and practicable considerations, such as noise benefit, cost, feasibility, community preferences, amenity impacts, safety, security and conflict with other planning and transport policies. In these cases the community should also be consulted to assist in identifying best overall solutions. The guidelines assist in outlining ways in which some reasonable and practicable limitations can be addressed in a manner that also minimises transport noise.

It is further acknowledged that there may also be situations in which the noise limit cannot practicably be achieved, especially in the case of major redevelopment of existing transport infrastructure. Similarly, it may not be practicable to achieve acceptable indoor noise levels if the new development is located very close to the transport corridor. In these situations the primary focus should be on achieving the lowest level of noise, with other reasonable and practicable considerations being secondary to this objective.

In cases where the noise limit or indoor noise criteria cannot practicably be met, longer term strategies for land use planning, transport policy and vehicle emissions should be considered to minimise transport noise impact over time.

3 METHODOLOGY

Noise measurements and modelling have been undertaken in accordance with the requirements of the Policy as described below in *Sections 3.1 and 3.2*.

3.1 Site Measurements

Noise monitoring was undertaken at three (3) locations within Margaret River as part of the proposed Margaret River Bypass (ref Lloyd George Acoustics 12042120-01). This noise monitoring data has been used for this assessment in order to calibrate the noise prediction model.

3.2 Noise Modelling

The computer programme *SoundPLAN 7.1* was utilised, incorporating the *Calculation of Road Traffic Noise* (CoRTN) algorithms, modified to reflect Australian conditions. The modifications included the following:

- An adjustment of –1.7 dB has been applied to the predicted levels based on the findings of *An Evaluation of the U.K. DoE Traffic Noise Prediction*; Australian Road Research Board, Report 122 ARRB – NAASRA Planning Group 1982.

Predictions are made at heights of 1.4 metres (single storey residence) and at 1.0 metre from a building facade (resulting in a + 2.5 dB correction due to reflected noise).

Various input data are included in the modelling such as ground topography, road design and traffic volumes, etc. These model inputs are discussed below.

3.2.1 Ground Topography, Road Design & Cadastral Data

Main Roads provided 3-dimentional topographical and road alignment data in digital format. It is assumed that the road will follow the exiting land contours. The contours were at 5 metre intervals and covered the road alignment and noise sensitive premises of concern.

3.2.2 Traffic Data

Traffic data includes:

- Traffic Volumes –

  Traffic volumes representing the "soon after bypass opening" and the two future scenarios are shown below. The traffic volumes were obtained from Main Roads.

Table 3.1 – Traffic Volumes used in the Noise Modelling

Description	Soon After Opening	2031 Low Development	2031 Full Development	Percentage Heavy Veh
Bussell Hwy to Tingle Ave	1,500	2,400	5,200	20%
Tingle Ave to Bypass road alignment	1,100	1,480	5,000	20%

Note: 18-hour volumes are assumed to be 95% of the AAWT volumes.

- Vehicle Speed –

  The vehicle speed assumed in the noise modelling is 60 km/h.

3.2.3 Road Surface –

The difference in noise emission between road surface types, when compared to Dense Graded Asphalt, is shown below in *Table 3.2*. The road surface for John Archibald Drive is assumed to be 10 mm Chip Seal.

Table 3.2 – Noise Relationship Between Different Road Surfaces

Road Surfaces						
Chip Seal			Asphalt			
14mm	**10mm**	**5mm**	**Dense Graded**	**Novachip**	**Stone Mastic**	**Open Graded**
+3.5 dB	+2.5 dB	+1.5 dB	0.0 dB	-0.2 dB	-1.0 dB	-2.5 dB

3.2.4 Ground Attenuation

The ground attenuation has been assumed to be 0.0 (0%) for the road surfaces and 1.0 (100%) for other areas. Note 0.0 represents hard reflective surfaces such as bitumen and water and 1.00 represents absorptive surfaces such as grass.

3.2.5 Parameter Conversion

The CoRTN algorithms used in the *SoundPlan* modelling package were originally developed to calculate the $L_{A10,18hour}$ noise level. The Policy however uses $L_{Aeq\ (Day)}$ and $L_{Aeq\ (Night)}$ noise descriptors. The relationship between the parameters varies depending on the composition of traffic on the road (volumes in each period and percentage heavy vehicles). For this project, the results of the measured noise levels adjacent to Bussell Highway (Margaret River Bypass Assessment)) where used to convert these parameters.

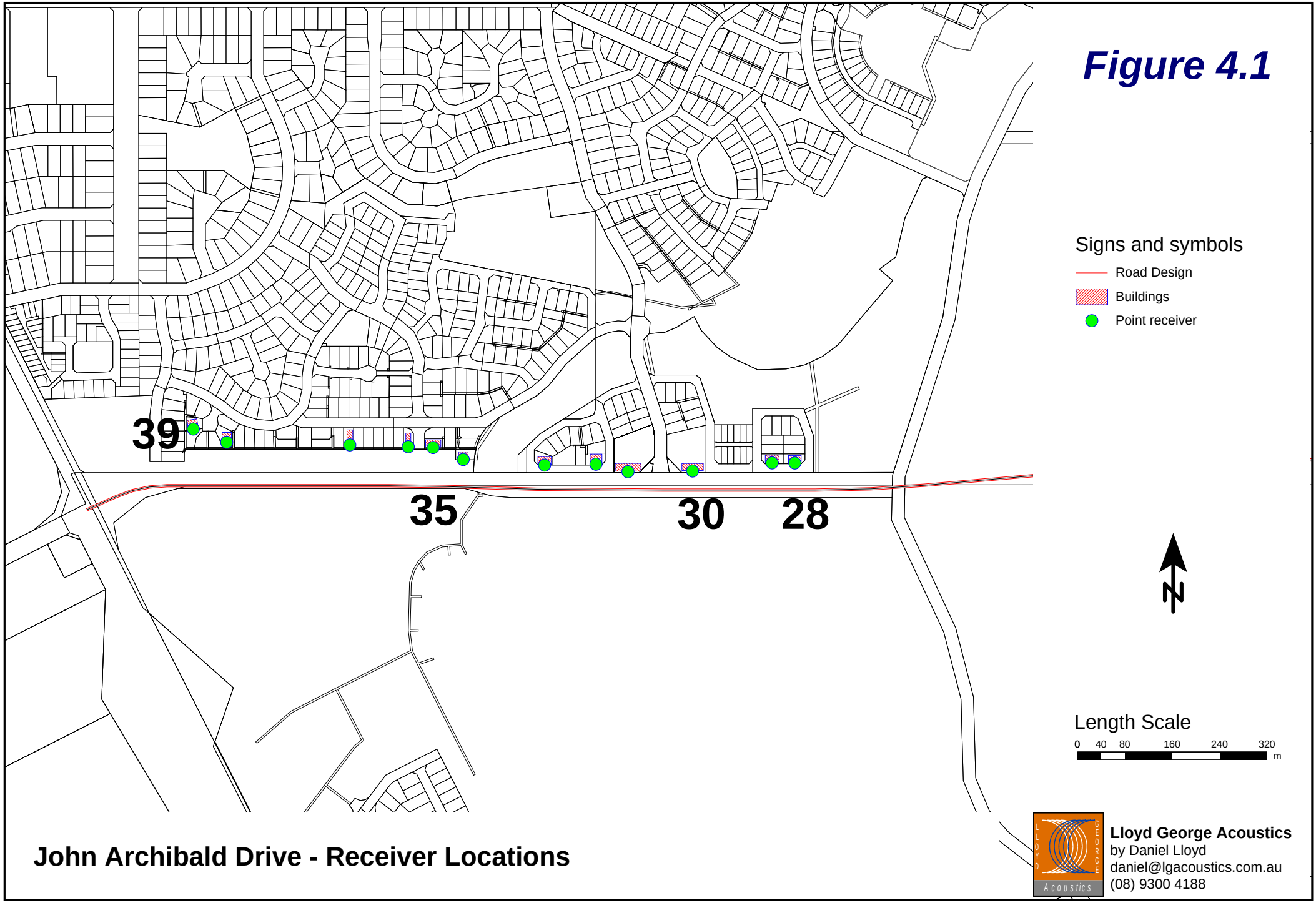
4 RESULTS

The results of the calibrated noise modelling to each receiver location, shown in *Figures 4.1,* are presented in *Table 4.1.* The cells shaded blue shows receivers predicted to be within the margin between the Policy's *target* and *limit* criteria and the cells shaded yellow show receivers predicted to be above the Policy's *limit* criteria. Noise level contour plots for each scenario are shown in *Figures 4.2 to 4.4* respectively. Please note that the receiver locations start at number 28 to avoid confusion with the Margaret River Bypass receiver locations.

Table 4.1 – Noise Prediction Results for Each Scenario

Rec No	Traffic Noise Level $L_{Aeq,day}$ dB		
	Soon After Road Opening	Future Low Development Scenario	Future Full Development Scenario
28	54	56	61
29	54	56	61
30	56	58	63
31	58	60	63
32	56	58	61
33	57	59	62
34	56	58	61
35	54	56	59
36	54	56	59
37	53	55	59
38	52	54	58
39	50	52	55

Figure 4.1



John Archibald Drive - Receiver Locations

Lloyd George Acoustics
by Daniel Lloyd
daniel@lgacoustics.com.au
(08) 9300 4188

Figure 4.2

Length Scale

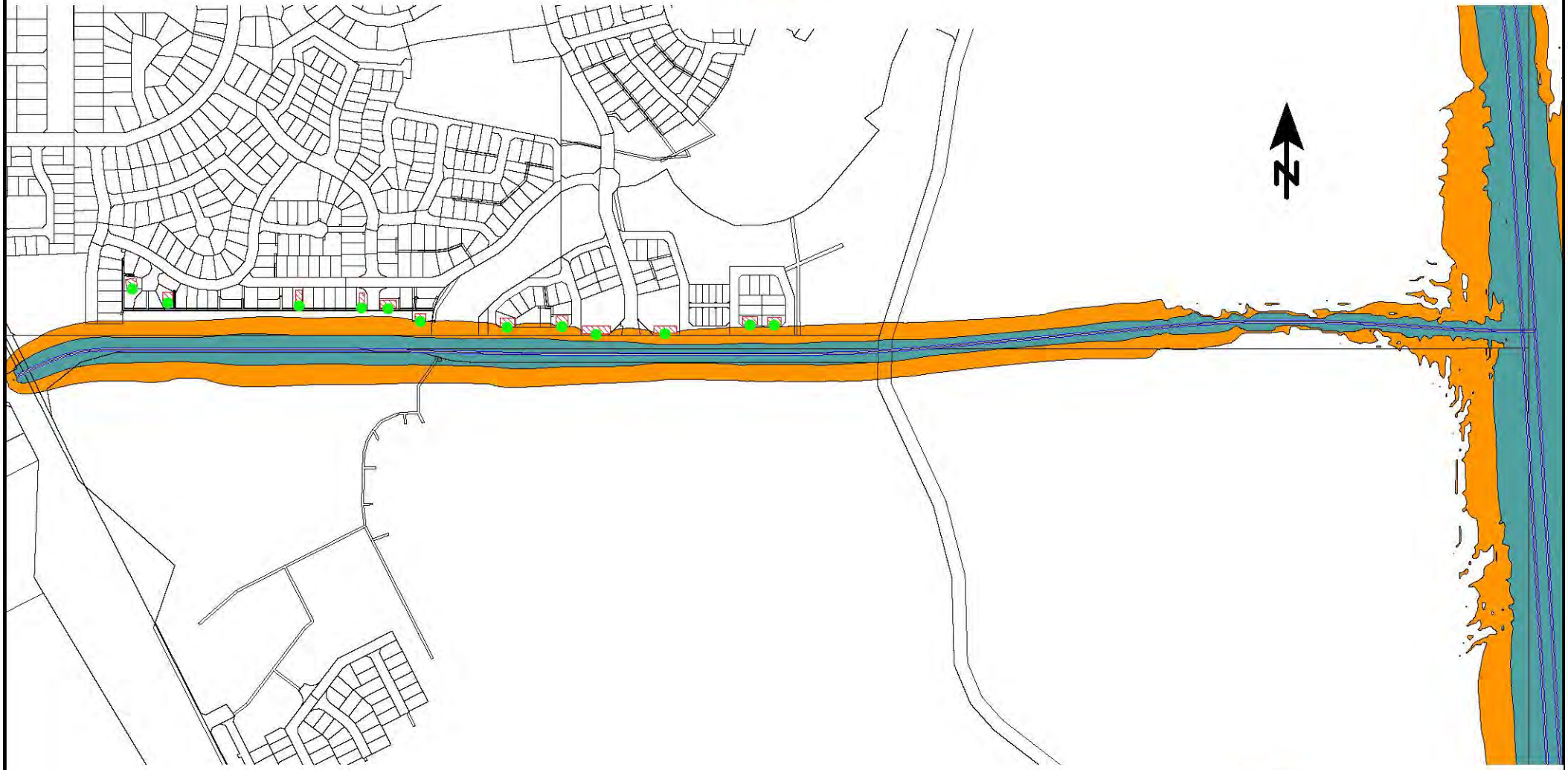
0 40 80 160 240 320 m

Signs and symbols

- Road Design
- Buildings
- Point receiver

Traffic Noise level
$L_{Aeq,(Day)}$ dB

	<=	55	Noise Target
55 <	<=	60	Above Noise Target - Below Noise Limit
60 <			Above Noise Limit



John Archibald Drive - Soon After Road Opening

$L_{Aeq,(Day)}$ Noise Level Contours - Without Noise Mitigation

Lloyd George Acoustics
by Daniel Lloyd
daniel@lgacoustics.com.au
(08) 9300 4188

Figure 4.3

Length Scale

0 40 80 160 240 320 m

Signs and symbols

- Road Design
- Buildings
- Point receiver

Traffic Noise level
$L_{Aeq,(Day)}$ dB

	<=	55	Noise Target
55 <	<=	60	Above Noise Target - Below Noise Limit
60 <			Above Noise Limit

John Archibald Drive - Future Traffic Volumes - Low Development Scenario

$L_{Aeq,(Day)}$ Noise Level Contours - Without Noise Mitigation

Lloyd George Acoustics
by Daniel Lloyd
daniel@lgacoustics.com.au
(08) 9300 4188

Length Scale

0 40 80 160 240 320 m

Signs and symbols

- Road Design
- Buildings
- Point receiver

Traffic Noise level
$L_{Aeq,(Day)}$ dB

	<=	55	Noise Target
55 <	<=	60	Above Noise Target - Below Noise Limit
60 <			Above Noise Limit

Figure 4.4

John Archibald Drive - Future Traffic Volumes - Full Development Scenario

$L_{Aeq,(Day)}$ Noise Level Contours - Without Noise Mitigation

Lloyd George Acoustics
by Daniel Lloyd
daniel@lgacoustics.com.au
(08) 9300 4188

5 ASSESSMENT

Under the Policy, transport infrastructure providers are required to design the transport corridor to, where practicable, achieve the noise *limit* of $L_{Aeq(Day)}$ 60 dB and $L_{Aeq(Night)}$ 55 dB, when assessed at ground floor level, one metre from the facade of a noise sensitive premises. Transport infrastructure providers are also required to consider design measures to meet the noise *target* of $L_{Aeq(Day)}$ 55 dB and $L_{Aeq(Night)}$ 50 dB and to implement these measures where reasonable and practicable. Where the future noise level from a transport infrastructure project is predicted to meet the noise *target* at noise sensitive premises, no further measures are required. It should be noted that in line with the Policy, only future traffic volume scenarios are considered in this section of the report.

Assuming the "low development" scenario for Margaret River, there are no receivers predicted to exceed the *limit* criteria and 10 receivers predicted to be within the margin between the *target* and the *limit*.

Assuming the "full development" scenario for Margaret River, there are seven (7) receivers predicted to exceed the *limit* criteria and four (4) receivers predicted to be within the margin between the *target* and the *limit*.

Under the policy, noise mitigation would only be required for the "full development" scenario and would only need to be considered for the "low development" scenario.

6 NOISE CONTROL OPTONS

For a new transport corridor, there are four main options for noise control under the Policy. These being:

- Road designed to minimise noise impacts (such as the corridor being in cut, or an increased distance from receivers);
- Quieter road surfacing;
- Noise barriers; and
- Facade protection to affected houses.

6.1 Road Design

As the noise sensitive premises are currently all located to the north of John Archibald Drive, consideration should be given to moving the road alignment further south, away from the receivers.

6.2 Road Surfacing

The road design, as modelled, assumes 10mm chip seal. This would be considered as one of the noisiest (and cheapest) of the road surfaces and is used extensively for rural road networks due to its low maintenance costs and longevity.

By replacing the Chip Seal road surface with Dense Graded Asphalt, a reduction in traffic noise levels of up to 2.5 dB could be achieved at receivers adjacent to John Archibald Drive. Using this noise control option would result in all receivers being below the *limit* for all scenarios. Traffic noise could be decreased by a further 2.5 dB by using Open Graded Asphalt in lieu of Dense Graded Asphalt.

6.3 Noise Barriers

The use of noise barriers at strategic locations can result in significant reductions in traffic noise. However, the high costs, visual impacts and maintenance issues (particularly graffiti) require careful consideration in regards to whether this option is practicable. The use of localised property fencing may be an option for premises along John Archibald Drive, which is often considered to be less intrusive.

It should be noted that a combination of a quieter road surface and a noise barrier could be used to achieve the target criteria at all locations.

6.4 Facade Protection

The Policy allows for the use of facade protection where it is considered impracticable to reduce the noise levels using other noise control methods. The Policy Guidelines provide two facade protection packages and these are reproduced in *Appendix A*. However, it should be noted that this option is generally only used when new residential developments are constructed adjacent to existing or future transport corridors. The facade protection appropriate for a residence is dependant upon the receiving transportation noise level. For those receivers predicted to receive a noise level in the margin between the *target* and the *limit* criteria (shaded blue in *Table 4.1*), "Package A" protection would be required. For those receivers predicted to receive a noise level above the *limit* criteria (shaded yellow in *Tables 4.1*), "Package B" protection would be required.

7 CONCLUSION

The analysis has shown that future traffic noise levels along the proposed John Archibald Drive, Margaret River, are predicted to exceed the criteria of the *State Planning Policy 5.4 Road and Rail Transport Noise and Freight Considerations in Land Use Planning* without noise mitigation measures, when assuming the "full development" scenario in Margaret River. Under this scenario, seven (7) receivers are predicted to exceed the *limit* criteria and noise control should be included in the design.

Should the "low development" scenario be considered as the most likely scenario, noise control should be considered if practicable.

Appendix A

Deemed-to-Satisfy Construction Standards

Noise insulation – "Deemed to Comply" packages for residential development

The following "deemed-to-comply" Packages outline noise insulation measures that are designed to ensure that the indoor noise standards in the Policy are achieved for residential developments in areas where outdoor noise levels will exceed the *target* noise levels by up to 8 dB(A).

The deemed-to-comply specifications are intended to simplify compliance with the noise criteria, and the relevant Package should be required as a condition of development. However, this should not remove the option to pursue alternative measures or designs. Departures from the deemed-to-comply specifications need to be accompanied by acoustic certification from a competent person, to the effect that the development will achieve the requirements of the Policy.

Superior construction standards, such as those specified in the "deemed-to-comply" packages, are now becoming more prevalent in residential buildings; and do not significantly increase the cost of building. A similar standard of construction has been recommended by the Western Australian Planning Commission for new housing in areas forecast to be seriously affected by aircraft noise.[1] That recommendation followed a comprehensive assessment of the efficacy and costs of noise attenuation measures, taking into account the recent changes in industry building standards as well as changes to the *Building Code of Australia*.

Where transport noise levels are more than 8 dB above the noise *target*, i.e. 3 dB above the noise *limit*, or where noise-sensitive development other than residential is proposed, a Detailed Assessment should be prepared by a competent person. The report should specify the level of noise reduction required and the noise insulation measures needed to comply with the Policy. The approval may require that the construction drawings be checked for compliance with the Detailed Assessment, and that follow-up verification be carried out to certify compliance.

[1] Statement of Planning Policy No 5.1, *Land Use Planning in the Vicinity of Perth Airport* and the accompanying report on *Aircraft Noise Insulation for Residential Development in the Vicinity of Perth Airport,* February 2004.

Package A: Noise levels within the *margin*

The following noise insulation package is designed to meet the indoor noise standards for residential developments in areas where noise levels exceed the noise target *but are within the* limit.

Area type	Orientation	**Package A measures**
Indoors		
Bedrooms	Facing road/rail corridor	• 6mm (minimum) laminated glazing • Fixed, casement or awning windows with seals • No external doors • Closed eaves • No vents to outside walls/eaves • Mechanical ventilation/airconditioning[2]
	Side-on to corridor	• 6mm (minimum) laminated glazing • Closed eaves • Mechanical ventilation/airconditioning
	Away from corridor	No requirements
Living and work areas[3]	Facing corridor	• 6mm (minimum) laminated glazing • Fixed, casement or awning windows with seals • 35mm (minimum) solid core external doors with acoustic seals[4] • Sliding doors must be fitted with acoustic seals • Closed eaves • No vents to outside walls/eaves • Mechanical ventilation/airconditioning
	Side-on to corridor	• 6mm (minimum) laminated glazing • Closed eaves • Mechanical ventilation/airconditioning
	Away from corridor	No requirements
Other indoor areas	Any	No requirements
Outdoors		
Outdoor living area[5]	Facing corridor	• Minimum 2.0m high solid fence (e.g. Hardifence, pinelap, or Colorbond) • Picket fences are not acceptable
	Side-on to corridor	
	Away from corridor	No requirements

[2] See section on Mechanical ventilation/airconditioning for further details and requirements.
[3] These deemed-to-comply guidelines adopt the definitions of indoor spaces used in AS 2107-2000. A comparable description for bedrooms, living and work areas is that defined by the Building Code of Australia as a "habitable room". The Building Code of Australia may be referenced if greater clarity is needed. A living or work area can be taken to mean any "habitable room" other than a bedroom. Note that there are no noise insulation requirements for utility areas such as bathrooms. The Building Code of Australia describes these utility spaces as "non-habitable rooms".
[4] Glazing panels are acceptable in external doors facing the transport corridor. However these must meet the minimum glazing requirements.
[5] The Policy requires that at least one outdoor living area be reasonably protected from transport noise. The protected area should meet the minimum space requirements for outdoor living areas, as defined in the Residential Design Codes of Western Australia.

Package B: Noise within 3 dB above the *limit*

The following noise insulation package is designed to meet the indoor noise standards for residential developments in areas where transport noise levels exceed the noise *limit* but by no more than 3 dB (See Table 1 in the Policy).

Area type	Orientation	Package B measures
Indoors		
Bedrooms	Facing road/rail corridor	• 10mm (minimum) laminated glazing • Fixed, casement or awning windows with seals • No external doors • Closed eaves • No vents to outside walls/eaves • Mechanical ventilation/airconditioning[6]
	Side-on to corridor	• 10mm (minimum) laminated glazing • Closed eaves • Mechanical ventilation/airconditioning
	Away from corridor	No requirements
Living and work areas[7]	Facing corridor	• 10mm (minimum) laminated glazing • Fixed, casement or awning windows with seals • 40mm (minimum) solid core external doors with acoustic seals[8] • Sliding doors must be fitted with acoustic seals • Closed eaves • No vents to outside walls/eaves • Mechanical ventilation/airconditioning
	Side-on to corridor	• 6mm (minimum) laminated glazing • Closed eaves • Mechanical ventilation/airconditioning
	Away from corridor	No requirements
Other indoor areas	Any	No requirements
Outdoors		
Outdoor living area[9]	Facing corridor	• Minimum 2.4m solid fence (e.g. brick, limestone or Hardifence) • Colorbond and picket fences are not acceptable
	Side-on to corridor	
	Away from corridor	No requirements

[6] See section on Mechanical ventilation/airconditioning for further details and requirements.

[7] These deemed-to-comply guidelines adopt the definitions of indoor spaces used in AS 2107-2000. A comparable description for bedrooms, living and work areas is that defined by the Building Code of Australia as a "habitable room". The Building Code of Australia may be referenced if greater clarity is needed. A living or work area can be taken to mean any "habitable room" other than a bedroom. Note that there are no noise insulation requirements for utility areas such as bathrooms. The Building Code of Australia describes these utility spaces as "non-habitable rooms".

[8] Glazing panels are acceptable in external doors facing the transport corridor. However these must meet the minimum glazing requirements.

[9] The Policy requires that at least one outdoor living area be reasonably protected from transport noise. The protected area should meet the minimum space requirements for outdoor living areas, as defined in the Residential Design Codes of Western Australia.

Mechanical ventilation/airconditioning

Where outdoor noise levels are above the "target", both Packages A and B require mechanical ventilation or airconditioning to ensure that windows can remain closed in order to achieve the indoor noise standards.

In implementing Packages A and B, the following need to be observed:

- evaporative airconditioning systems will not meet the requirements for Packages A and B because windows need to remain open;
- refrigerative airconditioning systems need to be designed to achieve fresh air ventilation requirements;
- air inlets need to be positioned facing away from the transport corridor where practicable;
- ductwork needs to be provided with adequate silencing to prevent noise intrusion.

Notification

Notifications on certificates of title and/or advice to prospective purchasers advising of the potential for noise impacts from road and rail corridors can be effective in warning people of the potential impacts of transport noise. Such advice can also bring to the attention of prospective developers the need and opportunities to reduce the impact of noise through sensitive design and construction of buildings and the location and/or screening of outdoor living areas.

Notification should be provided to prospective purchasers, and required as a condition of subdivision (including strata subdivision) for the purposes of noise-sensitive development or planning approval involving noise-sensitive development, where external noise levels are forecast or estimated to exceed the "target" criteria as defined by the Policy. In the case of subdivision and development, conditions of approval should include a requirement for registration of a notice on title, which is provided for under section 12A of the Town Planning and Development Act and section 70A of the Transfer of Land Act. An example of a suitable notice is given below.

Notice: This property is situated in the vicinity of a transport corridor, and is currently affected, or may in the future be affected, by transport noise. Further information about transport noise, including development restrictions and noise insulation requirements for noise-affected property, are available on request from the relevant local government offices.

Appendix B

Terminology

The following is an explanation of the terminology used throughout this report.

Decibel (dB)
The decibel is the unit that describes the sound pressure and sound power levels of a noise source. It is a logarithmic scale referenced to the threshold of hearing.

A-Weighting
An A-weighted noise level has been filtered in such a way as to represent the way in which the human ear perceives sound. This weighting reflects the fact that the human ear is not as sensitive to lower frequencies as it is to higher frequencies. An A-weighted sound level is described as L_A dB.

Sound Pressure Level (L_p)
The sound pressure level of a noise source is dependent upon its surroundings, being influenced by distance, ground absorption, topography, meteorological conditions etc and is what the human ear actually hears. Using the electric heater analogy above, the heat will vary depending upon where the heater is located, just as the sound pressure level will vary depending on the surroundings. Noise modelling predicts the sound pressure level from the sound power levels taking into account ground absorption, barrier effects, distance etc.

L_{Amax}
An L_{Amax} level is the maximum A-weighted noise level during a particular measurement.

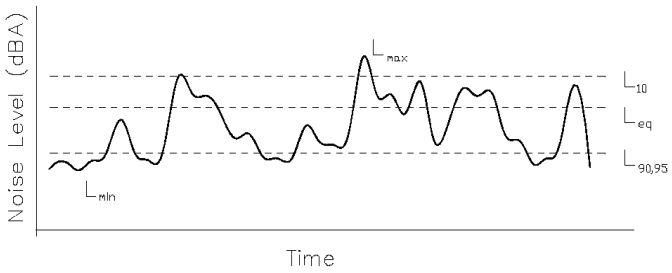
L_{A1}
An L_{A1} level is the A-weighted noise level which is exceeded for one percent of the measurement period and is considered to represent the average of the maximum noise levels measured.

L_{A10}
An L_{A10} level is the A-weighted noise level which is exceeded for 10 percent of the measurement period and is considered to represent the "*intrusive*" noise level.

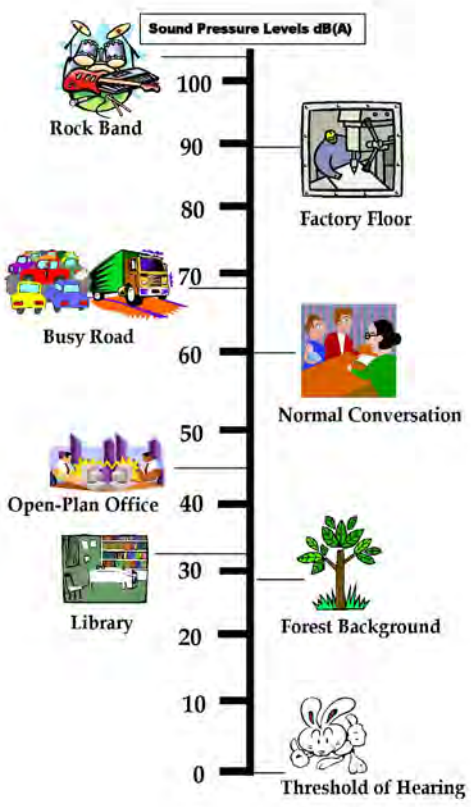
L_{Aeq}
The equivalent steady state A-weighted sound level ("equal energy") in decibels which, in a specified time period, contains the same acoustic energy as the time-varying level during the same period. It is considered to represent the "average" noise level.

L_{A90}
An L_{A90} level is the A-weighted noise level which is exceeded for 90 percent of the measurement period and is considered to represent the "*background*" noise level.

Chart of Noise Level Descriptors



Typical Noise Levels



Appendix I – Noise Contours

Dual Carriageway

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BUSSELL HIGHWAY (H043)
MARGARET RIVER PERIMETER ROAD
PRELIMINARY ALIGNMENT

LEGEND:

PROPOSED LAND REQUIREMENTS

PROPOSED NEW HIGHWAY ALIGNMENT

0m 25 50 75 100 125 150 175 200 225 250

SCALE 1:2500

C. COATES AUG 2012

ALIGNMENT 2 - BLUE (CUTTING) ALIGNMENT
2014 "AT OPENING"

TRAFFIC NOISE LEVELS
$L_{Aeq,(day)}$ dB

(NO SHADING) <=55 BELOW TARGET
>55 ABOVE TARGET LEVEL - BELOW LIMIT
>60 ABOVE LIMIT
>65

TRAFFIC VOL 1,460 veh/day (20% HV)

N

1400.000
1500.000
TP 1531.362
1600.000
1700.000
TP 1764.823
1800.000
1900.000
2000.000
2100.000
TP 2174.389
2200.000
2300.000
2400.000
2500.000
2600.000
2700.000
TP 2741.229
2800.000
2900.000
3000.000
3100.000
3200.000

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BUSSELL HIGHWAY (H043)
MARGARET RIVER PERIMETER ROAD
PRELIMINARY ALIGNMENT

LEGEND:

PROPOSED LAND REQUIREMENTS

PROPOSED NEW HIGHWAY ALIGNMENT

0m 25 50 75 100 125 150 175 200 225 250

SCALE 1:2500

C. COATES AUG 2012

ALIGNMENT 2 - BLUE (CUTTING) ALIGNMENT
2031 (EAST MARGARET RIVER DEVELOPMENT ONLY)

TRAFFIC NOISE LEVELS
$L_{Aeq,(day)}$ dB

(NO SHADING) <=55 BELOW TARGET
>55 ABOVE TARGET LEVEL - BELOW LIMIT
>60 ABOVE LIMIT
>65

TRAFFIC VOL 2,500 veh/day (20% HV)

N

1400.000
1500.000
TP 1531.862
1600.000
1700.000
1800.000
1900.000
2000.000
2100.000
TP 2171.369
2200.000
2300.000
2400.000
2500.000
2600.000
2700.000
TP 2741.228
2800.000
2900.000
3000.000
3100.000
3200.000

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MARGARET RIVER PERIMETER ROAD
PRELIMINARY ALIGNMENT

LEGEND:

PROPOSED LAND REQUIREMENTS

PROPOSED NEW HIGHWAY ALIGNMENT

0m 25 50 75 100 125 150 175 200 225 250

SCALE 1:2500

C. COATES AUG 2012

4600.000
4700.000
TP 4772.261
4800.000
4900.000
5000.000
5100.000
5200.000
5300.000
TP 5312.403
5400.000
5500.000
5600.000
5700.000
5800.000
5900.000
6000.000
6100.000
6200.000

2014 "AT OPENING"

TRAFFIC NOISE LEVELS
$L_{Aeq,(day)}$ dB

(NO SHADING) <=55 BELOW TARGET
>55 ABOVE TARGET LEVEL - BELOW LIMIT
>60 ABOVE LIMIT
>65

N

TRAFFIC VOLS
- NORTH OF ROSA BROOK RD, 1,780 veh/day (20% HV)
- SOUTH OF ROSA BROOK RD, 970 veh/day (20% HV)
- ROSA BROOK RD EAST, 860 veh/day (20% HV)

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MARGARET RIVER PERIMETER ROAD
PRELIMINARY ALIGNMENT

LEGEND:

PROPOSED LAND REQUIREMENTS

PROPOSED NEW HIGHWAY ALIGNMENT

0m 25 50 75 100 125 150 175 200 225 250

SCALE 1:2500

C. COATES AUG 2012

4600.000
4700.000
TP 4772.261
4800.000
4900.000
5000.000
5100.000
5200.000
5300.000
TP 5312.403
5400.000
5500.000
5600.000
5700.000
5800.000
5900.000
6000.000
6100.000
6200.000

2031 (EAST MARGARET RIVER DEVELOPMENT ONLY)

TRAFFIC NOISE LEVELS
$L_{Aeq,(day)}$ dB

(NO SHADING) <=55 BELOW TARGET
>55 ABOVE TARGET LEVEL - BELOW LIMIT
>60 ABOVE LIMIT
>65

TRAFFIC VOLS
- NORTH OF ROSA BROOK RD, 2,600 veh/day (20% HV)
- SOUTH OF ROSA BROOK RD, 1,650 veh/day (20% HV)
- ROSA BROOK RD EAST, 940 veh/day (20% HV)

N

Single Carriageway

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South West Region
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BUSSELL HIGHWAY (H043)
MARGARET RIVER PERIMETER ROAD
PRELIMINARY ALIGNMENT

LEGEND:

PROPOSED LAND REQUIREMENTS

PROPOSED NEW HIGHWAY ALIGNMENT

0m 25 50 75 100 125 150 175 200 225 250

SCALE 1:2500

C. COATES AUG 2012

SINGLE CARRIAGEWAY ALIGNMENT
2031 (EAST MARGARET RIVER DEVELOPMENT ONLY)

TRAFFIC NOISE LEVELS
$L_{Aeq,(day)}$ dB

(NO SHADING) <=55 BELOW TARGET
>55 ABOVE TARGET LEVEL - BELOW LIMIT
>60 ABOVE LIMIT
>65

TRAFFIC VOL 2,500 veh/day (20% HV)

N

1400.000
1472.813
1500.000
1600.000
1700.000
1800.000
1900.000
2000.000
2100.000
2180.425
2200.000
2300.000
2400.000
2500.000
2600.000
2700.000
TP 2787.510
2800.000
2900.000
3000.000
3100.000
3200.000

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BUSSELL HIGHWAY (H043)
MARGARET RIVER PERIMETER ROAD
PRELIMINARY ALIGNMENT

LEGEND:

PROPOSED LAND REQUIREMENTS

PROPOSED NEW HIGHWAY ALIGNMENT

0m 25 50 75 100 125 150 175 200 225 250

SCALE 1:2500

C. COATES SEP 2012

SINGLE CARRIAGEWAY ALIGNMENT
2014 "AT OPENING"

TRAFFIC NOISE LEVELS
$L_{Aeq,(day)}$ dB

(NO SHADING) <=55 BELOW TARGET

>55 ABOVE TARGET LEVEL - BELOW LIMIT

>60 ABOVE LIMIT

>65

TRAFFIC VOL 1,450 veh/day (20% HV)

N

1400.000
1472.813
1500.000
1600.000
1706.010
TP 1721.110
1800.000
1900.010
2000.000
2100.100
2180.125
2200.000
2300.000
2400.000
2500.000
2600.000
2700.000
TP 2787.510
2800.000
2900.000
3000.000
3100.000
3200.000

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BUSSELL HIGHWAY (H043)
MARGARET RIVER PERIMETER ROAD
PRELIMINARY ALIGNMENT

LEGEND:

PROPOSED LAND REQUIREMENTS

PROPOSED NEW HIGHWAY ALIGNMENT

0m 25 50 75 100 125 150 175 200 225 250

SCALE 1:2500

C. COATES AUG 2012

4500.000
4600.000
4700.000
TP 4792.336
4800.000
4900.000
5000.000
5100.000
5200.000
TP 5276.525
5300.000
5400.000
5500.000
5600.000
5700.000
5800.000
5900.000
6000.000

2031 (EAST MARGARET RIVER DEVELOPMENT ONLY)

TRAFFIC NOISE LEVELS
$L_{Aeq,(day)}$ dB

(NO SHADING)	<=55	BELOW TARGET
	>55	ABOVE TARGET LEVEL - BELOW LIMIT
	>60	ABOVE LIMIT
	>65	

TRAFFIC VOLS
- NORTH OF ROSA BROOK RD, 2,600 veh/day (20% HV)
- SOUTH OF ROSA BROOK RD, 1,650 veh/day (20% HV)
- ROSA BROOK RD EAST, 940 veh/day (20% HV)

N

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MARGARET RIVER PERIMETER ROAD
PRELIMINARY ALIGNMENT

LEGEND:

PROPOSED LAND REQUIREMENTS

PROPOSED NEW HIGHWAY ALIGNMENT

0m 25 50 75 100 125 150 175 200 225 250

SCALE 1:2500

C. COATES SEP 2012

4500.000
4600.000
4700.000
TP 4792.336
4800.000
4900.000
5000.000
5100.000
5200.000
TP 5276.625
5300.000
5400.000
5500.000
5600.000
5700.000
5800.000
5900.000
6000.000

2014 "AT OPENING"

TRAFFIC NOISE LEVELS
$L_{Aeq,(day)}$ dB

(NO SHADING) <=55 BELOW TARGET
>55 ABOVE TARGET LEVEL - BELOW LIMIT
>60 ABOVE LIMIT
>65

N

TRAFFIC VOLS
- NORTH OF ROSA BROOK RD, 1,780 veh/day (20% HV)
- SOUTH OF ROSA BROOK RD, 970 veh/day (20% HV)
- ROSA BROOK RD EAST, 860 veh/day (20% HV)

John Archibald Drive

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BUSSELL HIGHWAY (H043)
MARGARET RIVER PERIMETER ROAD
PRELIMINARY ALIGNMENT
(JOHN ARCHIBALD DRIVE)

LEGEND:

PROPOSED LAND REQUIREMENTS

PROPOSED NEW HIGHWAY ALIGNMENT

0m 25 50 75 100 125 150 175 200 225 250

SCALE 1:2500

C. COATES NOV 2012

2014 "AT OPENING"

TRAFFIC NOISE LEVELS
$L_{Aeq,(day)}$ dB

(NO SHADING) <=55 BELOW TARGET
>55 ABOVE TARGET LEVEL - BELOW LIMIT
>60 ABOVE LIMIT
>65

N

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MARGARET RIVER PERIMETER ROAD
PRELIMINARY ALIGNMENT
(JOHN ARCHIBALD DRIVE)

LEGEND:

PROPOSED LAND REQUIREMENTS

PROPOSED NEW HIGHWAY ALIGNMENT

0m 25 50 75 100 125 150 175 200 225 250

SCALE 1:2500

C. COATES NOV 2012

2031 (EAST MARGARET RIVER DEVELOPMENT ONLY)

TRAFFIC NOISE LEVELS
$L_{Aeq,(day)}$ dB

(NO SHADING) <=55 BELOW TARGET
>55 ABOVE TARGET LEVEL - BELOW LIMIT
>60 ABOVE LIMIT
>65

N

Single Carriageway

John Archibald Drive

GHD

1st Floor 10 Victoria Street
Bunbury WA 6230
T: 08 9721 0700 F: 08 9721 0777 E: bunmail@ghd.com.au

G:\61\27189\WP\14130.docx

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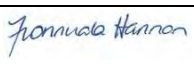
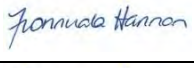
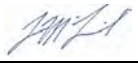
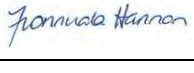
a	M Erskine	S McSevich		F Hannon		2/1/12
b	M Erskine	S McSevich		F Hannon		2/1/12
1	S McSevich	S McSevich		F Hannon		28/11/12

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