



Main Roads Western Australia
Mitchell Freeway Extension - Burns Beach Road to Romeo Road
Flora and Fauna Management Plan

May 2014

Table of contents

Abbreviations.....	1
1. Introduction.....	2
1.1 Project background.....	2
1.2 Project area.....	2
1.3 Scope of FFMP.....	3
1.4 Purpose and objectives of FFMP.....	4
1.5 Key project outcomes.....	4
1.6 Key impacts.....	4
1.7 Relevant documents.....	5
1.8 Limitations.....	5
2. Governance and Policies.....	7
2.1 Ministerial conditions.....	7
2.2 Implementation.....	8
2.3 Statutory requirements and legislation.....	9
2.4 Environmental policy.....	10
3. Existing environment and impacts.....	11
3.1 Vegetation.....	11
3.2 Conservation significant flora.....	12
3.3 Conservation significant ecological communities.....	13
3.4 Weeds.....	13
3.5 Dieback.....	14
3.6 Fauna habitat.....	14
4. Design and planning phase.....	18
4.1 Loss of native vegetation, conservation significant flora species and ecological communities.....	18
4.2 Restrictions to fauna movement.....	18
4.3 Environmental aspects dealt with in other project management plans.....	22
5. Construction phase.....	26
5.1 Overview.....	26
6. Operational phase.....	28
6.1 Monitoring and maintenance.....	28
6.2 Completion criteria.....	29
7. References.....	30

Table index

Table 1	Documents that address conditions in MS629.....	7
Table 2	Key Environmental Legislation relevant to the Project.....	9
Table 3	Fauna habitat types and occurrence within Project Area	15
Table 4	Objectives and KPIs to mitigate fauna movement impacts	21
Table 5	Revegetation objectives and KPIs	23

Abbreviations

Abbreviation/ acronym	Definition
AS/NZS	Australian Standards and New Zealand Standards
CEMP	Construction Environmental Management Plan
CWG	Mitchell Freeway Extension Community Working Group
DPaW	The Department of Parks and Wildlife (formerly Department of Environment and Conservation)
DSEWPaC	Department of Sustainability, Environment, Water, Population and Communities
DotE	Department of the Environment (formerly Department of Sustainability, Environment, Water, Population and Communities)
DEC	Department of Environment and Conservation
EAR	Environmental Assessment Report
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
FFMP	Flora and Fauna Management Plan
EMR	Environmental Management Register
EMS	Environmental Management Systems
EP Act	<i>Environmental Protection Act 1986</i>
ICAM	Incident Cause Analysis Method
MNES	Matters of national environmental significance
MRWA	Main Roads Western Australia
MRS	Metropolitan Region Scheme
MSDS	Material Safety Data Sheet
EIA	Environmental Impact Assessment
WAPC	Western Australian Planning Commission
WC Act	<i>Wildlife Conservation Act 1950</i>

1. Introduction

GHD Pty Ltd (GHD) has been commissioned by Main Roads Western Australia (Main Roads) to prepare a Flora and Fauna Management Plan (FFMP) for the proposed Mitchell Freeway Extension and associated works between Burns Beach Road and Romeo Road (the Project).

1.1 Project background

The Mitchell Freeway provides the primary road access route from the City of Perth to the north-west corridor; however, the freeway currently terminates at Burns Beach Road. The freeway has been constructed in several stages since the 1960s, with further extensions and widening works planned. The Mitchell Freeway Extension has been the subject of a planning process undertaken by Main Roads Western Australia (Main Roads). Further development of the freeway is now required to provide a more direct route for traffic in the far northern suburbs, take pressure off smaller local roads and facilitate residential and business development in the area.

The Western Australian Planning Commission (WAPC) has initiated Major Metropolitan Region Scheme (MRS) Amendment 992/33 Clarkson-Butler, Wanneroo, which contains 11 amendments for rezoning and reservation in the north-west corridor of the metropolitan region. Of the 11 amendments, six were considered by the Environmental Protection Authority (EPA) to have the potential to significantly impact on the environment and therefore should be assessed pursuant to Section 48A of the *Environmental Protection Act 1986* (EP Act). The EPA has developed a set of conditions which the EPA recommends be imposed if the proposed scheme amendment is approved; the Ministerial statement 629, (in relation to MRS Amendment 992/33 Clarkson-Butler, Wanneroo) is principally related to this project as detailed in Section 2.1.

1.2 Project area

The Mitchell Freeway Extension will be developed as a staged construction as summarised below and shown in Plate 1.

The proposed project will be constructed in three stages which are detailed as follows:

- Stage 1: (approximately 151.0 hectares (ha)) Freeway extension from Burns Beach Road to Hester Avenue and the connecting roads (Neerabup Road and Hester Avenue): Planned for 2015–2017
- Stage 2: (approximately 158.0 ha) Freeway extension from Hester Avenue to Romeo Road and connecting road (Romeo Road): Planned for 2017–2021
- Stage 3: (approximately 95.2 ha) Wanneroo Road duplication from Joondalup Drive to Hall Road: Planned for 2027–2029

This FFMP has been developed for Stage 1 of the Project only.

The project is mostly located within the City of Wanneroo, with works on Joondalup Drive and Burns Beach Road located within the City of Joondalup.

The total Project Area for Stage 1 is approximately 151.0 ha, and contains 86.5 ha of remnant vegetation, and has been the subject of several studies (as detailed in section 1.7); the environmental attributes of the site are described in section 3.

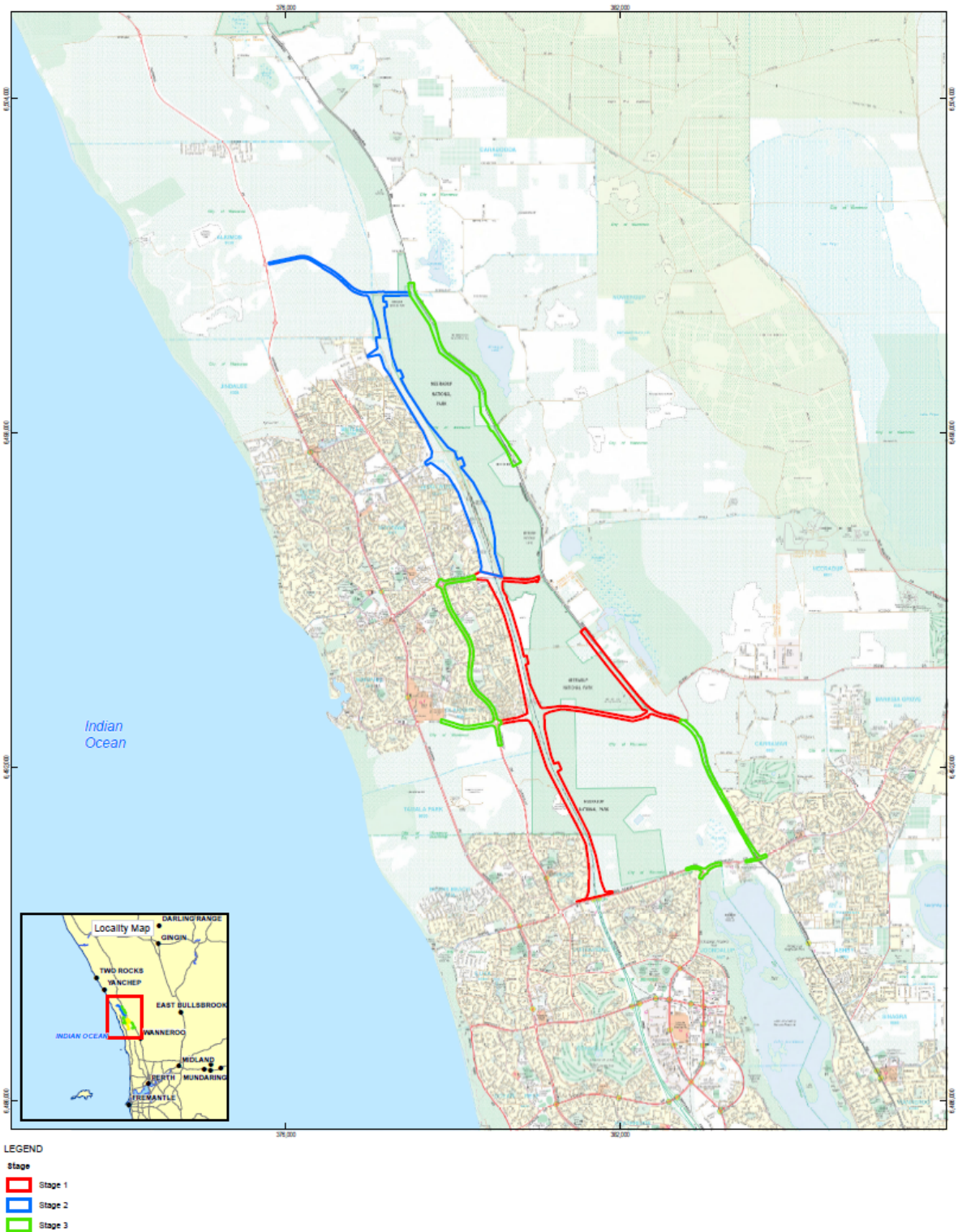


Plate 1 Project Area boundary (including proposed Mitchell Freeway extension and upgrade areas and proposed dual carriage way)

1.3 Scope of FFMP

This FFMP has been prepared to address the conditions of Ministerial Statement 629, in relation to MRS Amendment 992/33 Clarkson-Butler, Wanneroo. This statement specifies that a Vegetation and Fauna Management Plan should be prepared and implemented for the alignment of the Mitchell Freeway to ensure the protection and management of biodiversity in Neerabup National Park to the requirements of the EPA, DotE and DPaW.

1.4 Purpose and objectives of FFMP

The purpose of this FFMP is to identify, manage and monitor the potential impacts to native vegetation, flora and fauna during the design, construction and operational phases of the Mitchell Freeway Extension Project. In particular, this FFMP focuses on the risks relating to conservation significant species and ecological communities.

This FFMP has been developed with the overall objective of minimising the impact to vegetation, flora and fauna. To achieve this objective, the FFMP will aim to:

- Minimise impacts to native vegetation
- Minimise impacts to conservation significant flora and ecological communities
- Minimise impacts to conservation significant fauna and habitats
- Ensure appropriate environmental controls and procedures are implemented during construction to minimise flora and fauna impacts

A separate Construction Environment Management Plan (CEMP) (GHD 2014a) has been produced for the project, which outlines a broader suite of management measures for the construction phase of the project.

1.5 Key project outcomes

The principle aim of the project is to extend the road network including:

- Freeway extension from Burns Beach Road to Hester Avenue and the connecting roads
- Freeway extension from Hester Avenue to Romeo Road
- Wanneroo Road duplication from Joondalup Drive to Hall Road

Main Roads will employ standard construction methods and procedures for the project. These construction methods will include:

- Logging, clearing and mulching of vegetation
- Cutting and filling of the soil profile to create the required slope, most of the fill required for the project will be sourced from within the Project Area
- Trenching to provide for current and future service such as water and power facilities
- Construction of roads, bridges, underpasses, drainage culverts/ infrastructure and lighting
- Rehabilitation and/or revegetation of all disturbed areas that are not required for the ongoing function and maintenance of the road

1.6 Key impacts

The project will have impacts on flora and fauna in the design, construction and operational phases as summarised in Section 3 and detailed in an Environmental Impact Assessment (EIA) that was completed for the project (GHD 2014b). Key impacts include:

- Reduction of vegetation association extents
- Clearing of a DPaW priority listed flora species and a Priority ecological community (PEC)
- Loss of fauna habitat
- Loss of flora biodiversity and disturbance to vegetation adjacent to clearing areas due to edge effects, changes in hydrology and potential fragmentation
- Increased erosion and runoff

- Changes to existing drainage and hydrology
- Fragmentation of remnant bushland
- Increased risk of dieback and weeds introduction and/or spread
- Increased risk of fire

1.7 Relevant documents

This management plan draws information from various sources including relevant documents relating to legislation, publically available databases and previous studies by GHD and other consultants relevant to the Project. These documents have been reviewed for this FFMP to understand the project specific potential impacts to flora and fauna.

These documents include:

- Mitchell Freeway Extension Level 2 Flora and Level 1 Fauna assessment (GHD 2013a)
- Black Cockatoo targeted assessment (GHD 2013b)
- Neerabup Road Extension Level 2 Fauna Survey (GHD 2013c)
- A Fauna Movement study conducted along the Neerabup Road Extension (GHD 2013d)
- The CEMP developed concurrently with this FFMP for the Stage 1 project (GHD 2014a)
- An Environmental Impact Assessment (EIA) (GHD 2014b)
- Dieback survey (Glevan Consulting 2013)

1.8 Limitations

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 1.4 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.

Site conditions (including the presence of species and communities of conservation significance) may change after the date of this Report. GHD does not accept responsibility arising from, or in connection with, any change to the site conditions. GHD is also not responsible for updating this Report if the site conditions change.

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.

GHD has prepared this Report on the basis of information provided by Main Roads and Government authorities, which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified

information, including errors and omissions in the Report which were caused by errors or omissions in that information.

The opinions, conclusions and any recommendations in this Report are based, in part, on information obtained from, and testing undertaken at or in connection with, specific sample points. Site conditions at other parts of the site may be different from the site conditions found at the specific sample points. Investigations undertaken in respect of this Report are constrained by the particular site conditions, such as the location of buildings, services and vegetation. As a result, not all relevant site features and conditions may have been identified in this Report.

2. Governance and Policies

2.1 Ministerial conditions

This Flora and Fauna Management Plan (FFMP) has been developed in accordance with Main Roads standard practices and the EPA's ministerial statement 629.

Ministerial Statement Number 629 (pursuant to the Provisions of Division 3 of Part IV of the *Environmental Protection Act 1986*), for the amendment of the Metropolitan Region Scheme to accommodate modifications to the zones and reserves in the Clarkson-Butler District, dictates that a Vegetation and Flora Management Plan is produced that includes:

- Provision for revegetation
- A weed control program
- A dieback management plan including dieback survey within the proposed alignment
- A fire management plan
- A fauna survey to be undertaken along and adjoining the proposed alignments to delineate usage and movement patterns within the project area
- Relocation of individual scheduled and priority fauna if their ranges lie within or overlap the area of the proposed alignment
- Investigation into the alternatives for facilitation of fauna movement across each alignment
- Investigation into measures that will reduce pressures, such as introduced species, disease and increased road deaths, on fauna populations within Neerabup Nation Park
- Identification of design and construction elements required to minimise impacts on fauna and park management
- Monitoring of fauna movement across each alignment
- The use of lighting along the roads to assist in the reduction of road deaths of nocturnal terrestrial fauna species
- Allocation of responsibilities and timing for the implementation

Many of these aspects have been addressed within the various supporting documents to this plan as well as within the Construction Environment Management Plan (GHD 2014a). The specific conditions are dealt with in the documents shown in Table 1

Table 1 Documents that address conditions in MS629

Ministerial Statement 629 Condition	Document where addressed
Provision for revegetation	This document and CEMP (GHD 2014a)
A weed control program	This document and CEMP (GHD 2014a)
A dieback management plan including dieback survey within the proposed alignment	Gleven (2013) and CEMP (GHD 2014a)
A fire management plan	This document and CEMP (GHD 2014a)
A fauna survey to be undertaken along and adjoining the proposed alignments to delineate	Fauna Movement study conducted along the Neerabup Road Extension GHD (2013d)

Ministerial Statement 629 Condition	Document where addressed
usage and movement patterns within the project area	
Relocation of individual scheduled and priority fauna if their ranges lie within or overlap the area of the proposed alignment	CEMP (GHD 2014a)
Investigation into the alternatives for facilitation of fauna movement across each alignment	Fauna Movement study conducted along the Neerabup Road Extension GHD (2013d)
Investigation in measures that will reduce pressures, such as introduced species, disease and increased road deaths, on fauna populations within Neerabup Nation Park	This document and Fauna Movement study conducted along the Neerabup Road Extension GHD (2013d)
Identification of design and construction elements required to minimise impacts on fauna and park management	Fauna Movement study conducted along the Neerabup Road Extension GHD (2013d)
Monitoring of fauna movement across each alignment	This document
The use of lighting along the roads to assist in the reduction of road deaths of nocturnal terrestrial fauna species	This document
Allocation of responsibilities and timing for the implementation	This document and CEMP (GHD 2014a)

2.2 Implementation

The management measures presented in this FFMP form the basis for control of project activities; where/ when reference is made to procedures, guidelines or government documents the latest approved versions should be used.

The implementation of this FFMP is the responsibility of the persons identified throughout the document.

This FFMP identifies the person/s responsible for undertaking and implementing the management strategies during the design, construction and operational phases of the project. The responsibility of particular management procedures and actions can be delegated, though overall responsibility will remain with the listed person/entity.

All contractors will be required to prepare and submit management plans with specific objectives, strategies, monitoring regimes and reporting commitments consistent with this FFMP. These documents will require approval by Main Roads prior to the commencement of works at the site. Breaches of the FFMP may incur personal or company penalties as legislated by State and National laws. Environmental management systems (EMS) are put in place to ensure the effective and compliant implementation of this FFMP at the site.

2.2.1 Review and updates

Any relevant changes or updates to knowledge, standards, policies and procedures should be incorporated wherever possible during the construction of each stage of the project. This FFMP has been developed to apply to Stage 1 of the project only.

During implementation, review may be required to ensure the objectives of this plan are achieved. As such, in practice prescribed management and mitigation measures may require refinement, or alternatively require changes in approach. If review is necessary, Main Roads will reissue this plan to the relevant regulators for information. If the review includes substantial changes, where the outcome of the management significantly changes, Main Roads will seek the relevant regulators approval for the changes.

Given the entire project (three stages) is proposed to have construction until 2027–2029 this FFMP will require formal review and update prior to being applied to additional stages of the project. Consideration of the environmental values associated with the other project stages will also be required.

2.3 Statutory requirements and legislation

Key environmental legislation and standards relevant to this FFMP and the construction of the Project are listed in Table 2.

Table 2 Key Environmental Legislation relevant to the Project

Legislation	Relevance	Specific trigger	Regulatory authority
Commonwealth Legislation			
<i>Environment Protection and Biodiversity Conservation Act 1999</i>	Protection of environmental matters of national significance.	Black Cockatoo breeding and feeding habitat	Department of the Environment (DotE)
State Legislation			
Biosecurity and Agriculture Management Act 2007	Obligations for control, destruction and notification of gazetted noxious plants and animals.	Presence and/or introduction of declared plants within the road reserve.	Department of Agriculture and Food Western Australia (DAFWA)
<i>Environmental Protection Act 1986</i>	Prevention, control and abatement or pollution and conservation protection and enhancement of environment.	Entire Project Area.	DER
<i>Environmental Protection (Clearing of Native Vegetation) Regulations 2004</i>	Manages the clearing of native vegetation within the state to ensure it is managed appropriately and is not excessive.	All areas of native vegetation.	DER
<i>Soil and Land Conservation Act 1988 (WA) and Clearing Control Regulations 1991</i>	Deals with the conservation of soil and land resources and the mitigation of the effects of erosion.	Entire Project Area.	Commissioner for Soil and Land Conservation

Legislation	Relevance	Specific trigger	Regulatory authority
<i>Wildlife Conservation Act 1950 (WA)</i>	Provides for the conservation and protection of wildlife (flora and fauna). Special provisions and schedules cover protection and management of gazetted rare flora and fauna.	All areas of native vegetation.	Department of Parks and Wildlife (DPaW) (formerly Department of Environment and Conservation; DEC)

2.4 Environmental policy

Main Roads operates under its Environmental Policy and Sustainability Policy and also has an ISO 14001 accredited Environmental Management System. This CEMP has been developed in line with this policy:

“Main Roads Western Australia manages the State's road network to provide safe and efficient road access that will enhance community lifestyles and support economic prosperity. We seek to achieve balanced and sustainable outcomes for the community. Responsible environmental stewardship in developing and maintaining the road network is critical to our success. Main Roads is committed to the following principals;

- *Protecting and enhancing the environmental values of road reserves;*
- *Minimising the impact on the natural environment of roads and road use; and*
- *Conserving natural resources and minimising energy consumption and waste.*

The objectives of this policy are;

- *Fully satisfy all environmental legislation, Government Policy and, where specific legislation is lacking, uphold the spirit of the law;*
- *Implement, maintain and continually improve an effective environmental management system across Main Roads planning, business, project and management processes*
- *Apply an approach of "avoid, minimise and mitigate", in order of preference, to the management of environmental impacts associated with road construction projects*
- *Develop awareness of environmental management processes, standards and responsibilities among Main Roads' employees and contractor partners*
- *Listen and be responsive to community and stakeholder views on environmental issues; and*
- *Set specific environmental objectives and targets relating to the key environmental aspects of Main Roads' activities, and measure and report progress in achieving these targets”.*

3. Existing environment and impacts

The existing environment has been the subject of several investigations and is described in detail in the reports listed in section 1.7. These documents have been used to develop this FFMP and should be read in conjunction with this document. The existing environment is briefly described in the following sections as it relates to the management actions identified in this FFMP.

3.1 Vegetation

3.1.1 Description

Bioregion

As detailed the Flora and Fauna report (GHD 2013a) the Project Area is located within the Swan Coastal Plain Interim Biogeographic Regionalisation of Australia (IBRA) Bioregion, Perth Sub-Region (SWA02). This sub-region is dominated by woodlands of *Banksia* and Tuart on sandy soils, sheoak on outwash plains, and paperbark in swampy areas.

Broad vegetation mapping

Broad-scale vegetation mapping of the area (Beard 1979) identified the following four vegetation associations present within the Project Area:

- Medium woodland; tuart & jarrah (association 6)
- Shrublands; teatree thicket (association 37)
- Low woodland; banksia (association 949)
- Medium woodland; tuart (association 998) Spearwood

Heddle *et al.* (1980) mapped the Perth area at a finer scale than Beard (1979). The Heddle *et al.* (1980) mapping identified the following vegetation complexes within the Project Area (Government of Western Australia 2000):

- **Quindalup complex:** Coastal dune complex consisting mainly of two alliances – the strand and fore-dune alliance and the mobile and stable dune alliance. Local variations include the low closed forest of *Melaleuca lanceolata* – *Callitris preissii* and the closed scrub of *Acacia rostellifera*.
- **Cottesloe complex – central and south:** Mosaic of woodland of *Eucalyptus gomphocephala* and open forest of *E. gomphocephala* – *E. marginata* – *E. calophylla* [now *Corymbia calophylla*]; closed heath on the Limestone outcrops.
- **Karrakatta complex – central and south:** Predominantly open forest of *E. gomphocephala* – *E. marginata* – *C. calophylla* and woodland of *E. marginata* – *Banksia* species.
- **Wetlands/ Herdsman complex:** Sedgelands and fringing woodland of *E. rudis* – *Melaleuca* species.

3.1.2 Impacts

As detailed in the EIA (GHD 2014b) the clearing of native vegetation and the impacts associated with this clearing are primary risks associated with the project; this clearing will result in direct loss of native vegetation and this loss will result in other initial associated impacts, potential risks and the ongoing effects from the operational phase of the project.

The direct impact to vegetation from the project is the clearing of 86.6 ha of remnant vegetation in Stage 1.

The associated impacts from this clearing are:

- Loss of flora biodiversity due to decreased habitat availability
- Disturbance to vegetation adjacent to clearing areas due to edge effects
- Changes in hydrology (from road run off and drainage alteration)
- Increased fragmentation and decreases in patch size of remnant vegetation

3.2 Conservation significant flora

3.2.1 Description

As detailed in the Flora and Fauna report (GHD 2013a) no conservation significant flora species listed under the EPBC Act or Wildlife Conservation Act 1950 (WC Act) were recorded during the Level 2 flora and vegetation survey (GHD 2013a).

One DPaW Priority species was recorded within the Stage 1 Project Area; *Jacksonia sericea* (Priority 4); Approximately 706 individuals of this species were observed during the field studies within Stage 1.

Additionally there are two species listed under both the EPBC Act and WC Act and 12 DPaW Priority-listed species that are considered likely to be in the Project Area (but have not been identified during targeted surveys) that may be lost as a result of this project.

- *Eucalyptus caesia* (Priority 4)
- *Stylidium maritimum* (Priority 3)
- *Pimelea calcicola* (Priority 3)
- *Acacia benthamii* (Priority 2)
- *Caladenia huegelii* (Grand Spider Orchid) (State Threatened, Federal Endangered)
- *Drakaea micrantha* (Dwarf hammer-orchid) (State Threatened, Federal Vulnerable)
- *Austrostipa mundula* (Priority 2)
- *Conostylis bracteata* (Priority 3)
- *Conostylis pauciflora* subsp. *euryrhipis* (Priority 4)
- *Conostylis pauciflora* subsp. *pauciflora* (Priority 4)
- *Lecania turicensis* var. *turicensis* (a lichen) (Priority 2)
- *Sarcozona bicarinata* (Priority 3)
- *Schoenus griffinianus* (Priority 3)
- *Thelymitra variegata* (Priority 3)

These are described further in the Flora and Fauna report (GHD 2013a).

3.2.2 Impacts

As detailed in the EIA (GHD 2014b) there is one known DPaW priority species within the proposed clearing area of Stage 1 (*Jacksonia sericea*; 706 plants). These individual plants and up to 86.6 ha of their habitat will be lost as a result of clearing. This impact will result in a decrease in population size of this conservation significant species and loss of suitable habitat.

Additionally there are two species listed under both the EPBC Act and WC Act and 12 DPaW Priority-listed species that are considered likely to be in the Project Area (but have not been identified during targeted surveys) that may be impacted as a result of this project.

3.3 Conservation significant ecological communities

3.3.1 Description

No Federally-listed Threatened Ecological Communities (TEC) were recorded in the Project Area by GHD (2013a). No State-listed TEC were recorded within Stage 1 of the Project Area. A Priority 3 Priority Ecological Community (PEC) (Northern Spearwood Shrublands and Woodlands) was recorded by GHD (2013a) with up to 40.3 ha within Stage 1 of the Project Area. Subsequent to these surveys a new Priority 3 PEC has been listed by DPaW 'Banksia dominated woodlands on the Swan Coastal Plain IBRA region'. This PEC aligns with Vegetation Type 1 and approximately 35.9 ha of this PEC occurs within Stage 1 of the Project Area.

The locations of these ecological communities within the Project Area are detailed in the Flora and Fauna report (GHD 2013a).

3.3.2 Impacts

Two ecological communities will be directly impacted as a result of the project:

- Up to 40.3 ha of the Priority 3 PEC Northern Spearwood Shrublands and Woodlands will be impacted
- Up to 35.9 ha of the Priority 3 PEC *Banksia* dominated woodlands on the Swan Coastal Plain IBRA region will be impacted

3.4 Weeds

3.4.1 Description

As detailed the Flora and Fauna report (GHD 2013a) the survey identified a total of 146 introduced (exotic) and planted species within the greater Project Area (Stages 1, 2 and 3). Of these, three species are listed as Declared Pests under Section 22 of the *Biosecurity and Agriculture Management Act 2007* (BAM Act):

- *Asparagus asparagoides* (bridal creeper) – Approximately 12 individuals scattered throughout the Project Area (Stage 1 contained six bridal creeper individuals located on the eastern end of Hester Ave and on Wanneroo Road)
- *Solanum linnaeanum* (apple of sodom) – Approximately 13 individuals within the Tuart woodland (vegetation type 3). (Stage 1 contained six apple of sodom individuals in total, five on Neerabup Road west and one on Neerabup road east)
- *Zantedeschia aethiopica* (arum lily) – Approximately 100 individuals at the intersection of Romeo Road and Wanneroo Roads (Not recorded in Stage 1)

Bridal creeper is also listed as a Weed of National Significance (WoNS) (Australian Weeds Committee 2010). The locations of these species recorded within the Project Area are detailed in the Flora and Fauna report (GHD 2013a).

3.4.2 Impacts

There are several risks with regard to weeds and this project:

- There is a risk that the project will increase the spread of weeds through the Stage 1 area and surrounds. This includes the risk of spreading declared weeds (Bridal creeper, Apple of sodom and Arum lily) throughout Project Area.
- There is a risk that the project will introduce additional/different weed species into the area.
- There is a risk that declared weeds may be spread to areas containing conservation significant flora and may compete with conservation significant flora for habitat.

3.5 Dieback

3.5.1 Description

Glevan Consulting undertook an assessment of the vegetation within the Project Area in July 2013 for the presence of Phytophthora Dieback (Glevan Consulting 2013). The Project Area was determined to be a mosaic of infested, un-infested, and un-mappable vegetation. Less than 1% of the total area surveyed was determined to be infested, whereas approximately 60% was un-mappable. The key results from the study were:

- The Project Area lies predominantly within the Spearwood and Quindalup dune systems which is a landform where the effect of *P. cinnamomi* on the vegetation would be minimal
- Areas that were considered to be infested with *P. cinnamomi* were demarcated on site
- There were several sections of the Project Area that were considered Un-mappable and/or Un-protectable
- There were also Un-infested and Protectable areas within the Project Area and these should be managed as such.

3.5.2 Impacts

Dieback is a soil-borne pathogen recognised as a major threat to Australian vegetation, and in particular, the vegetation and dependent biota within the south west botanical province. Dieback is known to reduce the health and species diversity of native vegetation and the disease is listed as a key threatening process under the EPBC Act.

The key potential impact from the project in relation to Dieback is that the construction phase of the project has the potential to spread the disease into areas that are currently unaffected. This is primarily because uncontrolled movements across the site by construction vehicles, construction personnel or vegetation relocation (such as mulch) may lead to the proliferation and spread of dieback.

3.6 Fauna habitat

3.6.1 Fauna habitat

As detailed in the Flora and Fauna report (GHD 2013a) six broad fauna habitat types were identified in the Project Area based on the predominant landforms, soil and vegetation structure in the area. These habitat types are listed in Table 3.

It should be noted that there is a difference in the area of remnant vegetation to be cleared (see section 3.1.2, 86.6 ha) and the area of fauna habitat that will be lost for Stage 1 (99.1 ha). This difference relates to the differences between the mapping of the vegetation types and the broader fauna habitat types in GHD (2013a), and inclusion of some areas of degraded vegetation in the fauna habitat types. As a result, the areas of fauna habitat do not directly correlate to the total area of remnant vegetation to be cleared for Stage 1 of the Project. For the

purposes of this management plan the areas of remnant vegetation identified in section 3.1.2 have been used to quantify the specific impacts to fauna.

Table 3 Fauna habitat types and occurrence within Project Area

Habitat type	Total area (ha) within the Project Area
Low heathland on limestone outcrops	Stage 1: Not present Stage 2: 21.2 ha Stage 3: Not present Total: 21.2 ha
Banksia woodland on grey/brown sand	Stage 1: 34.0 ha Stage 2: 40.3 ha Stage 3: 14.8 ha Total: 89.1 ha
Tuart (<i>Eucalyptus gomphocephala</i>) woodland in deep dark brown sand	Stage 1: 38.3 ha Stage 2: 5.5 ha Stage 3: 10.6 ha Total: 54.4 ha
<i>Banksia sessilis</i> tall shrubland on grey sand and limestone outcropping	Stage 1: 2.2 ha Stage 2: 2.5 ha Stage 3: Not present Total: 4.7 ha
Jarrah (<i>E. marginata</i>)– <i>Banksia</i> woodland on grey/brown sand	Stage 1: 6.8 ha Stage 2: 2.1 ha Stage 3: 2.7 ha Total: 11.6 ha
Mosaic of <i>Banksia</i> woodland and low heathland	Stage 1: 18.3 ha Stage 2: 9.1 ha Stage 3: Not present Total: 27.4 ha
Highly degraded/cleared/planted roadside vegetation	Stage 1: 51.4 ha Stage 2: 77.3 ha Stage 3: 67.1 ha Total: 195.8 ha
Total area of habitat (all habitat types combined)	Stage 1: 151.0 ha Stage 2: 158.0 ha Stage 3: 95.2 ha
Total area of habitat containing remnant native vegetation	Stage 1: 99.1 ha Stage 2: 80.1 ha Stage 3: 27.3 ha

3.6.1 Fauna diversity

Fauna surveys in the Project Area (GHD 2013a, GHD 2013b, GHD 2013c and GHD 2013d) identified total of 114 vertebrate fauna species comprising 1485 individuals from both

opportunistic and trapping survey results. This included 70 birds, 29 reptiles, one amphibian, eight native mammals (including bats) and six introduced mammals.

3.6.2 Conservation significant fauna

The Level 1 fauna survey (GHD 2013a) and fauna trapping survey (GHD 2013c) identified seven conservation significant fauna species within the Project Area:

- Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*) – Endangered (EPBC Act) Schedule 1 (WC Act)
- Baudin's Black Cockatoo (*Calyptorhynchus baudinii*) – Vulnerable (EPBC Act) Schedule 1 (WC Act)
- Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) – Vulnerable (EPBC Act) Schedule 1 (WC Act)
- Carpet Python (*Morelia spilota imbricata*) – Schedule 4 (WC Act)
- Rainbow Bee Eater (*Merops ornatus*) – Marine/Migratory (EPBC Act), Schedule 3 (WC Act)
- Western Brush Wallaby (*Macropus irma*) – Priority 4
- Quenda/Southern Brown Bandicoot (*Isodon obesulus fusciventer*) – Priority 5

Black Cockatoos

A key aspect to this project is the presence of Black Cockatoos in the Project Area; GHD assessments (GHD 2013a and GHD 2013e) recorded three threatened species of Black Cockatoo (Carnaby's Black Cockatoo, Baudin's Black Cockatoo and Forest Red-tailed Black Cockatoo) in the Project Area as well as foraging habitat, roosting habitat and potential breeding habitat. The Project was referred to the DotE under the EPBC Act because it exceeded the threshold of impacts that are considered to be at risk of causing a significant impact (DSEWPac 2012).

The Project Area is:

- Within the known breeding range for the Carnaby's Black Cockatoo
- Within the area where the Red-tailed Black Cockatoo is known to occur and there is potential breeding habitat for the species
- Not within the recognised range for the Baudin's Black Cockatoo, however:
 - The species was recorded in the Project Area
 - The species is known to be utilising resources and areas outside those currently recognised (DSEWPac 2012)

3.6.3 Impacts to fauna habitat

The impacts to fauna as a result of the Project are associated with the impacts to flora and vegetation, though there are several additional impacts that are applicable to fauna including:

- Loss of fauna habitat including habitat for conservation significant fauna species
- Fragmentation of remnant vegetation patches and habitat
- Disruptions to breeding cycles and movement of Fauna
- Direct mortality to fauna from construction activities (vehicle strike)

3.6.4 Reserves and conservation areas

The following two DPaW managed reserves occur within the boundaries of the Project Area (Government of Western Australia 2012):

- Neerabup National Park (937 ha)
- Neerabup Nature Reserve (east of Wanneroo Rd) (132 ha)

The Project Area is surrounded by the following four other DPaW managed reserves (Government of Western Australia 2012):

- Lake Joondalup Nature Reserve (south of the Project Area).
- Gnangara–Moore River State Forest (east of the Project Area).
- Marmion Marine Park (west of the Project Area).
- Neerabup Lake and adjacent bushland (north-east of the Project Area)

Impacts to reserves and conservation areas

Stage 1 of the Project will involve the total clearing of:

- 1.52 ha (less than 0.2 %) of Neerabup National Park

4. Design and planning phase

This section describes the objectives, management strategies, key performance indicators (KPI), monitoring and reporting requirements in the design phase for each of the key flora and fauna issues identified in the Ministerial statement 629.

Where the primary management strategies for each key issue are implemented in the CEMP this FFMP document provides a brief summary only of the strategies; in these instances the CEMP should be referred to for more detail.

The development of management plans for each specific aspect and the implementation of strategies and actions will be the responsibility of the project's construction contractors.

4.1 Loss of native vegetation, conservation significant flora species and ecological communities

Stage 1 of the Project will result in the clearing of approximately 151.0 ha of which 86.6 ha is remnant native vegetation. The remnant vegetation contains habitat for flora and ecological communities that are of conservation significance as summarised in Sections 3.2 and 3.3 and detailed in the project flora and fauna report (GHD 2013a).

The design phase has refined the proposed Project Area with regard to limiting the total extent of clearing required as much as practical. The key management measures proposed to ensure the extent of clearing does not exceed the proposed 151.0 ha of clearing in Stage 1 will be implemented in the construction phase. As such, the objectives, management strategies, KPIs, monitoring and reporting requirements are presented in the CEMP.

4.2 Restrictions to fauna movement

4.2.1 Introduction

One of the key outcomes from the project is the creation of a new road that runs east-west between the eastern end of Neerabup Drive and Wanneroo Road. The new road will transect a section of native vegetation that is currently continuous between Burns Beach Road (to the south), Wanneroo Road (to the east), the Clarkson rail line (to the west) and Hester Avenue (to the north). The remnant native vegetation consists of the Neerabup national park, Neerabup nature reserve and regional open space (as detailed in section 3.6.4). The area is a mosaic of vegetation types broadly dominated by *Eucalyptus* woodland and *Banksia* woodland. The area is largely in good to excellent condition. The GHD flora and fauna report (GHD 2013a) details the characteristics of the vegetation within the Project Area that will be lost during Stage 1 of the project.

In addition to the loss of 86.6 ha of habitat that will be cleared for the project (which is addressed in section 4.1), the construction of the road will potentially impact the fauna that currently persists in the area in several other ways including:

- The road will fragment the habitat
- The road will present a barrier to movement through the area
- The road will increase the risk of vehicle strike (direct mortality) to fauna

The significance of these potential impacts cannot be quantified precisely for the project, however, the impacts of roads on habitat fragmentation, barrier effects and vehicle strike has been the subject of previous studies which have been reviewed to develop this FFMP.

Furthermore, GHD has conducted an investigation into the movement of fauna in the Stage 1 Project Area (specifically in the proposed Neerabup Road area).

The key outcomes from the Fauna movement study (GHD 2013d) are:

- 1059 fauna prints from at least 18 fauna species were observed during the movement study
- Large terrestrial fauna species (Emus and Western Grey Kangaroos) were recorded within the Neerabup Road Extension alignment area. These large species may venture onto the road resulting in an increased frequency of road strikes. These strikes could be serious, causing accidents and/or vehicle damage.
- Three areas of high fauna movement were identified during this study

The results of the literature review and movement study have been incorporated into the design of the project with regard to the construction of fauna underpasses, their location and dimensions (Plate 2). These design strategies will be implemented in the construction phase and monitored during the operational phase of the project.

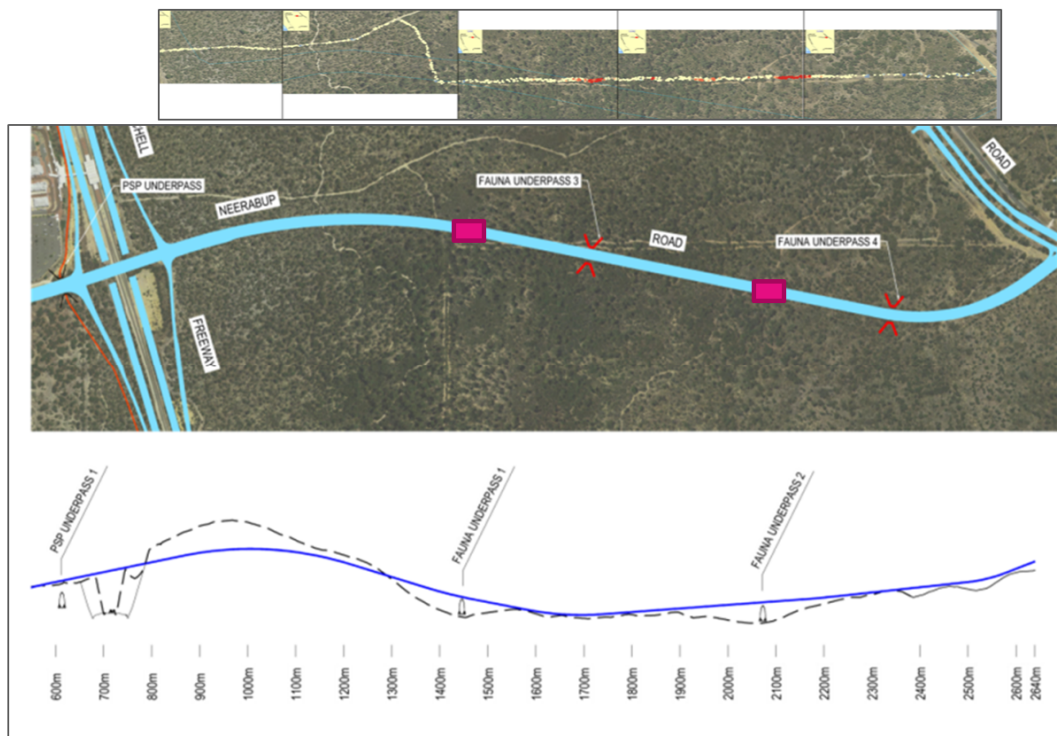


Plate 2 Location of four fauna underpasses (purple rectangles and red crosses) compared with the results of the fauna movement study (GHD 2014d) above (high fauna movement areas shown in red).

Design of underpasses

Fauna underpasses along Neerabup Road will be designed to facilitate fauna movement in all weather conditions. The Yaberoo Budjara Heritage Trail underpass on the western side of Neerabup Road will be a shared pedestrian/fauna underpass, and all other underpasses will be designed to minimise the use of these by pedestrians, motorcycles and horses and other uses incompatible with fauna underpasses. The dimensions of the underpasses will be varying between 3 m high and 9 m wide to 3 m high and 3 m wide, with no greater than 25 m length without a skylight to encourage fauna to use the underpasses. It is anticipated that two underpasses of the larger dimensions (9 m by 3 m) and two of the smaller underpasses will be constructed. The underpasses will be designed to exclude the pooling of water, with drainage

inbuilt. The bottom of the fauna underpasses will contain at least 10 mm of sand as well as fauna habitat such as logs and branches to encourage use by local fauna species. Detailed construction plans for these underpasses have been developed in consultation with Ecologists.

Location of underpasses

The location of the underpasses has been based on the results from the fauna movement study. The larger (9 m by 3 m) underpasses will be constructed as close as practical (given engineering and safety constraints) to the locations identified as high movement areas for fauna. The 3 m x 3 m underpasses will be placed in areas of higher fauna movement where the topography prohibits the placement of larger arch underpasses.

A single large (9 m by 3 m) underpasses will be constructed along Hester Avenue to facilitate fauna movement north south in this area.

Fencing in association with underpasses

Fences will be constructed in association with the underpasses to carrel fauna towards the underpass. Neerabup road will be fenced between the rail corridor and Wanneroo Road, in around the Wanneroo Road and Neerabup Road intersection to further exclude fauna from crossing the new road and being exposed to the risk of vehicle strike. Fences will be constructed in accordance with Main Roads standards and include a skirt installed 200 mm below and 300 mm above the bottom of the fence to prevent fauna from getting under the fence. Mesh needs to be small to keep small lizards and snakes out.

Revegetation

Impacts to habitat connectivity will be minimised in proximity to the new Neerabup Road by revegetating all areas that are not essential to the safe function of the road; that is, any areas that are cleared during the construction phase of the project, that do not need to remain clear of vegetation will be revegetated to provide habitat. The revegetation will provide cover for fauna through the underpasses which is likely to increase use and reduce risk of predation to fauna moving through more open ground. Revegetation will not use known bird feeding species in close proximity to the road verge to minimise bird strike during operation.

Lighting

Lighting will be incorporated into the design of the road. The use of lighting along the roads aims to assist in the reduction of road deaths (from vehicle strike) of terrestrial fauna species that move across the road at night. This lighting aims to reduce road deaths by illuminating the area to increase the rate of avoidance of animals by drivers and the lighting is likely to act as deterrent for fauna in the in immediate area. As artificial light is likely to deter fauna from using the immediate area, these light poles should not be constructed in close proximity to the underpasses. All lighting should be directed toward the road area and not into adjacent bushland to minimise the impacts of light to native nocturnal species that use the area.

Signage

Warning signs will be used to advise motorists when they are approaching sections of road where kangaroos and other large fauna species are likely to be a hazard on the road.

4.2.2 Objectives and Key performance indicators

The objective of the design is to reduce the impacts (from restrictions to movement) to individual animals and fauna populations living in the area. The key strategy is the incorporation of fauna underpasses, lighting, fencing and revegetation into the design of the Neerabup Road

extension. The objective of this infrastructure is to mitigate some of the impacts associated with the construction of Neerabup Road, specifically:

- Reduce the restrictions to fauna movement by providing a passage of movement between the northern and southern sections of habitat
- Provide habitat connectivity to reduce the impacts of habitat fragmentation
- Provide an alternative means of passage for fauna to reduce the frequency of crossing the road and thus reducing the likelihood of vehicle strike

The KPIs for this component of the project will be closely aligned with the management strategies and are listed in Table 4.

Table 4 Objectives and KPIs to mitigate fauna movement impacts

Objective	Target	Key Performance Indicator
Construction of fauna underpasses to facilitate fauna movement for a diverse range of fauna species.	Construction of at least four fauna underpasses (2 large and 2 small) meeting the recommended design characteristics.	Fauna underpasses constructed
Reduce the risk of fauna mortality form vehicle strike.	Install lighting along both sides of the new section of Neerabup Road before the operational phase of the road is commenced.	Lighting is installed prior to operational phase of road.
Provide habitat connectivity to reduce the impacts of habitat fragmentation.	Revegetate all available areas to reduce gaps between habitat and reduce need for fauna to move through open ground	Revegetation of available areas at completion of construction phase
Reduce the risk of vehicle strike to fauna.	Construct fences to corral fauna towards under passes and fence both sides of the new section of Neerabup Road before the operational phase of the road is commenced.	Fencing is complete prior to the operational phase of the road.

4.2.3 Monitoring and reporting

The monitoring and reporting on the management of impacts to fauna movement are discussed further in section 6.1.2 and will include monitoring over various temporal scales as summarised below.

Construction completion

The construction of the fauna underpasses, fencing and revegetation to address impacts to fauna movement will be conducted during the construction phase of the project. The Main Roads project management team in consultation with the Project Construction contractor (and qualified ecologists as required) to achieve full benefit from these strategies.

Ongoing infrastructure monitoring

On-going monitoring of the underpasses, lighting and fencing will occur in the operational phase of the Neerabup Road as per Main Roads standard operating procedures.

Revegetation monitoring

The revegetation will be monitored for the first three years after completion.

Assessment of underpass and fencing function

The monitoring of the underpasses will be conducted in the first 2 years of the operational phase of the road. This monitoring will aim to assess the functionality of the underpasses to allow Main Roads to apply improvements to future projects.

4.3 Environmental aspects dealt with in other project management plans

4.3.1 Dieback

Dieback is a soil-borne pathogen recognised as a major threat to Australian vegetation, and in particular, the vegetation and dependent biota within the south west botanical province.

The key potential impact from the project in relation to Dieback is that the construction phase of the project has the potential to spread the disease into areas that are currently unaffected. This is primarily because uncontrolled movements across the site by construction vehicles, construction personnel or vegetation relocation (such as mulch) may lead to the proliferation and spread of Dieback.

The management of Dieback for the Project is addressed in the CEMP. The key objective of the Dieback management plan is to avoid the spread of Dieback into uninfected areas.

4.3.2 Fire

The impacts from fire on environmental, social and commercial assets can be complex and dynamic. The implementation of fire management strategies will principally be conducted during the construction phase and as such are addressed in the CEMP.

The Project Area will have some fire hazard risks particularly given the proximity of the Project Area to the extensive areas of native bushland; the level of risk is a result of the type of activity being undertaken, weather conditions, and the proximity of the activity to fuel (and characteristics of the fuel). Fire hazard risks will be spatially and temporally dynamic and will require specific management planning in conjunction with DPaW and Department of Fire and Emergency Services (DFES).

4.3.3 Topsoil and Weed management and Revegetation planning

The management of topsoil, weeds and revegetation are interrelated as all three aspects require a coordinated approach. The relevant documents relating to top soil and weed management include:

- Environmental Impact Assessment (GHD 2014b)
- Level 2 Flora and Level 1 Fauna Assessment (GHD 2013a)
- The Project CEMP which should be referred to for detailed management objectives and strategies

Weed seeds can be transported through the uncontrolled spread of topsoil and vegetation. The Project Area is affected by introduced weed species, particularly in areas that are adjacent to existing infrastructure. With the movement of soil through various mechanisms, weed seeds can be spread easily throughout the Project Area, or even introduced from other areas if transported to site. Hence, weed control is necessary to prevent the introduction of new species, and the spread of those existing within the Project Area.

Studies at the site (GHD 2013a) in the Project Area have identified 146 weed species, three of which are declared category P1 plants under the *Biosecurity and Agriculture Management Act*

2007 (BAM Act). These plants have statutory management requirements that will be addressed in the Construction contractor's weed management plan.

Revegetation will be part of the final stages of the construction phase of the Project. Revegetation will take place in any areas that:

- Are not required to remain cleared for safety reasons
- Have been cleared or disturbed during the construction phase
- Have been cleared or disturbed prior to the Project and are immediately adjacent to the Project Area.

The Planning of revegetation will incorporate management of top soil and weeds. The following sections of this FFMP address the key aspects of a revegetation plan that will be developed in the design phase of the project, will be implemented in the final stages of the construction phase and monitored during the operational phase of the Project.

A project specific revegetation plan (PSRP) will be developed by the Project construction contractor in accordance to the Main Roads document for Revegetation Plans (document no. 607/056).

Objectives and KPIs

The implementation of management actions identified in the CEMP to manage top soil and weeds will affect the outcomes of revegetation and aim to:

- Avoid the introduction and spread of weeds
- Use indigenous native vegetation species consistent with adjacent communities in revegetation works
- Reduce the potential for soil erosion in areas of vegetation within the final landscape design

The objectives of the Revegetation plan will include those listed in Table 5. KPIs for the revegetation should be developed in the project specific revegetation plan (PSRP) by the Project construction contractor in consultation with revegetation/restoration practitioners and qualified ecologists. The broad objectives of the revegetation management plan should include:

- Revegetate sidetracks in accordance with Main Roads' *Revegetation Management Plan for Sidetracks*
- Ensure material sources used for the Project Works, including existing material sources, are restored and integrated ecologically and visually with the local landscape surroundings
- Ensure that the Site is restored and integrated ecologically and visually with the local landscape surroundings
- Minimise ongoing roadside management costs and future maintenance needs
- Minimise soil erosion

Table 5 Revegetation objectives and KPIs

Objective	Target	Key Performance Indicator
Revegetate all available areas in final stages of construction with locally native flora species	Revegetate all available areas	Revegetation of available areas at completion of construction phase
Provide habitat connectivity to reduce the impacts of habitat	Revegetate all available areas to	Revegetation of available areas at completion of construction phase

Objective	Target	Key Performance Indicator
fragmentation.	reduce gaps between habitat and reduce need for fauna to move through open ground	
Develop self-sustaining species and a diverse habitat	Select species to ensure species and structural diversity in the revegetated areas.	Initial restoration is completed prior to the operational phase of the road and revegetation is monitored and maintained for three years after construction.
Reduce the risk of weed re-invasion *	No significant invasion of weeds into the revegetated areas	Weed monitoring will take place during the first three years after planting and weed control will take place as guided by the monitoring results.

Management strategies

The Revegetation strategies for the project will be developed in a PSRP by the Project construction contractor in consultation with revegetation/restoration practitioners and qualified ecologist. The PSRP will include an implementation plan detailing the pre-clearance vegetation assessment, site preparation, species selection, vegetation establishment, weed control and dieback management. The PSRP will incorporate the following strategies:

- The revegetation should be designed to create self-sustaining, structurally and species diverse vegetation. These species should be locally occurring native plants with consideration given to seed provenance. The species selected should be consistent with Main Roads' environmental guideline for vegetation within the road reserve (document No. 6707/022).
- The revegetation plan should include the revegetation of areas that connect the existing vegetation to the fauna underpasses as described in 4.2 to facilitate movement of fauna.
- The management of top soil and weeds during the clearing phase of the Project will have implications on the revegetation conducted in the final stages of the construction phase in that:
 - Prior to clearing, a qualified and experienced environmental scientist/landscaper or ecologist will undertake a topsoil and vegetation assessment to determine areas of topsoil and mulch suitable for reuse, focussing on using topsoil and mulch that has minimal weed and more native species.
 - Weedy topsoil and mulch will either be treated prior to reuse, buried at least 1.5 m under fill or disposed of appropriately offsite.
 - The contractor will prepare a Topsoil Management Plan.
- The objective of reducing the risk of weed re-invasion into the revegetation areas will be achieved by:
 - Implementing the weed and topsoil strategies detailed in the CEMP
 - Revegetating degraded areas that were cleared or disturbed prior to the project such as track and cleared sections within the Neerabup national park that are a potential source of weed invasion
 - Ensuring the revegetation is maintained for the first three years which is likely to include active weed control within the revegetated areas and in the areas immediately adjacent to revegetation

The PSRP will include detailed revegetation implementation strategies such as:

- Deep ripping will be undertaken in summer to promote lateral cracking of compacted earth. Where possible, scarification and mulching will be considered to maximise seedling establishment
- Following the replacement of weed and dieback free topsoil direct seeding with native species will be undertaken
- Where possible, tube stock will be used in rehabilitation to increase the likelihood of establishment and retain the genetic integrity of the area
- Seeding will be undertaken in the optimal season, identified by restoration practitioners, specific to the suite of species selected. Rate of seed application will be determined in consultation with revegetation/restoration practitioners and/or qualified ecologist
- Fertiliser, containing nitrogen and phosphorus, will be used to encourage the growth of native seedlings at a rate determined by a revegetation/restoration practitioner
- Use of fertilisers in revegetation will be tested prior to broad-scale application to determine the effect on native and weed species abundance local to the area

Monitoring and reporting requirements

The monitoring of the revegetation should be detailed in the PSRP by the Project construction contractor to be consistent with Main Roads' revegetation monitoring and ideally be conducted for three years prior to the initial revegetation efforts. Monitoring will assess the need for ongoing maintenance activities for the revegetation and include assessment of weeds, plant death (or failure to establish), erosion and fire. The monitoring program is discussed in more detail in section 6.1.3 of this FFMP.

5. Construction phase

5.1 Overview

Many of the environmental management strategies identified in the design phase of the project will be implemented (or built) during the construction phase of the project. A CEMP has been developed for the project and was prepared to:

- Summarise the current status of the project site
- Summarise the potential environmental impacts of construction activities
- Define environmental management objectives
- Detail management actions or measures to achieve the environmental objectives
- Detail monitoring and reporting requirements
- Define environmental management responsibilities

The CEMP has been developed in the design phase to be implemented during the construction phase of the project. The CEMP was identified during the design phase as a key tool to manage impacts to the environment. Ongoing monitoring and reporting is a requirement in the CEMP and this will ensure effective implementation. The CEMP addresses a series of environmental issues and their management in the Construction phase of the project including:

- Vegetation, flora and fauna
- Topsoil and weed management
- Dieback
- Fire management
- Surface water and groundwater management
- Acid Sulfate Soils management
- Contaminated sites management
- Construction noise, dust and vibration management
- Construction waste management
- Aboriginal Heritage management
- European Heritage management

This document is designed to assist all parties involved in the Mitchell Freeway Extension Project to manage the identified potential environmental impacts that may result from construction activities. It will be used as a benchmark for contractors, who will be expected to prepare and submit their own CEMP consistent with the document.

The CEMP:

- Identifies key construction environmental issues that require management in order to achieve the construction outcomes at the site
- Provides environmental management actions set in accordance with the EPA's Ministerial Statement Number 629 requirements (and the Ministerial Conditions detailed in Section 2.1.)
- Allocates responsibility for management actions to appropriate personnel

- Identifies the potential for monitoring, maintenance or auditing programmes to assess management measures
- Complies with all relevant Local and State government legislation

The CEMP has been informed by the same relevant documents, legislation, ministerial conditions and operating standards as this FFMP and the documents are closely related.

6. Operational phase

This section describes the flora and fauna management actions that will be implemented in the operational phase of the Project. The majority of management actions will have been developed in the design phase of the Project and implemented in the construction phase, and as such this section generally describes monitoring regimes to ensure the objectives of the project specific management plans (as detailed in this FFMP and the CEMP) are achieved.

6.1 Monitoring and maintenance

6.1.1 Project specific management plans

The CEMP for the project details the need for monitoring programs to be established in each of the project specific management plans (listed in section 6.2). The monitoring required for these plans is primarily conducted during the construction phase of the project. As such this FFMP will not discuss the monitoring regimes in detail. However, the project specific management plans should be consulted in the operational phase of the project to inform the completion criteria that is discussed in Section 6.2.

6.1.2 Fauna movement

The monitoring and reporting on the management of impacts to fauna movement will include monitoring over various temporal scales as described below.

Construction completion

The construction of the fauna underpasses, fencing and revegetation to address impacts to fauna movement will be conducted during the construction phase of the project. The progress will be monitored by the Main Roads project management team. The Project Construction contractor and Main Roads will liaise regularly during the construction phase of the project to ensure that the objectives are being achieved. There is also likely to be a requirement for ecological advice and guidance during the final design and construction of the underpasses and fences and revegetation efforts to achieve full benefit from these strategies. Main Roads will monitor the need for ecological input.

Ongoing infrastructure monitoring

On-going monitoring and checks of the underpasses and fences will occur in the operational phase of the Neerabup road as per Main Roads standard operating procedures. The monitoring will assess the assets for structural integrity, vandalism and the need for maintenance. The results from this monitoring will be incorporated into the assessment of the functionality of the underpasses.

Assessment of underpass function

Monitoring of the underpasses will be conducted in the first two years of the operational phase of the road. This monitoring will aim to assess the functionality of the underpasses to allow Main Roads to apply improvements to future projects. The methodology of the monitoring program will be developed by ecologists with experience in linear infrastructure projects and fauna underpasses. The monitoring program will incorporate the use of motion sensor cameras set on the fauna underpasses to record the frequency and species that use the underpasses.

6.1.3 Revegetation

The revegetation will be monitored for the first three years after completion to ensure that the KPIs and objectives of the revegetation plan are achieved. This monitoring will aim to assess the function of the revegetation techniques employed and will be reported to Main Roads to ensure the revegetation establishes and becomes self-sustaining. The monitoring will include assessment of the revegetation associated with the underpasses.

The monitoring methods will be developed by the contractor and approved by Main Roads. The methods statement will include specific monitoring methods such as:

- Permanently marked monitoring plots, each 10 m wide by 10 m long where practical (or equal to 100 m² in narrower locations). The location of these plots will be agreed with the Main Roads Environmental Representative and be established immediately after practical completion of the revegetation works. Plots must be distributed to include as many site variables as possible
- Visual inspection of the entire revegetation area to identify areas where additional weed control, infill planting or other maintenance is required
- Establish at least 5 permanent photographic monitoring points at locations with permanently marked monitoring plots. The photographs for each photographic monitoring point must show the same site as it develops over time

6.2 Completion criteria

A review of the management actions identified in the design phase and implemented in the construction phase of the project will be conducted by Main Roads to ensure that commitments to reduce impacts to flora and fauna have been addressed. The completion criteria should also include the auditing and compilation of all reports of breaches to the KPIs identified in the project specific management plans.

Completion criteria for the Project will include auditing and checks on all project specific management plan KPIs and objectives including the:

- Vegetation, flora and fauna management plan
- Dieback management plan
- Fire management plan
- Topsoil and weed management plan
- Surface and ground water management plan
- Acid Sulphate Soils management plan
- Contaminated sites management plan
- Construction waste management plan
- Aboriginal Heritage management plan
- European Heritage management plan

7. References

- Beard, JS 1979, *Vegetation Survey of Western Australia: Perth Map and Explanatory Memoir 1:250,000 series*, Perth, Vegmap Publications.
- GHD 2013a, *Mitchell Freeway Extension Flora and Fauna Assessment Report*. Unpublished report completed for Main Roads Western Australia
- GHD 2013b, *Mitchell Freeway Extension Black Cockatoo Assessment*. Unpublished report completed for Main Roads Western Australia
- GHD 2013c, *Neerabup Road Extension Level 2 Fauna Survey*. Unpublished report completed for Main Roads Western Australia
- GHD 2013d, *Neerabup Road Extension Fauna Movement Survey*. Unpublished report completed for Main Roads Western Australia
- GHD 2013e, *Mitchell Freeway Extension Preliminary Site Investigation*. Unpublished report completed for Main Roads Western Australia
- GHD 2014a, *Mitchell Freeway Extension Construction Environment Management Plan*, Unpublished report completed for Main Roads Western Australia
- GHD 2014b, *Mitchell Freeway Extension Environmental Impact Assessment*, Unpublished report completed for Main Roads Western Australia
- Glevan Consulting 2013, *Mitchell Freeway Extension Phytophthora Dieback Occurrence Assessment and Management Plan*. Unpublished report completed for GHD.
- Government of Western Australia 2012, *Natural Resource Management Shared Land Information Platform*, retrieved May 15, 2013, from <http://spatial.agric.wa.gov.au/slip/>.
- Hedde, EM, Loneragan, OW & Havel, JJ 1980, 'Vegetation Complexes of the Darling System, Western Australia', In Atlas of Natural Resources, Darling System, Western Australia, Perth, Department of Conservation and Environment.
- Mitchell, D, Williams, K, & Desmond, A 2002, 'Swan Coastal Plain 2 (SWA2 — Swan Coastal Plain subregion)', In A Biodiversity Audit of Western Australia's 53 Biogeographical Subregions in 2002, Perth, Department of Conservation and Land Management.
- Nayton, G, 2013a, Desktop assessment of non-indigenous heritage places within study area associated with the Mitchell Freeway extension between Burns Beach Road and Romeo Road.
- Nayton, G, 2013b, Archaeological survey of non-Indigenous heritage places within Stage 1 construction area associated with the Mitchell Freeway extension from Burns Beach Road to Hester Avenue.
- O'Connor R, and O'Connor E, 2013 Aboriginal heritage desktop assessment Mitchell Freeway Extension from Burns Beach Road to Romeo Road and Associated Projects, Prepared by R & E O'Connor Pty Ltd.

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: permal@ghd.com.au

© GHD 2014

This document is and shall remain the property of GHD. The document may only be used for the purpose for which it was commissioned and in accordance with the Terms of Engagement for the commission. Unauthorised use of this document in any form whatsoever is prohibited.

G:\61\29435\WP\139718.docx

Document Status

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
A	J Kuiper	T Moulds		D Farrar		21/03/2014
B	J Kuiper	T Moulds		D Farrar		21/03/2014
0	T Moulds	D Farrar		D Farrar		13/05/2014
1	L Zimmermann	D Farrar		D Farrar		29/05/2014

www.ghd.com

