Main Roads Western Australia

Ravensthorpe Bypass

Environmental Impact Assessment

February 2014

Executive summary

Main Roads Western Australia (Main Roads) is proposing to construct a heavy haulage route which will bypass the township of Ravensthorpe to the north. The proposed heavy haulage route will provide an alternative heavy vehicle route around Ravensthorpe which eliminates the "stall" risk for heavy vehicles and addresses the safety issues arising from trucks losing traction on the steep hill through Ravensthorpe town site. This Project includes the realignment of the Hopetoun Road intersection with the South Coast Highway (SCH). The opportunity to realign the Hopetoun Road intersection with the SCH is being undertaken to improve safety and the level of service of this intersection.

The proposed works will include the construction of approximately 4.4 kilometres (km) of new road that will bypass the Ravensthorpe town site and 1.9 km of road re-construction of the SCH. The Project Area for the Project is 32.8 hectares (ha) in total and comprises three (3) sections. The majority of the Project is located in land zoned rural, with two parcels of land zoned recreational.

Main Roads commissioned an alignment selection study for the Ravensthorpe Heavy Haulage Route (RHHR) (Main Roads 2012). The key environmental, social, economic and engineering constraints within the study area were identified and mapped. This review guided the development of the route options north and south of Ravensthorpe. Following a series of information sessions and public meetings, the Ravensthorpe Shire Council endorsed Option 2 of the Ravensthorpe Heavy Haulage Route Planning Study . Since the endorsement of this option, Main Roads in consultation with the council and local community have further refined the alignment (here in referred to as the Project Area), which is the subject of this EIA.

Main Roads commissioned GHD Pty Ltd (GHD) to prepare an Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) for the Project. This Report presents the EIA and EMP for this Project. The EIA and EMP will be used to identify, assess and manage the anticipated environmental impacts associated with the Project.

The following studies and desktop assessments were used to identify and describe the key aspects of the existing environment of the Project Area and surrounds and to assist in identifying the potential impacts associated with Project development:

- Ravensthorpe Heavy Haulage Route Fauna assessment and targeted fauna surveys (GHD 2014a);
- Ravensthorpe Heavy Haulage Route Noise Assessment (GHD 2013b);
- Ravensthorpe Heavy Haulage Route Air Assessment (GHD 2013c);
- Ravensthorpe Heavy Haulage Preliminary Site Contamination Investigation (GHD 2013d);
- Report of an Aboriginal Heritage Survey for the Proposed Ravensthorpe Heavy Haulage Route in Ravensthorpe, Western Australia (Brad Goode and Associated 2013);
- Addendum Report of an Archaeological Survey for the amemded sections of the proposed Ravensthorpe Heavy Haulage Route in Ravensthorpe, Western Australia (Brad Goode and Associated 2014);
- Ravensthorpe Heavy Haulage Route Botanical Survey (Great Southern Biologic 2013a);
- Ravensthorpe Heavy Haulage Route Targeted Spring Flora Survey (Great Southern Biologic 2013b);

- Phytophthora Dieback Assessment and Associated Management Plan for the Proposed Ravensthorpe Bypass Heavy Haulage Route, Ravensthorpe (Great Southern Biologic 2013c);
- Survey of Ravensthorpe Heavy Haulage Route as re-aligned (Great Southern Biologic 2014); and
- Ravensthorpe Heavy Haulage Route Short Range Endemic survey (SRE) (GHD 2014b).

Key environmental aspects and impacts

Contaminated sites

A Physical Site Investigation (PSI) identified a property adjacent to the western extent of Section 3 (i.e. along the SCH) and classified as “Contaminated - remediation required” due to the presence of hydrocarbons (dissolved and free phase) within soil and groundwater from petrol and diesel sources. The land has been used as a service station and summary records for the property indicate that impacted groundwater extends from the property in a south-easterly direction. A site walkover also identified a number of items of interest including an industrial property, a rural property, rubbish items, stockpiles of dumped rock and sand materials, Asbestos Contaminated Materials (ACM) fragments, a former mine, a caravan dump point, a water treatment plant, a water storage dam and a chemical storage yard.

Based on the site characterisation, history and site walkover, a Conceptual Site Model (CSM) was developed and a qualitative assessment of risks undertaken with respect to credible receptors of contamination. The majority of identified features present a Very Low or Low risk of impact to identified receptors. Three features however have Risk Ratings of Moderate (Fenced Chemical Storage and Dumped Rubbish including ACM in Bushland) to High (Service Station) and as such require management in accordance with relevant guidelines and regulations. This is particularly pertinent with respect to the ACM identified on the site. Should the development of the RHHR not require excavations in the vicinity of the Service Station, the Risk Rating for this item may be reduced.

Based on the outcomes of the PSI it is recommended that prior to commencement of intrusive works, the ACM fragments identified at two locations within Section 2 should be appropriately removed from the site and disposed at a licenced facility. Should further ACM be identified during the works, this should also be appropriately removed. In addition a Site Management Plan (SMP) is prepared to outline the actions to be taken should contamination be identified from any of the identified sources.

Terrestrial vegetation and flora

A total of 24.07 ha of vegetation will be cleared for the Project. The vegetation ranges in condition from *Excellent* to *Completely Degraded*. There is approximately 97,900 ha of native vegetation remaining within 20 km of the Project Area (a total area of 125,600 ha) (GoWA 2012). The remnant vegetation within the Project Area represents 0.024 % of the vegetation remaining within 20 km of the Project Area. Potential impacts on vegetation are not only restricted to loss of native vegetation within the Project Area, but also to impacts on the vegetation adjacent to the disturbance. The clearing of vegetation will result in a range of potential direct impacts to vegetation associations, including:

- Reduction in the extent of vegetation associations locally and regionally; and
- Reduction in the viability of vegetation associations resulting from the loss or disruption of ecological functions.

Conservation significant flora

Two flora species of conservation significance, *Grevillea sulcata* (Priority 1 - 1 plant recorded adjacent the Project Area) and *Acacia bifaria* (Priority 3 – 713 individuals recorded within Project Area) were found during the GSB surveys. Eight *Austrostipa* species were recorded as a result of targeted surveys conducted during September 2013 but these did not include the conservation species known from the Ravensthorpe region: *Austrostipa* sp. Carlingup Road (S. Kern & R. Jasper LCH 18459) (Priority 1) or *Austrostipa* sp. Ravensthorpe Range (A. Markey & J. Allen 6261) (Priority 1).

An assessment of the known populations of *Acacia bifaria* and *Grevillea sulcata* was undertaken to determine the significance of the populations within the Project Area and local area. The assessment indicates that the potential impact on *Grevillea sulcata* is Nil and on *Acacia bifaria* is considered to be Moderate.

Management measures to reduce the impact on the two species of conservation significance and vegetation adjacent to the Project Area have been recommended and should be included in the Project EMP.

Fauna and fauna habitats

Construction of the Project will require clearing of 19.5 ha of vegetation and loss of the associated fauna habitat. The remaining 13.5 ha of the Project Area is already highly modified (primarily paddocks and roads). The potential to impact on the regional connectivity and habitat linkages from the Project is generally restricted to Section 2 of the Project Area, as Sections 1 and 3 are located in fragmented areas.

No terrestrial vertebrate fauna species of conservation significance were recorded within the Project Area during the fauna field surveys.

Fauna species of conservation significance

Carnabys Black Cockatoo was assessed as likely to occur within the Project Area. The key potential issue to Carnaby's Black Cockatoo species within the Project Area is the loss of habitat including the:

- Loss of up to 19.5 ha of foraging habitat in the Project Area;
- Loss of suitable diurnal (loafing) and potential night roosting habitat within Sections 2 and 3 of the Project Area; and
- Loss of potentially suitable breeding habitat in the form of 150 large trees, some with large hollows located in close proximity to water within Sections 2 and 3 of the Project Area.

Given the Project is likely to have impacts on conservation significant fauna and their habitats (e.g. Carnaby's Black Cockatoo), the Project would require referral to the Depatment of the Environment (DotE).

GHD recommends that immediately prior to the clearing of vegetation that a pre-clearance fauna survey be conducted to remove any fauna that may be displaced in the clearing process. This recommendation should be included in the EMP.

Short Range Endemic (SRE) species

The impacts to SRE species is currently unknown due to the lack of species identifications currently available. Until the specimens have been identified no specific conclusions can be reached. The habitats examined within Sections 2 and 3 of the RHHR appear to be continuous within the local area and are therefore unlikely to form habitats that would encourage the existence of SRE species within the area, however, this conclusion will be informed by the species recorded when information becomes available.

Indigenous Heritage

Brad Goode and Associates completed an Aboriginal Heritage survey of the Project Area. The survey identified two “registered aboriginal sites” and eight “other Heritage places” within 5 km of the Project Area. Two sites were recorded with close proximity to the Project Area - Mt Cattlin 2 artefact scatter (registered Site ID 26270) and the Ravensthorpe Ceremonial Area (other heritage Place ID 26267). Stakeholder consultation with the Aboriginal working group confirmed there are no new Sites impacted by this Project.

It is recommended that Main Roads be allowed to proceed with their proposal to construct a heavy haulage route at Ravensthorpe within the Project Area on the condition that they avoid any impact upon or disturbance to the registered Mt Cattlin 2 artefact scatter (Site ID 26270) and the Ravensthorpe Ceremonial Area (Place ID 26267) other heritage place.

The Project Area will not impact the scientific values of these sites, however re-assessment of the Site boundaries prior to construction is recommended to confirm that this. Indigenous Heritage measures will be included in the Project EMP, and actioned accordingly if Heritage sites are found during Project works.

Dieback

All vegetation within the Project Area has been classified as uninterpretable due to the insufficient density of susceptible species. However, several susceptible species and potentially susceptible species were identified in low densities across the Project Area. Accordingly, six samples were collected from indicator species deaths and all samples returned negative results for Phytophthora. While this suggests that the area is likely to be free of the pathogen it is not possible to categorically determine the absence of the disease due to the low density of susceptible species.

Several unmappable areas were also identified and not surveyed as no disease distribution information can be gained from areas where native vegetation has been removed or degraded.

Despite the area being classified as uninterpretable, possible introduction of the disease would have a detrimental influence to the health of vegetation in neighbouring areas. General operational best practice hygiene is recommended and should be incorporated into the Project EMP.

Environmental approvals

Commonwealth approvals

The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) provides legislative protection for Matters of National Environmental Significance (MNES) including all nationally threatened fauna and flora species and ecological communities. An assessment of the Significant Impact Criteria was undertaken according to the DotE Significant Impact Policy Statement 1.1 (DotE 2013b) to determine the significance of the removal of up to 19.5 ha of habitat including 150 significant trees to the Carnaby’s Black Cockatoo within the Project Area. It was determined that the proposed Project is unlikely to have a significant impact on Carnaby’s Black Cockatoo.

It was determined after reviewing the DotE Significant Impact Policy Statement 1.1 (DotE 2013b) that the clearing of up to 19.5 ha of fauna habitat for the Project is unlikely to have a significant impact on any EPBC listed flora or fauna species or ecological community discussed in this document within the Project Area. .

State approvals

Referral to the Environmental Protection Authority (EPA)

Significant proposals (e.g. subdivision and development applications) must be referred to the EPA under Section 38 of the *Environmental Protection Act 1986* (EP Act). Based on this assessment it does not appear that the Project will have a significant environmental impact, assuming appropriate Project design and implementation of environmental management measures. However, for regulatory certainty and public assurance Main Roads has chosen to refer the Project.

Department of Environment Regulation

Main Roads has been issued with a Statewide Purpose Clearing Permit (CPS 818/9) which allows for road works clearing and prescribes specific management and offset requirements. This Project would be assessed under the CPS 818/9.

Environmental Management Plan

The EMP is a document to guide the development of each section of the Project prior to, during and post construction in order to comply with environmental licences, approvals and reflect the environmental commitments made by Main Roads. The EMP specifically addresses the following potential impacts:

- Disturbance and loss of native vegetation, flora and fauna habitats;
- Disruption to native fauna;
- Introduction and/or spread of weeds;
- Spread of dieback;
- Changes to visual amenity; and
- Contaminated sites.

Acronyms

ACMC	Aboriginal Cultural Materials Committee
AH Act	*Aboriginal Heritage Act 1972*
ARRP	*Act Agriculture and Related Resources Protection Act 1976* (WA)
ASS	Acid Sulphate Soils
BAP	Benzo(a)pyrene
BOM	Bureau of Meteorology
CAWS Act	*Country Areas Water Supply Act 1947*
CCW	Conservation Category Wetland
CEMP	Construction Environmental Management Plan
DAFWA	Department of Agriculture and Food Western Australia
DAA	Department of Aboriginal Affairs
DBH	Diameter at Breast Height
DEC	Department of Environment and Conservation (now the Department of Environmental Regulation or the Department of Parks and Wildlife)
DER	Department of Environment Regulation
DotE	Department of the Environment
DPaW	Department of Parks and Wildlife
DSEWPC	Department of Sustainability, Environment, Water, Population and Communities (now the Department of the Environment)
DIA	Department of Indigenous Affairs
DoW	Department of Water
EIA	Environmental Impact Assessment
EP Act	*Environmental Protection Act 1986*
EPA	Environmental Protection Authority
EPBC Act	*Environment Protection and Biodiversity Conservation 1999*
EPP	Environmental Protection Policy
ESA	Environmentally Sensitive Area
FMP	Flora / Fauna Management Plan
IBRA	Interim Biogeographic Regionalisation of Australia
LRP	Landscape Remediation Plan
IUCN	International Union for Conservation of Nature MRWA
MNES	Matters of National Environmental Significance
MRWA	Main Roads Western Australia
MUW	Multiple Use Wetland
MWSSD Act	*Metropolitan Water Supply, Sewerage, and Drainage Act 1909*

NEPM	National Environmental Protection Measure
NNTT	National Native Title Tribunal
NRM	Natural Resource Management
PATN	A software package designed to display patters in complex data
PDWSA	Public Drinking Water Source Area
PEC	Priority Ecological Community
PF	Priority Flora
RIWI Act	*Rights in Water and Irrigation Act 1914*
SLIP	Shared Land Information Platform
SWMP	Surface Water Management Plan
TDS	Total Dissolved Solids
TEC	Threatened Ecological Community
TFD	Threatened Flora Database
TMP	Traffic Management Plan
WAHERB	Herbarium of Western Australia
WAPC	Western Australian Planning Commission
WC	*Wildlife Conservation Act 1950*

Table of contents

Table index

Figure index

Appendices

1. Environmental Impact Assessment

1.1 Project background

The South Coast Highway (SCH) is the main inter-regional route between the Goldfields-Esperance and Great Southern Regions, and links the towns of Albany, Ravensthorpe and Esperance. The SCH also provides a link between the Wheatbelt and Esperance via the Brookton Highway.

The SCH, which has operated as a significant freight route for many years, climbs steeply through Ravensthorpe. Most heavy vehicles climb the Ravensthorpe Hill without incident. However, a small minority fail to negotiate the steep grade and stall on the hill. The hill is approximately 150 m long. Most of the incline has a grade of 9% however, the grade increases dramatically to 11% near the apex (Plate 1). Anecdotally there are reports of between 20 and 50 heavy vehicles per year being stranded (either stall or lose traction) while attempting the incline and require assistance (a tow) to remove the vehicle from the road.

Trucks losing traction also pose a risk to businesses located either side of the highway, pedestrians and the primary school located at the bottom of the hill. There are considerable risks in recovering stranded heavy vehicles from the steep hill.

The local community and stakeholders have become increasingly concerned with the regularity of these incidents and the risks associated with the recovery of these vehicles.

Livestock vehicles also spill effluent on the road as they climb the hill, making the road slippery and reducing town site amenity. Traffic on the road network in the Ravensthorpe area is also increasing due to growth in the local mining and agriculture sectors. A significant number of these vehicles are double road trains, carting grain and other agricultural products such as fertiliser and livestock to and from the Esperance port.

Main Roads Western Australia (Main Roads) is proposing to construct a heavy haulage route which will bypass the township of Ravensthorpe to the north. The proposed heavy haulage route will provide an alternative heavy vehicle route around Ravensthorpe which eliminates the "stall" risk for heavy vehicles and addresses the safety issues arising from trucks losing traction on the steep hill through Ravensthorpe town site.

This Project includes the realignment of the Hopetoun Road intersection with the SCH. The Hopetoun Road currently intersects with the SCH in a 'Y' Junction configuration opposite the Ravensthorpe School (Plate 2). These intersection types are a poor design and have low safety standards. The opportunity to realign the Hopetoun Road intersection with the SCH is being undertaken to improve safety and the level of service of this intersection. The new intersection will be at right angles to the SCH and form part of a roundabout with the SCH / heavy haulage route intersection. Additionally, the intersection and Hopetoun Road will be relocated away from the Ravensthorpe School.

A number of public meetings and consultation with key stakeholders have been undertaken by Main Roads to determine the preferred option for the heavy haulage route. Several route options were considered (Main Roads 2012) however, the general consensus among stakeholders is to construct a dedicated heavy haulage route to the north of the Ravensthorpe town site, herein referred to as the Ravensthorpe Heavy Haulage Route (RHHR).

Funding for the Project has been provided in the 2012/13, 2013/14 and 2014/15 financial years. The Project must be completed by 30 June 2015 with pre-construction scheduled to commence in February 2014 and finish in April 2015.

Plate 1 Steep incline on main street of Ravensthorpe near school

Plate 2 'Y' Junction configuration on Hopetoun Road intersection

1.2 Purpose of this document

This Report presents the Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) for this Project.

This EIA and EMP will be used to identify, assess and manage the anticipated environmental impacts associated with the Project. Main Roads intends to refer this Project under s38 of the *Environmental Protection Act 1986* and the EIA will be included in the Referral documentation.

1.3 Scope of works

Main Roads commissioned GHD Pty Ltd (GHD) to prepare an Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) for the Project. GHD's scope of works included:

Environmental Impact Assessment

The EIA of the Project will include the following items:

- Determine the key environmental aspects to be considered, potential environmental and whether referral to either the Environmental Protection Authority (EPA) or Department of Aboriginal Affairs (DAA) is required;
- A description of the existing environment, including physical, biological, social, aesthetic, heritage, noise, and site contamination;
- Field investigations as a minimum undertaken for the following environmental aspects:
    - Flora
    - Dieback
    - Fauna
    - Aboriginal heritage
    - Noise
    - Wetlands
    - Contaminated sites
    - Air quality
    - Acid Sulfate Soils.
- Consultation with regulatory stakeholders to determine requirements;
- Impact assessment that describes the proposed works and the potential impacts on the key aspects of the existing environment, with reference to all features of the Project including road, material pits, access tracks and spoil sites;
- Provision of all necessary information to obtain and assist the Project Manager in applying for clearances required under legislative provisions, including (but not limited to) those required under the following Acts and regulations:
    - *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*
    - *Rights in Water and Irrigation Act 1914*
    - *Conservation and Land Management Act 1984*
    - *Wildlife Conservation Act 1950*
    - *Heritage of Western Australia Act 1990.*
- Provision of environmental management actions suitable for inclusion in the tender documentation for Project implementation;
- Provision of sufficient information to prepare the EMP for construction;
- Identification of key environmental aspects for further environmental investigation; and
- Identification and recommendation of potential regulatory approvals required including an assessment of whether the Project is likely to have a significant environmental impact which may trigger referral to either the EPA or DotE.

During the preliminary desktop investigations it was determined that field surveys for a wetland assessment were not required for this Project.

Main Roads is completing the geotechnical investigation and assessment of Acid Sulfate Soils. This information was not available at the time of compiling this report.

Clearing of Native Vegetation

With regard to clearing of native vegetation the following is required:

- Confirmation of whether the clearing of native vegetation will occur;
- Confirmation of whether the Project occurs within an Environmentally Sensitive Area (ESA) that contains remnant vegetation;
- Assessing the Project within the CPS 818/9 framework*;*
- Reporting on the outcome of the above assessment; and
- Propose actions consistent with the Main Roads offset principles.

Environmental Management Plan

The EMP will be prepared for the identified impacts, including the following items:

- Environmental management actions in accordance with results of the EIA report;
- Planning that minimises the environmental impacts of the works and identifies those responsible for implementation
- A monitoring and maintenance program that assesses the implementation; and
- A list of commitments identifying management requirements.

1.4 Project Area

The proposed works will include the construction of approximately 4.4 km of new road that will bypass the Ravensthorpe Road and 1.9 km of road re-construction of the SCH. The Project Area is located in the Shire of Ravensthorpe, to the north of the Ravensthorpe township (Figure 1). The proposed works include the construction of the RHHR that will bypass Ravensthorpe town to the north.

Project area description

The Project Area is 32.8 hectares (ha) in total, comprising three (3) sections displayed in Figures 2- 4. The Project Area is the extent of the proposed disturbance area, including activities associated with the construction of the proposed RHHR, with the exception of site offices and material pit areas. Main Roads has committed to placing these items in already disturbed areas (e.g. in cleared agricultural land, adjacent Section 1).

Section 1 SCH

Includes a 1.5 km stretch of the SCH which is 20-40 m wide (6.2 ha) and is located on the SCH/RHHR intersection at the western end of the Project Area (Figure 2). This is scheduled for construction from October 2014 to April 2015.

Section 2 RHHR

This section is 5.3 km long, 40-70 m wide (12.27 ha) and is located in the central part of the Project Area to the north of Ravensthorpe (Figure 3). This section is predominately the RHHR and side road connections and is scheduled for construction starting October 2014 to April 2015. Timing of this section will be governed by the approvals processes, including that of Native Title (usually 12 months). This Section includes 250 m of re-alignment of Floater Rd.

Section 3 SCH and Hopetoun Road Realignment

A 14.4 ha section that includes 0.8 km along SCH, 700 m of the Hopetoun road realignment and the SCH/RHHR/Hopetoun Road intersection (Figure 4). Construction is scheduled to begin between October 2014 and April 2015.

Project Area for supporting technical studies

Main Roads commissioned GHD to undertake various supporting technical studies during 2013 (see Section 2.2). These supporting studies considered a Project Area approximately 51 ha. During the design process Main Roads provided a revised Project Area, (as described above). The footprint for the revised Project Area is a reduced area, compared to the initial Project Area (32.8 ha compared to an area greater than 51 ha), however it does include three small additions to the original footprint area:

- Floater road extension (0.72 ha)
- Within Section two near Cattlin Creek Road (0.02 ha)
- Within Section two just north of South Coast Highway (0.57 ha).

The three additional areas are incorporated into the Project Area description (see Section 1.4.1) These additions have been reviewed and additional site investigations were undertaken in December 2013 for flora and fauna, and in January 2014 for aboriginal heritage. The findings of the surveys are provided as appendices in this report.

1.5 Relevant Legislative Requirements

Key Commonwealth and Western Australian environmental legislation that may be relevant to the Project is outlined in Table 1. This EIA identifies (but does not apply for) additional clearances required under legislative requirements, including those required under the following Acts.

Table 1 Key Environmental Legislation Relevant to the Project

Legislation	Responsible Government agency	Aspect
Commonwealth Legislation		
Environment Protection and Biodiversity Conservation Act 1999	Department of the Environment (DotE)	Matters of National Environmental Significance including threatened flora and fauna
Native Title Act 1993	National Native Title Tribunal	Native title
State Legislation		
Aboriginal Heritage Act 1972	Department of Aboriginal Affairs (DAA)	Archaeological and ethnographic sites
Agricultural and Related Resources Protection Act 1976	Department of Agriculture and Food (DAF)	Weeds and feral animals
Conservation and Land Management Act 1984	Department of Parks and Wildlife (DPaW)	Use, protection and management of public lands and waters and its flora and fauna
Contaminated Sites Act 2003	Department of Environment Regulation (DER)	Management of contaminated sites
Environmental Protection Act 1986	DER	Environmental impact assessment and

		management
Environmental Protection (Noise) Regulations 1997	DER	Noise standards
Environmental Protection (Clearing of Native Vegetation) Regulations 2004	DER	Clearing of native vegetation
Heritage of Western Australia Act 1990	Heritage Council of Western Australia	European heritage protection
Land Administration Act 1997	Department of Regional Development	Administration of State Land
Rights in Water and Irrigation Act 1914	Department of Water	Access to and use of water resources; protection and management of river flows and drainage
Soil and Land Conservation Act 1945	Department of Agriculture and Food, WA	Protection of soil and prevention/management of soil erosion
Wildlife Conservation Act 1950	DPaW	Protection of native wildlife

1.6 Limitations and assumptions

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

GHD otherwise disclaims responsibility to any person other than Main Roads Western Australia 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.

This EIA is based upon the Project Area designed and approved by Main Roads for this and additional information provided by the Main Roads Project Manager, including the description of the Project Area.

GHD has prepared this report on the assumption that information provided by Main Roads and others who provided information to GHD (including Great Southern Bio Logic, Brad Goode and Associates and Government authorities), which GHD has not independently verified or checked beyond the agreed scope of works. The following technical studies have assessed particular environmental aspects and potential impacts, and are therefore relied upon for inclusion in this report:

- Ravensthorpe Heavy Haulage Route Fauna assessment and targeted fauna surveys (GHD 2014a);
- Ravensthorpe Heavy Haulage Route Noise Assessment (GHD 2013b);

- Ravensthorpe Heavy Haulage Route Air Assessment (GHD 2013c)
- Ravensthorpe Heavy Haulage Preliminary Site Contamination Investigation (GHD 2013d);
- Report of an Aboriginal Heritage Survey for the Proposed Ravensthorpe Heavy Haulage Route in Ravensthorpe, Western Australia (Brad Goode and Associated 2013);
- Addendum Report of an Archaeological Survey for the amemded sections of the proposed Ravensthorpe Heavy Haulage Route in Ravensthorpe, Western Australia (Brad Goode and Associated 2014);
- Ravensthorpe Heavy Haulage Route Botanical Survey (Great Southern Biologic 2013a);
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- Survey of Ravensthorpe Heavy Haulage Route as re-aligned (Great Southern Biologic 2014);
- Phytophthora Dieback Assessment and Associated Management Plan for the Proposed Ravensthorpe Bypass Heavy Haulage Route, Ravensthorpe (Great Southern Biologic 2013c); and
- Ravensthorpe Heavy Haulage Route Short Range Endemic survey (SRE) (GHD 2014b).

GHD does not accept liability in connection with unverified information, including errors and omissions in the report which were caused by errors or omissions in the technical information.

It should be noted that each of the reports is based upon the Project Area described in Section 1.4 and displayed in Figure 1. Further assessment may be required should the Project Area significantly change.

Main Roads is completing the geotechnical investigation and assessment of Acid Sulfate Soils. This information was not available at the time of compiling this Report.

LEGEND:

Project Area

- Section 1
- Section 2
- Section 3

1: 100,000 (at A4)

0 500 1,000 2,000 3,000 4,000

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 51

N

Main Roads Western Australia
Ravensthorpe Heavy Haulage Bypass

Job Number 61-29016
Revision 0
Date 29 Nov 2013

Study Areas

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

G:\61\29016\GIS\Maps\MXD\6129016_E004_Fig1_Rev0.mxd

Data source: Landgate: Travellers Atlas 2004; MRWA: Project Area - 20130605; GA: Geodata 250K Topo Series III - 2006. Created by: gowen

223,600 224,200 224,800 225,400

6,280,800 6,280,200

Locality Map

NEWDEGATE–RAVENSTHORPE ROAD
RAVENSTHORPE
SOUTH COAST HIGHWAY
HOPETOUN-RAVENSTHORPE ROAD

FLOATER RD
SOUTH COAST HWY
DUNN ST
DANCE ST
NEIL ST
SPENCE ST
SCOTT ST

1:6,000 (at A3)

0 30 60 120 180 240 300
Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 51

N

LEGEND

Roads

Study Area

Section 1

Main Roads Western Australia
Ravensthorpe Heavy Haulage Bypass

Job Number	61-29016
Revision	0
Date	06 Dec 2013

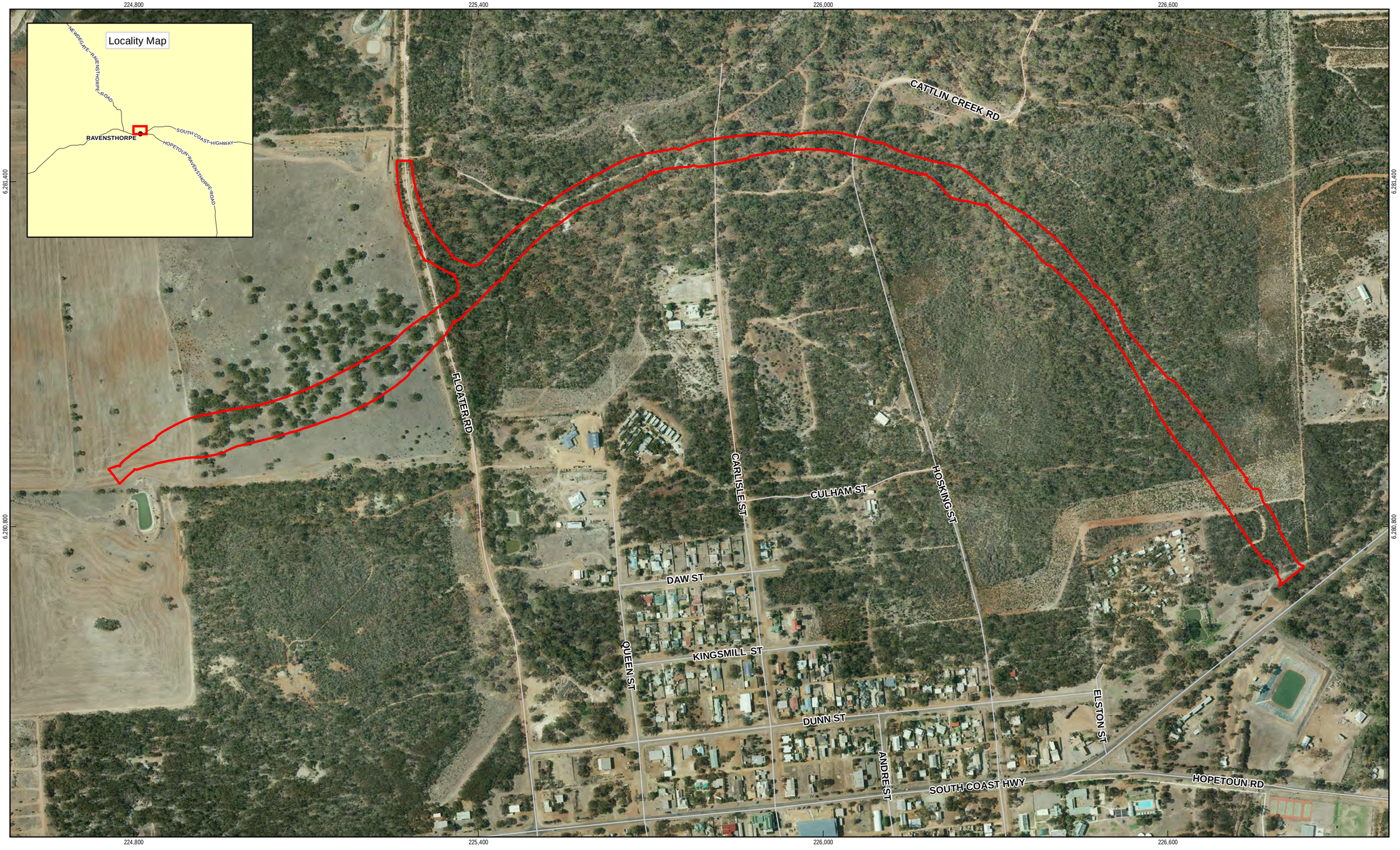
Project Area - Section 1

Figure 2

G:\61\29016\GIS\Maps\MXD\6129016_G008_Fig2_Rev0.mxd

Data source: GA: Topo 250k Series 3 - 2006; Landgate: Virtual Mosaic - 20131205; MRWA imagery; Ravensthorpe MRWA, Road Names - 20130118; GHD: Study Area - 20130605. Created by: bflorczak

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



1:6,000 (at A3)

0 30 60 120 180 240 300

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 51

N

LEGEND

Roads

Study Area

Section 2

Main Roads Western Australia
Ravensthorpe Heavy Haulage Bypass

Job Number	61-29016
Revision	0
Date	19 Feb 2014

Project Area - Section 2

Figure 3

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Data source: GA: Topo 250k Series 3 - 2006; MRWA imagery; Ravensthorpe MRWA, Road Names - 20130118; GHD: Study Area - 20130605. Created by: bflorczak

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

1:5,000 (at A3)

0 25 50 100 150 200 250
Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 51

N

LEGEND

Roads

Study Area

Section 3

Main Roads Western Australia
Ravensthorpe Heavy Haulage Bypass

Job Number	61-29016
Revision	0
Date	16 Dec 2013

Project Area - Section 3

Figure 4

G:\61\29016\GIS\Maps\MXD\6129016_G010_Fig4_Rev0.mxd

Data source: GA: Topo 250k Series 3 - 2006; Landgate: Virtual Mosaic - 20131205; MRWA imagery; Ravensthorpe MRWA, Road Names - 20130118; GHD: Study Area - 20130605. Created by: bflorczak

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

2. Methods

This EIA has been prepared to identify key impacts that the Project and its associated activities may have on environmental aspects identified by the desktop and field investigations. The EMP component (Section 4) of this report recommends management and mitigation measures during the planning, construction and post-construction phases of the Project to avoid, mitigate or manage the identified environmental impacts.

2.1 Desktop investigations

A list of desktop investigations undertaken for each of the key environmental aspects of the Project is shown in Table 2. The majority of the desktop investigations, pending the type of investigation, employed a 5 – 20 km buffer around the Project Area. The purpose of using a buffer is to capture the majority of the known and or predicted environmental constraints associated with that particular environmental aspect (e.g. threatened flora and fauna for the locality) to inform the field investigations and the EIA.

2.2 Technical studies

Table 2 lists the technical studies undertaken by GHD, Great Southern Bio Logic and Brad Goode and Associates to inform the EIA and EMP. These studies identified and described the key aspects of the existing environment of the Project Area and surrounds and assisted in identifying the potential impacts associated with Project development. A full description of the desktop and field investigation methodology for each study is provided in each report, including the limitations and assumptions for each technical study.

Table 2 Information sources

Aspect	Desktop investigation	Technical study incorporating desktop and field investigations
Climate	Climatic data available from the Bureau of Meteorology (BoM 2013)	N/A
Land use and social settings	-	South Coast Highway - Alignment Selection Study for : the RHHR Summary Planning Report (Main Roads 2012) – Appendix I
Acid Sulfate Soils	Acid Sulfate Soils Risk Mapping prepared from: • Australia Soil Resources Information System (ASRIS 2013) • Government of Western Australia (2013)	N/A
Contaminated sites	Identification of potentially contaminated sites using the DPaW Contaminated Sites Database (DEC 2013a)	Ravensthorpe Heavy Haulage Preliminary Site Contamination Investigation (GHD 2013d) – Appendix B
Hydrology and hydrogeology	Assessment of the surface and groundwater features based on Department of Water Geographic Data Atlas (DoW 2013).	N/A

Aspect	Desktop investigation	Technical study incorporating desktop and field investigations
Reserves	Reserves for conservation as shown in the DPaW Estate spatial dataset.	N/A
Environmentally Sensitive Areas	Identification of Environmentally Sensitive Areas utilising the DPaW Native Vegetation Viewer (DEC 2013b).	N/A
Matters of National Environmental Significance	Use of the *Environment Protection and Biodiversity Conservation Act 1999* Protected Matters Search Tool for Matters of National Environmental Significance in the Project Area (DotE 2013a)	Ravensthorpe Heavy Haulage Route Botanical Survey (Great Southern Bio Logic 2013a) – Appendix C Ravensthorpe Heavy Haulage Route Targeted Spring Flora Survey (Great Southern Bio Logic 2013b) – Appendix C Ravensthorpe Heavy Haulage Route Fauna assessment and targeted fauna surveys (GHD 2014a) including Ravensthorpe Heavy Haulage Route Fauna additional areas fauna survey– Appendix D
Terrestrial vegetation and flora	Beard Vegetation Mapping (1980)	Ravensthorpe Heavy Haulage Route Botanical Survey (Great Southern Bio Logic 2013a) Ravensthorpe Heavy Haulage Route Targeted Spring Flora Survey (Great Southern Bio Logic 2013b) Survey of Ravensthorpe Heavy Haulage Route as re-aligned (Great Southern Biologic 2014) – Appendix C

Aspect	Desktop investigation	Technical study incorporating desktop and field investigations
Threatened and Priority Ecological Communities	Ecological communities listed in the following databases as being within the Project area: • DPaW Threatened Ecological Community (TEC) and Priority Ecological Community (PEC) spatial datasets • DPaW Priority Ecological Communities List (DEC 2013b) • Threatened Ecological Communities Endorsed by the Minister for Environment (DEC 2013b) Protected Matters Search Tool for Matters of National Environmental Significance in the Project Area (DotE 2013a)	Ravensthorpe Heavy Haulage Route Botanical Survey (Great Southern Bio Logic 2013a)
Fauna and fauna habitats	DPaW NatureMap (DEC 2013c) Protected Matters Search Tool for Matters of National Environmental Significance in the Project Area (DotE 2013a)	Ravensthorpe Heavy Haulage Route Fauna assessment and targeted fauna surveys (GHD 2014a) including Ravensthorpe Heavy Haulage Route Fauna additional areas fauna survey– Appendix D Ravensthorpe Heavy Haulage Route Fauna – Short Range Endemic Survey (SRE) (GHD 2014b) – Appendix K
Conservation Significant Flora and Fauna	Conservation significant flora and fauna listed in the following databases as being within the Project area: • DPaW NatureMap (DEC 2013c) • DPaW Threatened and Priority Fauna datasets • DPaW Declared Rare and Priority Flora datasets Protected Matters Search Tool for Matters of National Environmental Significance in the Project Area (DotE 2013a)	Ravensthorpe Heavy Haulage Route Botanical Survey (Great Southern Bio Logic 2013a) Ravensthorpe Heavy Haulage Route Targeted Spring Flora Survey (Great Southern Bio Logic c 2013b) Ravensthorpe Heavy Haulage Route Fauna assessment and targeted fauna surveys (GHD 2014a) including Ravensthorpe Heavy Haulage Route Fauna additional areas fauna survey– Appendix D Survey of Ravensthorpe Heavy Haulage Route as re-aligned (Great Southern Biologic 2014)

Aspect	Desktop investigation	Technical study incorporating desktop and field investigations
Heritage – European and Indigenous	Identification of European and Indigenous heritage sites utilising: • Department of Aboriginal Affairs Heritage Inquiry System (DAA 2013) • Department of Sustainability, Environment, Water, Populations and Communities Australian Heritage Database (DotE 2013a) • *Environment Protection and Biodiversity Conservation Act 1999* Protected Matters Search Tool (DotE 2013a)	Report of an Aboriginal Heritage Survey for the Proposed Ravensthorpe Heavy Haulage Route in Ravensthorpe, Western Australia (Brad Goode and Associated 2013) – Appendix E Addendum Report of an Archaeological Survey for the amemded sections of the proposed Ravensthorpe Heavy Haulage Route in Ravensthorpe, Western Australia (Brad Goode and Associated 2014) – Appendix E
Noise quality	N/A	Ravensthorpe Heavy Haulage Route Noise Assessment (GHD 2013b) – Appendix F
Air quality	N/A	Ravensthorpe Heavy Haulage Route Air Assessment (GHD 2013c) – Appendix G

A description of terms and conservation codes used in this report are consolidated in Appendix A.

The results of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) Protected Matters Search Tool and NatureMap database search are presented in Appendix B.

2.3 Stakeholder consultation

A planned consultation programme has been applied to this Project over a 12 month period. Consultation has included the distribution of newsletters, public meetings and letters sent to all constituents of the Shire of Ravensthorpe. Main Roads has been responsible for the planning and undertaking of the consultation with all stakeholders.

A public meeting held on March 28th 2012 invited people to nominate their opinions and preferences regarding the alignment options for the bypass and the upgrade of the intersection of the Hopetoun Road.

2.3.1 Government agency - DEC

In the initial planning phase of the Project, Main Roads and a representative from GHD met with Depratment of Environment and Conservation (DEC) Great Southern Region (now DPaW and DER) to discuss the Project. The meeting was held at the DEC Great Southern Region office in Albany 15/02/2013. This meeting presented to the DEC the investigations that were to be undertaken. The DEC supported the environmental investigations proposed for the Project with a request that a targeted survey be undertaken for specific species. These targeted surveys were completed.

2.3.2 Aboriginal heritage consultation

A search of the Department of Aboriginal Affairs Sites Register was conducted on 10th April 2012. This search found one previously recorded Aboriginal heritage Site ID 26270 Mt Cattlin 2

and four other heritage places. These are described in the Aboriginal Heritage Survey report shown in Appendix E of this EIA.

Aboriginals representing the WC98/70 native title claim group and the Esperance Nyungars met with Main Roads and Brad Goode and Associates on-site on 17th April 2012. The purpose of this meeting was to present the purpose of the Project as well as discuss the specifications of the clearance sought for the construction of the Project. The alignment options were presented at this site visit.

As a result of the consultation no new ethnographic sites of significance were found. The survey also nominated the preferred alignment. This option does not require s.18 consent under the *Aboriginal Heritage Act 1972*. The survey recommended that it there was a potential that one heritage place ID 26267 may be impacted as a result of the Project that Main Roads write to the Registrar to seek and assessment of the status of this place.

3. Existing environment

The key environmental aspects considered relevant to this Project are outlined in this section. For each aspect, a baseline environmental description is included and, where appropriate, is followed by an assessment of potential environmental impacts.

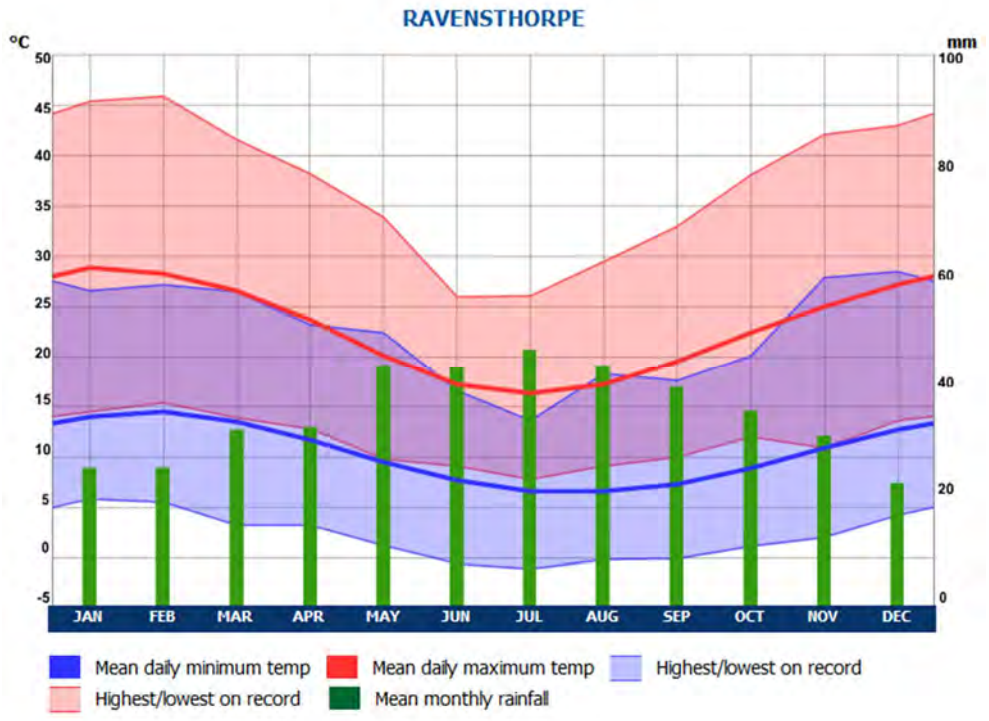
Where relevant, recommendations are provided for additional investigations. Management and mitigation measures to address the identified impacts are outlined in Section 6 (EMP).

3.1 Climate, geology and soils

The Ravensthorpe weather station (station number 10633) is the nearest Bureau of Meteorology weather station to the Project, situated approximately 8.4 km from the Ravensthorpe town site. Ravensthorpe's climate is defined as temperate, with cool wet winters and warm dry summers (Chart 1). A summary of the climatic data (BoM 2013) for this weather station is below:

- Mean maximum temperature: 16.3 °C (July) to 29.0 °C (January);
- Mean minimum temperature: 6.7 °C (July and August) to 14.6 °C (February);
- Rainfall: 427.5 mm per annum; and
- Mean number of days of rain ≥ 1 mm: 74.5.

Chart 1 Ravensthorpe annual temperatures and rainfall



(Weatherzone 2013)

The following geological descriptions of the Project Area are taken from the Ravensthorpe 1:100000 geology map (1996). Annabelle Volcanics (AAv) are located to the west of Ravensthorpe town site, comprising mafic to intermediate tuff and agglomerate, and related epiclastic rocks (mainly andesite); subordinate dacite; metamorphosed. Colluvium (Qcg) borders the Annabelle Volcanics to the south, comprising rubble of boulders and sand derived from granitoid rock and granitoid gneiss; minor outcrops of granitoid rock.

Manyutup Tonalite (AYt) underlies the majority of the Ravensthorpe town site, comprising tonalite and quartz diorite; massive, coarse-grained, and equigranular; metamorphosed. Colluvium (Czc) extends to the east of Ravensthorpe town site, comprising clay, silt, and rock fragments.

The soil subsystem identified within the Project Area is (ASRIS 2013) the Ravensthorpe 2 subsystem: Hills (400 m) with steep slopes grading to moderately inclined on lower slopes, dominated by a south-east to north-west trending central ridge on Archaean greenstone consisting of mafic and ultramafic rocks in the central part of the Ravensthorpe Zone. Calcareous loamy earths and shallow gravels with associated red shallow loams and bare rock. Scrub heath on upper slopes and crests. Mallee and shrubland on mid to lower slopes.

No impacts were identified or recommendations warranted for this environmental aspect.

3.2 Land use and social setting

3.2.1 Key aspects

The Project is located within the Shire of Ravensthorpe, around the Ravensthorpe town site (to the north). The majority of the alignment is located in land zoned rural, with two parcels of land zoned recreational. A summary of the land use types intersected by the Project Area is provided in Table 3.

The land zoned recreational is located to the north of the South Western Highway and to the east where the Alignment is proposed to connect back into the town. The proposed Alignment will traverse both the SCH (zoned major highway) and the Hopetoun Road (zoned important regional road). A motel, a caravan park and two houses are located within 100 m of the alignment.

Table 3 Summary of land use types intersected by the Project Area.

Land type / Interest Holder	Form of interest (owner/occupier, caveator)	Approximate area (ha or m^2)	Consents Yes/No
Private	Owner/Occupier	3.77 ha	Yes - Conditional
Private	Owner/Occupier	24.62 ha	Yes - Conditional
Private	Owner	2.03 ha	Yes
Private	Owners	1.16 ha	Yes
State of WA	Vacant Crown Land	2.85 ha	N/A
State of WA	State	1.53 ha	N/A
State of WA	State	0.91 ha	N/A
State of WA	State	3.75 ha	N/A
State of WA	State	6.03 ha	N/A
State of WA	Vested with the Shire of Ravensthorpe	0.15 ha	Council Concurrence

Source: Main Roads (2013) – via Project Manager Lindsay McCartin

Alignment selection study

Main Roads commissioned an alignment selection study for the RHHR (Main Roads 2012). The key environmental, social, economic and engineering constraints within the study area were identified and mapped. This review guided the development of the route options north and south of Ravensthorpe.

In summary, the major environmental constraints at a desk top level were remnant vegetation, hydrology/surface water areas and noise. The social constraints identified at a desk top level were: disruption of community facilities and services, property severance, and land use/town planning. The engineering and economic constraints that have been identified at a desktop level are topography/design grade, mining activity, construction length and cost.

On 10 September 2012, following a series of information sessions and public meetings, the Ravensthorpe Shire Council endorsed Option 2 of the Ravensthorpe Heavy Haulage Route Planning Study . Since the endorsement of this option, Main Roads in consultation with the council and local community have further refined the alignment, which is the subject of this EIA.

3.2.2 Recommendations

The nearby sensitive receptors should be consulted regarding the proposed works and management of potential impacts including noise and dust.

3.3 Acid Sulfate Soils

3.3.1 Key aspects

Acid Sulfate Soils (ASS) are defined as naturally occurring soils, peats and sediments that contain iron sulphides, predominantly in the form of pyrites (DEC 2009). A full description of ASS is provided in Appendix A.

Mapping of the probability of ASS occurring within the soil profile indicates that soils within the Project Area have a Low to Extremely Low Probability of Occurrence (ASRIS 2012). Based on the geology of the Project (Section 3.1), ASS is most likely to occur in any low lying alluvial sediments, but unlikely to be present in weathered bedrock or residual sands.

3.3.2 Key potential impacts

Undisturbed, ASS do not pose a risk, and only becomes an issue where works are required below the water table, or lowering of the water table is required..The Project is not expected to require excavation below, or dewatering of, the water table, and as such will not require management of ASS. However, should construction requirements be altered following site investigations, and dewatering or excavation below the water table be required, dedicated ASS investigations and management may be required.

3.3.3 Recommendation

Main Roads are not expecting to be working below the water table for this Project and therefore no ASS investigations or management plans are expected to be required. Should the Project require works below the water table, ASS sampling will be undertaken and if required, ASS management measures will be incorporated into the Project EMP.

3.4 Contaminated sites

3.4.1 Key aspects

A search of the online DEC Contaminated Sites Database (DEC 2012) did not identify any registered contaminated sites within the Project Area.

The DEC Contaminated Sites Database presents information of known contaminated sites that have been classified by the DEC within the following categories:

- Contaminated – remediation required;
- Contaminated – restricted use; and
- Remediated for restricted use.

The DEC Contaminated Sites Database does not provide details of sites that are listed as 'Possibly Contaminated – Investigation Required'.

A search of the DEC Contaminated Sites Database shows that a parcel of four sites is located approximately 50 m from the Project Area. These four sites are classified as "Contaminated - remediation required" due to the presence of hydrocarbons from petrol and diesel.

No further properties had been reported as known contaminated sites at the time of the search (21st January 2013).

The main outcomes of GHD's Preliminary Site Contamination Investigation (PSI) (GHD 2013d – Appendix B) with regards to contaminated sites are:

- A property comprising four parcels was identified adjacent to the western extent of Section 3 (i.e. along the SCH) classified as "Contaminated - remediation required" due to the presence of hydrocarbons (dissolved and free phase) within soil and groundwater from petrol and diesel sources. Summary records for the property indicate that impacted groundwater extends from the property in a south-easterly direction. The full extent of the impacts have not been determined, however are indicated to be present at least 130 metres to the east and 25 metres to the south. The land has been used as a service station and was confirmed as such during the site walkover;
- A site walkover identified a number of items of interest including an industrial property, a rural property, rubbish items, stockpiles of dumped rock and sand materials, Asbestos Contaminated Materials (ACM) fragments, a former mine, a caravan dump point, a water treatment plant, a water storage dam and a chemical storage yard.

Based on the site characterisation, history and site walkover, a Conceptual Site Model (CSM) was developed and a qualitative assessment of risks undertaken with respect to credible receptors of contamination. The CSM identifies a number of possible contamination sources, summarised below:

- Risk Rating of **NA**: Unknown features present in inaccessible areas;
- Risk Rating of **Very Low**: Water Storage Dam;
- Risk Rating of **Low**: Industrial Property, Rural Property, Former Mine Site, Caravan Dump Point, Water Treatment Plant and Dumped Rubbish in Bushland;
- Risk Rating of **Moderate**: Fenced Chemical Storage and Dumped Rubbish Including ACM in Bushland; and
- Risk Rating of **High**: DEC Classified Properties (Service Station).

3.4.2 Key potential impacts

As observed by the Risk Ratings above, the majority of identified features present a Very Low or Low risk of impact to identified receptors. Three features however have Risk Ratings of Moderate to High and as such require management in accordance with relevant guidelines and regulations. This is particularly pertinent with respect the ACM identified on the site. Should the development of the RHHR not require excavations in the vicinity of the DEC Classified Properties (Service Station), the Risk Rating for this item may be reduced.

3.4.3 Recommendations

Based on the outcomes of the PSI and with reference to the report limitations outlined in GHD 2013d – Appendix B, the following actions are recommended:

- Prior to commencement of intrusive works, the ACM fragments identified at two locations within Section 2 should be appropriately removed from the site and disposed at a licenced facility. This should be undertaken in accordance with all relevant legislation and guidelines. Should further ACM be identified during the works, this should also be appropriately removed. Where ACM has been identified and removed, the resulting ground surface should be suitably validated;
- A Site Management Plan (SMP) is prepared to outline the actions to be taken should contamination be identified from any of the identified sources. The SMP should include an unexpected finds protocol, which will detail the procedures to be undertaken should unexpected items be encountered during the works or should observations of contamination become apparent. The SMP should specifically outline the actions to be undertaken should contamination be identified in the vicinity of the Fenced Chemical Storage and DEC Classified Properties (Service Station) both located adjacent to Section 3.

3.5 Hydrology and hydrogeology

Hydrology and hydrogeology aspects in the Project Area are provided in Table 4. No rivers proclaimed under the *Rights in Water and Irrigation Act 1914* (RIWI Act) were identified within the Project Area. The Ravensthorpe Surface Water Area is located approximately 1.5 km south of the Project. The Ravensthorpe Catchment Public Drinking Water Source Area is protected and located approximately 2.25 km to the south of the Project Area.

Table 4 Search results of the DoW Geographic Data Atlas (DoW 2012) within the Study Area

Aspect	Details	Results
RIWI Surface Water Areas	Surface water areas proclaimed under the RIWI Act.	Ravensthorpe Surface Water Area
RIWI Irrigation District	Irrigation Districts proclaimed under the RIWI Act.	None present
RIWI Rivers	Rivers proclaimed under RIWI Act.	None present
Public Drinking Water Source Areas (PDWSA)	PDWSA 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).	Ravensthorpe Catchment Area
RIWI Groundwater areas	Groundwater areas proclaimed under the RIWI Act.	Kondinin-Ravensthorpe

Waterways Management Areas	Areas proclaimed under the *Waterway Conservation Act 1976*.	Esperance Coast Management Area

3.5.1 Key aspects - Surface water

No rivers or surface water bodies listed under the RIWI Act were identified within the Project Area (DoW 2012).

A small waterway / drainage line is located within Section 2. The drainage line is ephemeral and freely draining with only a couple of small pools within the Project Area. The creek drains directly into Cattlin Creek which runs parallel to the Project Area, approximately 115 m to the north.

Surface water impacts could include hydrocarbon contaminated runoff and erosion. Existing road drains will be re-constructed after completion of the Project, and therefore the Project is not expected to alter current surface water drainage in the long term.

3.5.2 Key aspects - Wetlands

Wetlands of International Significance are listed under the Ramsar Convention, which is an International treaty that covers the conservation of internationally important wetlands (Appendix A). A search of the EPBC Protected Matters Search Tool (PMST) in January 2013 did not identify any Ramsar listed sites within 5 km of the Project Area. The nearest Ramsar wetland, Lake Gore (No. 55), is approximately 131 kilometres east of the Project Area.

No Nationally Important Wetlands (NIW) are located within the Project Area, with Culham Inlet System (WA024) identified as the nearest NIW, approximately 30 km to the south of the Project.

3.5.3 Key aspects - Groundwater

A search of the DoW Geographic Data Atlas (DoW 2012) identifies the Project Area as being in the Kondinin-Ravensthorpe groundwater area (DOW 2012).

The use of groundwater in WA is protected under the RIWI Act and managed by the Department of Water (DoW) (Appendix A). The DoW Geographic Data Atlas (DoW 2012) search indicates that the Project Area is not within a RIWI Groundwater Area. As such, a licence is not required to abstract water from a superficial aquifer.

The Project does not include the taking of groundwater or activities that are likely to impact on groundwater quality. As such, the proposed works are not expected to impact on either local or regional groundwater. Licensing will be required if groundwater is to be abstracted from a confined aquifer.

3.5.4 Recommendations

Drainage design for the final alignment will maintain existing surface water drainage patterns and avoid exacerbating waterlogging in susceptible areas.

Potential surface water impacts arising from road construction will be addressed through the Project EMP.

No impacts were identified or recommendations warranted for this environmental aspect.

3.6 Conservation areas and reserves

One conservation reserve (WA27527) managed by the DEC has been identified within 5 km of the Project Area (Figure 2). Overshot Hill is located approximately 4.8 km to the north west of the Project. Due to the separation distance, the Project will not impact on this site.

No impacts are identified or recommendations warranted for this environmental aspect of the Project.

3.7 Environmentally Sensitive Areas

Environmentally Sensitive Areas (ESA) are declared by notice under Section 51B of the EP Act (Appendix A).

A search of DEC's online Native Vegetation Viewer (DEC 2011b) identified one ESA within 5 km of the Project Area. The ESA (6960) is located approximately 3.3 km to the north east of the proposed Ravensthorpe Bypass, and therefore the Project is not expected to result in direct or indirect impacts to this ESA.

No impacts are identified or recommendations warranted for this environmental aspect.

3.8 Matters of National Environmental Significance

3.8.1 Key aspects

The EPBC Act provides legislative protection for Matters of National Environmental Significance (MNES). A desktop search using the EPBC Act *Protected Matters Search Tool* (DotE 2013a) was undertaken to identify any MNES within the Project Area, including a 20 km buffer. The desktop search identified threatened and migratory species as potentially present within the Project Area.

A summary of the search results is provided in Table 5.

Table 5 Matters of National Environmental Significance which may occur, or relate to, the Project Area

Matters of National Environmental Significance	Presence
World Heritage Places	None
National Heritage Places	One National Heritage Place potentially occurs within the Project Area. Section 3.11.1 addresses National Heritage Places within the Project Area.
Wetlands of International Importance	None
Nuclear Actions	No
Great Barrier Reef Marine Park	No
Commonwealth marine areas	No
Listed Threatened ecological communities	None
Threatened Species	17 threatened EPBC listed species of flora and fauna potentially occur within the Project Area. Section 3.10 address threatened flora species listed under the EPBC Act known from, or predicted to occur within, the Project Area. Section 3.11 address threatened fauna species listed under the EPBC Act known from, or predicted to occur within, the Project Area

Listed Migratory Species	Nine EPBC listed migratory species were recorded as potentially present. Section 3.11 address migratory fauna species listed under the EPBC Act known from, or predicted to occur within, the Project Area
Groundwater resources in areas of coal seam gas or coal mine operations	No

There are no impacts identified or recommendations warranted for the following MNES:

- World Heritage Places
- Wetlands of International Importance
- Nuclear Actions
- Great Barrier Reef Marine Park
- Commonwealth Marine Area
- Groundwater resources in areas of coal seam gas or coal mine operations.

3.9 Terrestrial vegetation and flora

3.9.1 Key aspect – Broad vegetation associations, extent and status

The Western Australian Interim Biogeographic Regionalisation of Australia (IBRA) divides Australia into 89 bioregions based on biological and geographic/geological attributes. The Project Area is located within the Fitzgerald subregion of the Esperance Plains Region.

Clearing of each Section of the Project Area will result in clearing of less than 0.01 % of the Esperance Plains IBRA bioregion and Fitzgerald sub-region (Table 6). Impacts at the IBRA bioregion and sub-region levels are not expected to be significant.

Table 6 Percentage of IBRA bioregion and sub-region within the Project Area

IBRA region/sub-region	Total extent (ha)	Area (ha) within the Project Area (% of total extent within Project Area (regional impact)			
		Section 1	Section 2	Section 3	**Total Project Area**
Esperance Plains bioregion	2,921,330.13	6.22 (0.000213%)	12.27 (0.000420%)	14.41 (0.000493%)	**32.9 (0.00113%)**
Fitzgerald sub-region	1,577,940.24	6.22 (0.000392%)	12.27 (0.000776%)	14.41 (0.000913%)	**32.9 (0.00208%)**

Beard (1979) mapping indicates that the Project is located within the following two broad vegetation associations:

- Medium woodland; York gum [*Eucalyptus loxophleba*] (association 352)
- Shrublands; mallee scrub, black marlock [*Eucalyptus redunca*] (association 516)

The local and regional impacts on the loss of vegetation associations have been assessed using the mapped extent of the Beard (1977) vegetation associations within the Project Area, as adapted by Shepherd *et al.* (2002). The extent of Beard's (1977) vegetation associations have been determined by the state-wide vegetation remaining extent calculations maintained by the DPaW (latest update 2012 – Government of Western Australia 2013). As indicated in Table 7,

the extent of vegetation association 516 at the state, IBRA region, IBRA sub-region and local government authority (LGA) scale is greater than 30 % of the pre-European extent. The extent of vegetation association 352 at state, IBRA bioregion, IBRA sub-region and LGA scales is between 10 and 30 % of the pre-European extent.

The extent of clearing required for this Project is less than 1 % at the state, IBRA bioregion, IBRA sub-region and local government authority levels.

It should be noted that the vegetation association areas have been determined at a scale of 1:250,000 and may not include all areas that have been cleared for mining and other purposes throughout the south-west. However, given the size of the Esperance Plains IBRA region and extent of vegetation associations (many represented by thousands of hectares) this data is considered to be the best available to determine regional impacts of clearing for the Project.

3.9.2 Key potential impacts

Vegetation association 352 is currently present below the 30 % level (which is regarded by the EPA as the threshold for vegetation association retention) at the state, IBRA bioregion, IBRA sub-region and local government authority levels. However, the clearing required for the Project is likely to have an insignificant – minor impact on the regional vegetation extents as clearing of the Project Area would not result in Beard (1977) vegetation associations 352 or 516 being significantly further reduced (Table 7).

No recommendations are warranted for this environmental aspect.

Table 7 Extent of Beard (1977) vegetation associations within the Project Area

Vegetation association	Region	Pre-European extent (ha)	Current extent (ha)	Remaining (%)	Current extent in IUCN I–IV (proportion of current extent) (%)	Amount within Project Area (ha)				% of current extent within Project Area			
						Section 1	Section 2	Section 3	**Total Project Area**	Section 1	Section 2	Section 3	**Total Project Area**
Medium woodland; York gum (352)	State	724,272.97	143,677.93	19.84	2.12	6.22	12.17	7.93	**26.32**	0.0043	0.0085	0.0055	**0.018**
	Esperance Plains IBRA region	22,816.85	6611.36	28.98	0.16					0.094	0.18	0.12	**0.40**
	Fitzgerald IBRA sub-region	22,816.85	6611.36	28.98	0.16					0.094	0.18	0.12	**0.40**
	Shire of Ravensthorpe	20,570.71	5717.74	27.80	0.18					0.11	0.21	0.14	**0.46**
Shrublands; mallee scrub, black marlock (516)	State	607,434.25	334,357.35	55.04	43.61	0	0.10	6.48	**6.58**	0	0.000030	0.0019	**0.0020**
	Esperance Plains IBRA region	318,746.72	220,173.05	69.07	41.07					0	0.000045	0.0029	**0.0030**
	Fitzgerald IBRA sub-region	219,038.35	183,491.16	83.77	45.26					0	0.000054	0.0035	**0.0036**
	Shire of Ravensthorpe	153,600.89	128,227.69	83.48	38.3					0	0.000078	0.0051	**0.0051**

(GoWA 2013)

3.9.3 Key aspect – Vegetation types and conditions

Section 1

One vegetation community (*Eucalyptus oleosa* subsp. *corvina* – Eole), which has been largely cleared, occurs in Section 1. The majority of Section 1 is *Completely Degraded*, while the vegetation of Section 1 ranges from *Very Good* to *Completely Degraded.*

Section 2

Three vegetation communities (*Eucalyptus oleosa* subsp. *corvina* – Eole, *Eucalyptus salmonophloia* – Esal, *Melaleuca hamata* – Mham) occur in Section 2. The vegetation within Section 2 is largely in *Excellent* to *Very Good* condition, with cleared areas in *Completely Degraded* condition.

Section 3

Two vegetation communities (*Eucalyptus oleosa* subsp. *corvina* – Eole, *Eucalyptus salmonophloia* – Esal) occur in Section 3. The majority of the vegetation of Section 3 ranges from *Very Good* to *Good–Fair* condition, with cleared areas and some areas of vegetation in *Completely Degraded* condition.

The areas of each vegetation community within the Project Area are provided in Table 8.

Table 8 Vegetation communities within the Project Area

Vegetation community	Area of vegetation community (ha)			
	Section 1	Section 2	Section 3	**Total Project Area**
Eucalyptus oleosa subsp. *corvina* (Eole)	2.84	8.54	6.10	**17.48**
Eucalyptus salmonophloia (Esal)	-	2.18	3.51	**5.69**
Melaleuca hamata (Mham)	-	0.91	-	**0.91**
Total vegetation	**2.84**	**11.62**	**9.61**	**24.07**
Cleared	3.38	0.64	4.80	**8.81**

3.9.4 Key potential impacts

A total of 24.07 ha of vegetation will be cleared for the Project. The vegetation ranges in condition from *Excellent* to *Completely Degraded*. There is approximately 97,900 ha of native vegetation remaining within 20 km of the Project Area (a total area of 125,600 ha) (GoWA 2012). The remnant vegetation within the Project Area represents 0.024 % of the vegetation remaining within 20 km of the Project Area. Potential impacts on vegetation are not only restricted to loss of native vegetation within the Project Area, but also to impacts on the vegetation adjacent to the disturbance. The clearing of vegetation will result in a range of potential direct impacts to vegetation associations, including:

- Reduction in the extent of vegetation associations locally and regionally
- Reduction in the viability of vegetation associations resulting from the loss or disruption of ecological functions.

3.9.5 Key aspect - Threatened and Priority Ecological Communities

Ecological communities are defined as naturally occurring biological assemblages that occur in a particular type of habitat (English and Blyth, 1997). Threatened Ecological Communities (TECs) are ecological communities that have been assessed and assigned to one of four categories as detailed in Appendix A.

A PMST search (DSEWPaC 2013a) did not indicate any federally listed TECs within 20 km of the Project Area. A search of the DEC TEC and Priority Ecological Communities (PEC) database (DEC 2013c) identified a number of PEC in the nearby Ravensthorpe Range. All of these grow on soils and landforms that do not occur within the Project Area.

No TEC or PEC were present within the Project Area.

No recommendations are warranted for this environmental aspect.

3.9.6 Flora diversity

A NatureMap search identified 608 flora species within the Project Area, of which 63 were introduced. As the NatureMap query covers the surrounding 5 km area, the query is expected to identify a number of species and vegetation communities that are not present within the Project Area.

The most dominant families identified in the NatureMap search were:

- Myrtaceae (112 species)
- Proteaceae (65 species)
- Fabaceae (93 species)

A total of 233 flora species were recorded within the Project Area. Due to the good quality of remnant vegetation within Section 2, a disproportionately high number of species were recorded within this Section.

3.9.7 Key potential impacts

Clearing of native vegetation will be required for the Project. Potential impacts on flora will result in a range of potential direct impacts to flora species, including:

- Reduction in the viability of flora species resulting from the loss or disruption of vegetation and associated ecological functions
- Loss of individual species locally and regionally.

3.9.8 Conservation significant flora

Significant flora species are protected under both State and Commonwealth Legislation as detailed in Appendix A.

A total of 25 species of conservation significance were identified as potentially occurring within 5 km of the Project Area as a result of the desktop assessment. An additional two Priority One species (*Austrostipa* sp. Carlingup Road (S. Kern and R. Jasper LCH 18459) and *Austrostipa* sp. Ravensthorpe Range (A. Markey and J. Allen 6261)) were identified as potentially occurring within 20 km of the Project Area) as a result of the desktop assessment.

Two flora species of conservation significance, *Grevillea sulcata* (P1) (x 1) and *Acacia bifaria* (P3) were found during the GSB surveys (l survey. Eight Austrostipa species were recorded as a result of targeted surveys conducted during September 2013 but these did not include the conservation species known from the Ravensthorpe region: *Austrostipa* sp. Carlingup Road (S. Kern & R. Jasper LCH 18459) P1 or *Austrostipa* sp. Ravensthorpe Range (A. Markey & J. Allen 6261) P1.

Table 9 shows the numbers of the number of the P3 *Acacia bifaria* recorded within and adjacent the Project Area during the GSB surveys.

Table 9 Calculated counts of *Acacia bifaria* and *Grevillea sulcata* for the Project Area and surveyed area

Taxon	Section 1	Section 2	Section 3	Total	
				Within	Adjacent
Acacia bifaria (P3)	6	648	59	**713**	**484**
Grevillea sulcata (P1)	0	0	0	**0**	**1**

3.9.9 Key potential impacts

In order to quantify key impacts on these flora species of conservation significance, publically available databases were searched (Table 10). It should be noted that it is likely that these taxa are more widespread and the lack of records for these taxa are due to lack of survey effort.

Table 10 Counts of *Acacia bifaria* and *Grevillea sulcata* from FloraBase

Taxon	No. of records
Acacia bifaria (P3)	531 individuals (31 records)
Grevillea sulcata (P1)	280 individuals (11 records)

(WA Herbarium 1998)

An assessment of the known populations of *Acacia bifaria* and *Grevillea sulcata* was undertaken to determine the significance of the populations within the Project Area and local area. The number of populations and plants of these taxa known from within the Project Area, the area adjacent to the Project Area and the whole of Western Australia are described in Table 11. This indicates that the potential impact on *Grevillea sulcata* is Nil and on *Acacia bifaria* is considered to be Moderate.

Information on all of these taxa is limited and few surveys for these taxa have occurred. These taxa are likely to be more wide spread in the general area and the estimation of populations and plants in the whole of Western Australia, as included in Table 11, is a conservative estimate as:

- *FloraBase* and *NatureMap* records do not always provide details on the number of plants present. Records often provide comments such as ‘scattered’ and ‘common’ for their frequency. However, where a count was not provided the record has only been included as one plant.
- Records on *FloraBase* only represent those lodged with the herbarium. There may be other populations in areas not surveyed or records may not have been lodged.

Table 11 Potential impacts to conservation significant flora recorded within the Project Area at local and regional levels

Taxon	Frequency		Local impact (%) (No. within Project Area /No. within local area)	State-wide records (See Table 10)	Total known records (No. within Project Area + local area + state-wide records)	State impact (%) (No. within Project Area/Total known records)	Project potential impact	Project potential impact following management (see 3.9.18)
	Within Project Area (see Table 9)	Within surveyed area (see Table 9)						
Acacia bifaria (P3)	713	1197	59 %	531	1728	41 %	Moderate	Moderate
Grevillea sulcata (P1)	0	1	0 %	280	281	0 %	Nil	Nil

3.9.10 Key aspect - Weeds and Declared Pests

A NatureMap search undertaken for the Project Area in January 2013 identified 63 naturalised flora species. The EPBC PMST search identified several species that may potentially occur within the Project Area (see Table 12).

Table 12 Weeds of National Significance (WoNS) potentially present within the Project Area and other major weeds

Common Name	Scientific Name	Significance Class	Declared Pest
African boxthorn	*Lycium ferocissimum*	WoNS	No
Bridal creeper	*Asparagus asparagoides*	WoNS	Yes
Onion weed	*Asphodelus fistulosus*		No
Soursob	*Oxalis pes-caprae*		No
Wild radish	*Raphanus raphanistrum*		No
Saffron thistle	*Carthamus lanatus*		Yes
Horehound	*Marrubium vulgare*		Yes
Prickly pear	*Opuntia* sp.	WoNS	No
Freesia	*Freesia* sp.		
Swan plant	*Gomphocarpus fruticosus*		Yes
African lovegrass	*Eragrostis curvula*		
Star of Bethlehem	*Ornithogalum umbellatum*		Yes

Section 1

The understorey in the road reserves of Section 1 has been largely replaced by weeds, including the WoNS, *Lycium ferocissimum* (African boxthorn), *Asparagus asparagoides* (bridal creeper) and the Noxious *Asphodelus fistulosus* (onion weed) and *Oxalis pes-caprae* (soursob). The paddock immediately north of the highway contains African boxthorn and the Declared Pest *Carthamus lanatus* (saffron thistle), *Marrubium vulgare* (horehound) and Ornithogalum umbellatum (star of Bethlehem) and the Noxious soursob and *Raphanus raphanistrum* (wild radish).

Section 2

The understorey of Section 2 contains the WoNS, African boxthorn, bridal creeper and *Opuntia* sp. (prickly pear). The Declared Pest saffron thistle was widespread in the western portion of Section 2. *Freesia* sp. (freesias) have established along the margin of the minor creek that drains into Cattlin Creek.

Section 3

The WoNS, African boxthorn and bridal creeper, are smothering shrubs in the *Eucalyptus salmonophloia* (salmon gum) woodland, while the Declared *Gomphocarpus fruticosus* (swan plant) is spreading through winter-wet areas. Noxious onion weed, stinkwort and soursob are present along the road reserves of South Coast Hwy, with *Eragrostis curvula* (African lovegrass) growing beside the Hopetoun–Ravensthorpe Rd.

3.9.11 Key potential impacts

There is a moderate risk of spreading these weed taxa or introducing new weed taxa into the Project Area and adjacent areas during the proposed works. There is potential for weeds to be spread throughout the entire Project Area.

3.9.12 Recommendations

The following management measures to reduce the impact on the two species of conservation significance and vegetation adjacent to the Project Area should be included in the Project EMP.

Acacia bifaria (P3)

It is unlikely that direct impacts on this taxon will be avoidable as it occurs scattered within the Project Area. It is recommended that:

- Clearing should minimise the direct loss of individuals where possible.
- Adjacent individuals and/or populations should be appropriately flagged.
- Personnel, vehicles and machinery should avoid individuals where possible to prevent direct and indirect damage.
- A rehabilitation plan should be implemented which should include post-construction monitoring. Rehabilitation measures should include topsoil management and, where possible, seed collection for use in post-construction rehabilitation.

Grevillea sulcata (P1)

No direct impacts on this taxon will occur as it occurs adjacent to the Project Area. It is recommended that:

- Adjacent individuals and/or populations should be appropriately flagged.
- Personnel, vehicles and machinery should avoid individuals where possible to prevent direct and indirect damage.
- Weed management
- Weed management is included in the EMP, with particular emphasis on management of WoNS populations within the Project Area prior to, and during, road construction, and as part of on-going road reserve management.

3.10 Fauna and fauna habitats

GHD completed a Level 1 Fauna assessment of the Project Area during June 2013. The aim of the Level 1 fauna assessment was to provide Main Roads with an assessment of any likely fauna constraints and outline potential impacts to fauna potentially arising from the Project (GHD 2014a – Appendix D).

This report also presents the findings of the supplementary targeted survey for Carnaby's Black Cockatoo and Ravensthorpe Range Slider in the Project Area during October 2013, and additional areas survey for the revised Project Area (GHD 2014a – Appendix D).

In late November 2013 a survey for Short Range Endemic (SRE) invertebrates was commissioned to provide further detail for RHHR areas that contain native vegetation due to the likely presence of such species along the south coast of Western Australia. The ful report is presented in Appendix K.

3.10.1 Key aspect - fauna habitats of the Project Area

Fauna habitat types within the Project Area are associated with the vegetation types described in Section 3.9.3. There are eight separate habitat types within the Project Area. Each of these habitat types are well represented in the immediate vicinity of the Project Area and in the broader Ravensthorpe district.

The area of each habitat type within each section is summarised in Table 13. The Project Area of approximately 32.8 ha consists of up to 19.5 ha of fauna habitat associated with remnant vegetation. The remaining 13.3 ha consists of completely modified habitats which have very little (e.g. maintained lawns) to no value for native fauna (e.g. bitumen roads).

Section 1

This section is dominated by modified habitat such as paddocks and roads. With the exception of 1.5 ha of mixed Eucalyptus woodland there is limited habitat value in this section.

Section 2

Section 2 is directly adjacent to a large continuous tract of native vegetation that extends to the north of the Project Area. A total of 10.4 ha of Section 2 consist of high value habitat, including Salmon Gum woodlands and Mixed Eucalyptus woodlands. This section also includes the only creek line habitat in the Project Area. The mixed woodlands in Section 2 would provide a variety of habitat resources to a wide range of fauna species, including priority species such as the Ravensthorpe Range Slider (*Lerista viduata)* which requires thick leaf litter and the EPBC Act listed Carnaby's Black Cockatoos (*Calyptorhynchus latirostris*) which is known to use Salmon Gum woodlands.

Section 3

Section 3 contains approximately 7 ha of Salmon Gum / mixed Eucalyptus woodland, potentially suitable habitat for Carnaby's Black Cockatoo. Approximately 7 ha (50% of the area of this section) consists of highly modified habitat which is primarily the SCH and the Hopetoun-Ravensthorpe Road. There is a variety of land uses immediately adjacent to Section 3 including the golf course, equestrian cub, rifle club, waste water treatment ponds, the recreation centre, private residences, Coates Hire, the Caravan Park and Camel Park. As such, Section 3 of the Project Area has limited habitat connectivity to vegetation in the broader Ravensthorpe region.

Section 3 contains 81 significant trees that are potential breeding trees for Carnaby's Black Cockatoo and 11 of these trees contain hollows that would be suitable for the cockatoos. Some of the potential nesting trees in Section 3 are situated in habitat that has a disturbed understorey; the DotE criteria (DSEWPaC 2012) for breeding trees for Black Cockatoos recognises the high value of large trees with hollows (or the potential to develop hollows), regardless of the condition of the understorey in the habitat. During the field survey five native birds were recorded utilising the hollows in Section 3, including:

- Red-capped Parrot (*Purpureicephalus spurius*)
- Australian Wood Duck (*Chenonetta jubata*)
- Galah (*Cacatua roseicapilla*)
- Port Lincoln Parrot (*Barnardius zonarius*)
- Striated Pardalote (*Pardalotus striatus*)

Connectivity

Section 2 of the Project Area has broad connectivity to a large continuous tract of habitat to the north between Floater Road and Cattlin Creek Road. The habitat to the north of the Project Area is generally representative of the habitat types within the Project Area and includes Salmon Gum woodlands and mixed Eucalyptus woodlands. The Project Area has limited connectivity to any substantial tracts of habitat on the southern, eastern and western sides of the area (Sections 1 and 3); these areas are dominated by infrastructure and highly disturbed vegetation.

Table 13 Summary and area of each habitat type per section

Habitat type	Section 1	Section 2	Section 3	Total area of each habitat type in Project Area (all sections combined)
Salmon Gum woodland	0	3.6 ha	1.9 ha	**5.5 ha**
Salmon Gum woodland with degraded understorey	0	0	1.3 ha	**1.3 ha**
Mixed Eucalyptus woodland	0	2.2 ha	2.1 ha	**4.3 ha**
Mixed Eucalyptus woodland with degraded understorey	1.5 ha	3.2 ha	1.3 ha	**6.1 ha**
Melaleuca Shrubland	0	1.3 ha	0	**1.3 ha**
Modified Native vegetation	0	0	0.8 ha	**0.8 ha**
Completely modified	4.7 ha	1.8 ha	7 ha	**13.5 ha**
Creek line	0	0.2 ha	0	**0.2 ha**
Total area of habitat (all habitat types combined) per section	**6.2 ha**	**12.2 ha**	**14.4 ha**	**Total area of all habitat types within Project Area = 32.8 ha**

3.10.2 Key potential impacts

Construction of the Project will require clearing of 19.5 ha of vegetation and loss of the associated fauna habitat. The remaining 13.5 ha of the Project Area is already highly modified (primarily paddocks and roads). The amount of clearing in each section is summarised in Table 14.

Table 14 Area of native vegetation and associated fauna habitat to be lost in Project Area for each section

Section	Total area of section	Total are of vegetation/fauna habitat to be cleared	Summary of habitat value
Section 1	6.2 ha	1.5 ha of mixed Eucalyptus woodland and 4.7 ha of completely modified habitat	This vegetation lacks structural or species diversity and has limited habitat value. Carnaby's Black Cockatoo - Habitat values are limited to some potential foraging habitat (1.5 ha of mixed Eucalyptus woodland). The DotE risk referral guidelines (DSEWPaC 2012) state that impacting on 1 ha of foraging habitat would be considered a significant

			impact.
Section 2	12.2 ha	10. 4 ha of Salmon Gum and mixed Eucalyptus woodlands and 1.8 ha of completely modified habitat	High to moderate value, high to moderate connectivity to broader landscape, some degraded areas, habitat values including foraging and potential breeding trees for Carnaby's Black Cockatoo. Habitat values include 69 potential breeding trees (including 2 trees with potential hollows), and 10.4 ha of foraging habitat. The value of the potential breeding trees is increased due to the close proximity of foraging resources to the breeding resources. Clearing in this section is likely to trigger referral to the EPA and DotE.
Section 3	14.4 ha	7.4 ha of Salmon Gum and mixed Eucalyptus woodlands and 7 ha of completely modified habitat	High to moderate value (primarily the hollow bearing trees which could potentially be used by Carnaby's Black Cockatoo), limited connectivity to broader landscape, some degraded areas. Habitat values includes 81 potential breeding trees (including 11 trees with potential hollows), and 7.4 ha of foraging habitat. Clearing in this section is likely to trigger referral to the EPA and DotE.

The potential to impact on the regional connectivity and habitat linkages from the Project is generally restricted to Section 2 of the Project Area, as Sections 1 and 3 are located in highly fragmented areas.

The proposed alignment for Section 2 of the RHHR is situated on the southern end of a continuous tract of vegetation extending to the north of the Project Area. However, the RHHR is situated on the northern edge of the town site of Ravensthorpe which has considerable existing habitat fragmentation. The additional heavy haulage route is unlikely to add significantly to the existing habitat fragmentation in a regional context.

Section 2 contains an area of vegetation that has been previously cleared as part of a series of large fire breaks around the town site of Ravensthorpe. The proposed RHHR is likely to provide a substantial fire break for the town site and as such the existing fire breaks may be superfluous and deemed obsolete, which in turn could allow these areas to regenerate. This regeneration may provide benefits to regional habitat fragmentation and linkages.

3.10.3 Key aspect - fauna diversity

Terrestrial vertebrate fauna

A NatureMap search indicated that there are a number of fauna taxa recorded within 20 km of the Project Area including:

- 121 bird species
- 10 frog species

- 24 mammal species
- 32 reptile species

During the field surveys all sections of the Project Area were surveyed and the fauna species encountered were recorded. Fauna recorded during the field surveys are presented in Appendix D and include 42 birds, five mammals (three of which are introduced taxa) and five reptiles.

No fauna species of conservation significance were recorded within the Project Area during the fauna field surveys.

Short Range Endemic species

Ten species from groups known to contain SRE species were recorded during the survey in 2013. The raw collection data is shown in Short Range Endemic (SRE) report (Appendix K). A list of species and their status is provided below. Specimens are currently being identified by the Western Australian Museum and results are currently unavailable. The centipede specimens recorded during the survey are not considered to be SRE species as they are both widespread within Western Australia.

• Gastropoda sp1 (large)	Unknown
• Gastropoda sp2 (small tight blunt)	Unknown
• Gastropoda sp3 (small long spiral)	Unknown
• Gastropoda sp4 (medium)	Unknown
• Crustacea: Isopoda: Armadillidae sp.	Unknown
• Crustacea: Isopoda: Philosciidae sp.	Unknown
• Chilopoda: Scolopendromorpha: Scolopendridae: *Cormocephalus hartmeyeri*	Widespread
• Chilopoda: Geophilomorpha: Mecistocepgalidae: *Australoschendyla albanyensis*	Widespread
• Arachnida: Mygalomorph: Nemesiidae? sp.	Unknown
• Arachnida: Mygalomorph: sp. Juvenile	Unknown

3.10.4 Key aspect - conservation significant fauna

The conservation of fauna species and their significance status is currently assessed under both Federal (EPBC Act) and State (WC Act) Acts. Conservation significant fauna include those fauna listed under the EPBC Act, WC Act and the Priority list of fauna produced by DPaW. The relevant conservation codes and Legislation are further described in Appendix A.

Priority species

Western Brush Wallaby (*Macropus irma)* (P4), Ravensthorpe Range Slider (P1) and Peregrine Falcon (*Falco peregrinus)* (S) are all considered likely or possible to occur within the Project Area. Although targeted efforts were made to survey for these species they were not recorded during the field surveys. These species have no special legislative protection, but their presence would normally be considered relevant to an assessment of the conservation significance of an area.

Migratory species

The Rainbow Bee-eater (*Merops ornatus)* was considered likely to occur in the Project Area and is listed as a species under an international agreement by DPaW and migratory under the EPBC Act (as such the species is considered a MNES). The Rainbow Bee-eater is a reasonably common bird in the Ravensthorpe area and there is suitable habitat within the Project Area and surrounds.

WC Act and the EPBC Act listed species

Carnaby's Black Cockatoo

Carnaby's Black Cockatoo is listed as Threatened under the Western Australian WC Act and Endangered under the federal EPBC Act. Targeted surveys for Carnaby's Black Cockatoo were conducted during the field survey from 11th to 14th June and 22nd to 24th October 2013 in accordance with DotE guidelines (DSEWPaC, 2012).

No Carnaby's Black Cockatoos were recorded within the Project Area during the field surveys. Evidence of foraging by the species was recorded during the June field survey, but not in the October survey. Two groups of Carnaby's Black Cockatoo of approximately 35 individuals per group were recorded in two separate locations, approximately 5 km from the Project Area during the survey period. No evidence of breeding was recorded during the targeted Cockatoo survey in October (which was scheduled to coincide with the breeding period for the species).

Furthermore, the species was not recorded in the Ravensthorpe area at all during the October survey period. Given the results of the October targeted survey, it is considered unlikely that the species breeds in the Project Area.

Systematic searches through the Project Area to map all foraging habitat for Carnaby's Black Cockatoo found there is a total of 19.5 ha of foraging habitat present in the Project Area. The quantity of foraging habitat and discussion on the habitat values in each section are presented in Table 10.

Searches of the Project Area recorded 145 trees significant to Carnaby's Black Cockatoo. In total, there were 13 trees with hollows suitable for nesting and 8 hollows had evidence of use (by un-confirmed species). Given the competition with other fauna taxa for the use of hollows in the Project Area and the proximity of the hollows to the town site of Ravensthorpe, it is unlikely that the Cockatoo would utilise these hollows for breeding. Given the lack of evidence to support breeding activity during the June and October 2013 surveys, it is considered unlikely that the Project Area is important breeding habitat. However these hollow-bearing trees may be used for roosting or foraging.

Malleefowl

A targeted survey for Malleefowl (*Leipoa ocellata)* was conducted during the field survey from 11th to 14th June 2013. Opportunistic observations for evidence of this bird species were conducted for the duration of the four day survey. Surveys were conducted in accordance with the DotE survey guidelines and over 15 hours of systematic searches through Sections 2 and 3 were conducted.

Section 1 of the Project Area was not systematically searched for Malleefowl due to the degraded condition of the habitat. No evidence of Malleefowl was recorded during these surveys; that is, no scratchings, mounds (old or new) and no observations of the bird were recorded.

Chuditch

Opportunistic observations for evidence of the Chuditch (*Dasyurus geoffroii)* were conducted for the duration of the four day survey. Surveys were conducted in accordance with the DotE survey guidelines for threatened mammals.

Given the results from this targeted survey effort, biology, habitat requirements, the quality and availability of suitable habitat and records of Chuditch in the area, the likelihood of occurrence assessment concluded that it was possible that Chuditch could occur within the Project Area. It should be noted that the home range for Chuditch is larger than the Project Area (55–120 ha for females and up to 400 ha for males) (Van Dyke, 2008) and therefore it is unlikely that the Project Area provides a significant proportion of the habitat or resource requirements for any individuals or populations of Chuditch.

Likelihood of occurrence

The desktop searches identified 25 terrestrial conservation significant fauna species that potentially could occur within 20 km of the Project area. An assessment on the likelihood of conservation significant fauna species occurring in the Project Area was conducted (GHD 2013a - Appendix D). This assessment was based on species biology, habitat requirements, the quality and availability of suitable habitat and records of the species in the area.

Section 1 does not offer any habitat of high value for conservation significant species. This assessment found that species of conservation significance were unlikely to occur in Section 1. Sections 2 and 3 have several habitat attributes that are similar, and the sections are directly adjacent to each other. As such, the likelihood of occurrence assessment considered the two sections to have the same outcome for each of the conservation significant species.

Seven species are considered possible or likely to occur within Sections 2 and 3 of the Project Area. A summary of this assessment is presented in Table 15.

Table 15 Summary of likelihood of occurrence assessment

Species name	Common name	Status			Database search		Outcome of assessment
		WC Act	EPBC Act	DEC	Nature Map	EPBC	
Birds							
Botaurus poiciloptilus	Australasian Bittern	T	E			X	Unlikely
Burhinus grallarius	Bush Stone-curlew			P4	X		Unlikely
Calyptorhynchus latirostris	Carnaby's Black Cockatoo	T	E		X	X	Likely
Falco peregrinus	Peregrine Falcon	S			X		Possible
Hylacola cauta subsp. *whitlocki*	Shy Heathwren (western)			P4	X		Unlikely
Leipoa ocellata	Malleefowl	T	V; Mi		X	X	Unlikely
Merops ornatus	Rainbow Bee-eater	IA	Mi		X		Likely
Platycercus icterotis subsp. *xanthogenys*	Western Rosella (inland)			P4	X		Possible

Psophodes nigrogularis subsp. *oberon*	Western Whipbird (Mallee)			P4	X		Unlikely
Pezoporus wallicus flaviventris	Western Ground Parrot	T	E			X	Unlikely
Reptiles							
Acanthophis antarcticus	Southern Death Adder			P3	X		Unlikely
Lerista viduata	Ravensthorpe Range Slider			P1	X		Possible
Mammals							
Dasyurus geoffroii	Chuditch	T	V		X	X	Possible
Isoodon obesulus subsp. *fusciventer*	Quenda			P5	X		Unlikely
Macropus eugenii subsp. *derbianus*	Tammar Wallaby (WA subsp)			P5	X		Unlikely
Macropus irma	Western Brush Wallaby			P4	X		Possible
Myrmecobius fasciatus	Numbat	T	V		X		Unlikely
Parantechinus apicalis	Dibbler	T	E		X	X	Unlikely
Phascogale calura	Red-tailed Phascogale	T	E		X	X	Unlikely
Pseudomys occidentalis	Western Mouse			P4	X		Unlikely
Pseudomys shortridgei	Heath Mouse	T	V		X	X	Unlikely

IA = protected under international agreement; P1 = Priority 1; P2 = Priority 2; P3 = Priority 3; P4 = Priority 4; P5 = Priority 5; S = other specially protected fauna; Mi = migratory; T = Threatened; V = Vulnerable; E = Endangered

3.10.5 Key potential impacts

There is potential for the Project to impact on fauna species of conservation significance, in particular Migratory species and WC Act and EPBC Act listed fauna species that are possibly or likely to occur within the Project Area.

Rainbow Bee-eater

The Rainbow Bee-eater is a reasonably common bird in the Ravensthorpe area and there is suitable habitat within the Project Area and surrounds. Therefore it is unlikely that this species will be impacted significantly by the Project.

Carnaby's Black Cockatoo

The key potential issue to Carnaby's Black Cockatoo species within the Project Area is the loss of habitat including the:

- Loss of up to 19.5 ha of foraging habitat in the Project Area
- Loss of suitable diurnal (loafing) and potential night roosting habitat within Sections 2 and 3 of the Project Area
- Loss of potentially suitable breeding habitat in the form of 145 large trees with large hollows located in close proximity to water within Sections 2 and 3 of the Project Area

Malleefowl and Chuditch

An assessment of the potential impacts to Malleefowl and Chuditch from the Project may benefit from informal discussions with DER; however, any such assessment is likely to conclude the potential for the RHHR Project to impact on either species is limited.

Short Range Endemic species

The impacts to SRE species is currently unknown due to the lack of species identifications currently available. The potential impacts of clearing on SRE invertebrates may be categorised as:

- Direct impacts
- Indirect impacts.

Direct impacts are the obvious and unavoidable destruction or degradation of habitat, generally native vegetation that occurs due to clearing (e.g. road corridors, lay down areas, borrow pits etc). Indirect impacts are generally gradational, and more difficult to predict and manage because they may occur at moderate to large distances from the project footprint. These impacts may be expressed some time after clearing has occurred.

The zone of influence for indirect impacts may be considerably larger than areas of direct distance. Potential indirect impacts of clearing for road construction include:

- Alteration of surface hydrology regimes, sedimentation, and water quality (e.g. under roads and infrastructure).
- Surface water contamination from plant equipment and infrastructure.
- Dust deposition.
- Vibration disturbance from heavy vehicles.
- Risk of extinction from reduction and/or fragmentation in habitat.

3.10.6 Recommendations

Planning and design

- Given the Project is likely to have impacts on conservation significant fauna and their habitats (e.g. Carnaby's Black Cockatoo), the Project would require referral to the DotE.

Construction Phase

- GHD recommends that immediately prior to the clearing of vegetation that a pre-clearance fauna survey be conducted to remove any fauna that may be displaced in the clearing process. This recommendation should be included in the EMP.

Short Range Endemic species

- Until the specimens have been identified no specific conclusions can be reached. The habitats examined within stages 2 and 3 of the RHHR appear to be continuous within the

local area and are therefore unlikely to form habitats that would encourage the existence of SRE species within the area, however, this conclusion will be informed by the species recorded when information becomes available.

3.11 Heritage

3.11.1 Key aspect - European Heritage

No Commonwealth Heritage-listed places were identified, but one nominated National Heritage area traverses the eastern area of the Project (DSEWPaC 2013). The Fitzgerald River Ravensthorpe Range Area is a biodiversity hotspot and has been described as forest, woodland and heath "characterised by high endemism among plants and reptiles.

A search of the Heritage Council of WA (HCWA 2013) identified 63 Heritage sites within the search area (HCWA, 2013), however none of these sites are located within 100 m of the Project Area and as such the expected works are not expected to impact on these sites.

No perceived impacts or recommendations are warranted for this environmental aspect of the Project. However should impacts become apparent as further development progresses, Main Roads will implement the *Corporate Procedure Environmental Guideline – Heritage*.

3.11.2 Key aspect - Indigenous Heritage

A search of the Department of Indigenous Affairs (DIA) Aboriginal Heritage Inquiry System (DIA 2012) identified ten indigenous Heritage sites within 5 km of the Project Area. The DIA inquiry system separates “registered aboriginal sites” and “other Heritage places” into two categories. The inquiry identified two “registered aboriginal sites” and eight “other Heritage places” within 5 km of the Project Area.

Table 16 Indigenous Heritage identified in the desktop search

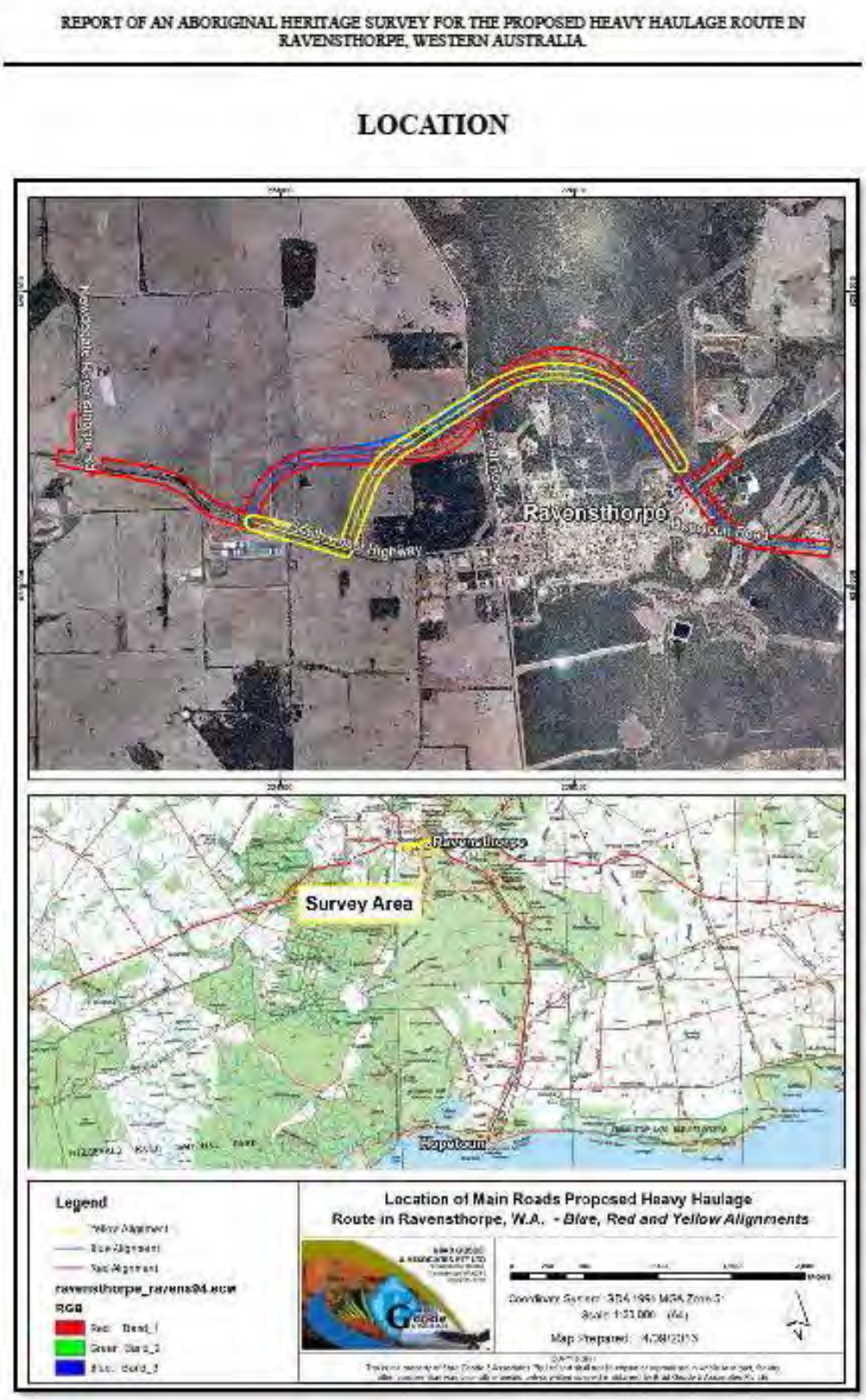
Site ID	Site name	Site type	Status
21378	Jerdacuttup River	Mythological	Registered
26270	Mt Cattlin 2	Artefacts/Scatter	Registered
21598	Rav/01 – Marked Tree	Modified tree	Insufficient Information
26267	Ravensthorpe Ceremonial Area	Ceremonial/Historical	Lodged
26269	Mt Cattlin 1	Artefacts/Scatter	Lodged
26271	Mt Cattlin 3	Man-made Structure/ Artefacts/ Scatter	Lodged
26272	Mt Cattlin 4	Artefacts/Scatter	Lodged
27015	Old Ravensthorpe Burial Ground	Skeletal material/Burial, Historical	Lodged
29333	Mt Cattlin isolated Finds	Isolated artefacts	Lodged
29352	Cattlin Creek	Mythological, Historical	Insufficient Information

Site identification Aboriginal heritage survey

Brad Goode and Associates was commissioned to conduct a site identification Aboriginal heritage survey of three alignment options under consideration. Each of the alignment’s incorporated a 100 m wide corridor (Brad Goode and Associated 2013 – Appendix E). Figure 5 displays the Project Area with regard to the three alignment options surveyed by Brad Goode

and Associates. The entirety of the Project Area was assessed by one or more of the three options as part of the Aborigianal heritage surveys undertaken by Brad Goode and Associates.

Figure 5 Aboriginal heritage survey area (Brad Goode and Associated 2013 and 2014)



As the Project is currently planned the most southern portion of the extent of Site ID 26270 Mt Cattlin 2 will be directly affected by the red alignment and the outer extremity of the yellow and blue alignments.

Main Roads will not affect the scientific values of the site if the yellow or blue alignment is chosen as this portion of the site (70m x 30m) was previously salvaged in connection with a Section 18 consent notice sought by Galaxy Resources in 2011 Therefore a new Section 18 consent notice may not be necessary if Main Roads select the yellow or blue options.

Main Roads should clarify this by writing to the registrar and seek a reassessment of the sites boundary and status in relation to their obligations under the AHA (see Guilfoyle 2009, O'Reilly 2013).

Research has also determined that Place ID 29352 Cattlin Creek would be directly affected by the red alignment but not the yellow or blue options. Should Main Roads choose the red alignment, application for ministerial consent under Section 18 of the AHA would be required.

Place ID 26267 Ravensthorpe Ceremonial Area is identified to be located adjacent to the South Coast Highway 140m to the east of the proposed intersection with the proposed alignments. If the South Coast Highway is widened at this point some potential exists to affect this place which is yet to be assessed against Section 5 of the AHA.

Main Roads could also seek to have the reported values at this place re-assessed as the details reported to date would unlikely meet the definition of a site under Section 5 of the AHA. Alternatively should Main Roads plan to affect this place then an application for ministerial consent under Section 18 of the AHA would be required.

As a result of the consultations held with representatives from the Wagyl Kaip WC98/70 and Esperance Nyungars WC96/94 native title claim groups no new ethnographic sites of significance as defined by Section 5 of the AHA were identified to affect any of the three alignment options.

Of the three alignments options presented the yellow and blue alignments were preferred by the Aboriginal informants. The groups identified that no sites as defined by Section 5 of the AHA will be affected by the blue or yellow alignment options. In their opinion no Section 18 applications would be required for the yellow or blue alignment options.

The red alignment option was not acceptable to those consulted as it would affect the Cattlin Creek and the portion of the site Mt Cattlin 2 that still contained cultural material. All those consulted stated that they would not support a Section 18 application for this red alignment option.

During the survey the informants requested the engagement of Aboriginal monitors for works near any DAA sites or places and in particular the area on the eastern side of Floater Road bordering the Cattlin Creek. In regard to potential Project works near Cattlin Creek the informants requested a 50m buffer zone from the creek.

Archaeological survey of the Main Roads RHHR 2013

Brad Goode and Associates was commissioned to conduct an archaeological survey of the Project Area. The archaeological survey was undertaken to identify and record any Aboriginal archaeological sites that may be located within the Project Area in order that Main Roads can avoid disturbing them or, as required under Section 18 of the *Western Australian Aboriginal Heritage Act 1972*, seek the consent of the Minister for Aboriginal Affairs to proceed with activities that may disturb Aboriginal heritage sites.

During the course of the archaeological survey described in this report, that part of the Site ID 26270 Mt Cattlin 2 artefact scatter that coincides with the designated survey area was targeted and scrutinized for the presence of Aboriginal archaeological material. As a consequence, no Aboriginal archaeological artefacts were identified. This is consistent with the results of the archaeological salvage referred to above where all visible artefacts were collected and subsequently placed in another part of the Site ID 26270 Mt Cattlin 2 artefact scatter.

The Place ID 26267 Ravensthorpe Ceremonial Area is according to information contained in the relevant file held at the Department of Aboriginal Affairs, a place where ceremonies took place in the historic past. Although it appears on the Aboriginal Sites Database as having a historical component, there is no mention of any Aboriginal historical material or artefacts in the relevant file. During the course of the archaeological survey the Ravensthorpe Ceremonial Area other heritage place was targeted and scrutinized for the presence of Aboriginal archaeological material. As a consequence, no Aboriginal archaeological artefacts or material were identified.

The information pertaining to the Place ID 26267 Ravensthorpe Ceremonial Area that has been lodged with the Registrar of Aboriginal Sites has been assessed as insufficient to complete an assessment within the terms of section 5 of the *Aboriginal Heritage Act 1972*. Consequently, the Place ID 26267 Ravensthorpe Ceremonial Area appears on the Department of Aboriginal Affairs' Aboriginal Sites Database as 'Other Heritage Place'. Despite this, the provisions of the *Aboriginal Heritage Act 1972* still apply to this other heritage place until it is assessed as a place to which the *Aboriginal Heritage Act 1972* does not apply.

As a result of the archaeological survey of the designated survey area, no Aboriginal archaeological sites were identified.

Archaeological survey for the amended sections of the proposed RHHR 2014

Brad Goode and Associates was commissioned to conduct further archaeological survey for Aboriginal heritage sites for the modified sections of the proposed Ravensthorpe Heavy Haulage Route that was previously surveyed by O'Reilly in 2013. Specifically, Main Roads required the archaeologist to survey a connecting ramp to Floater Road and a section of the Heavy Haulage Route where widening of the corridor is required to facilitate a connection point with the South Coast Highway (see Figure 1 - Brad Goode and Associated 2014, Appendix E). Resulting from this brief Mr Stuart Johnston conducted the inspection on the 20th to 21st of January, 2014.

No archaeological sites or cultural material as defined by section 5a of the AHA were identified at the Floater Road survey area. Near where the Heavy Haulage Route is proposed to intersect the South Coast Highway, several flaked pieces (16) of white porcelain identified to be telegraph line insulators, manufactured by Buller's Ltd. London circa 1890-1950 (see Museum Victoria) were identified, as well as two flaked pieces of glass. All these flaked pieces of porcelain and glass were identified within the survey area, and located at 226807mE 6280728mN (UTM GDA 94, Zone 51).

It was concluded that the porcelain insulator and flaked glass is unlikely to be of Aboriginal origin. Therefore, no new archaeological sites, as defined by section 5 of the *Aboriginal Heritage Act 1972* were located within or in close proximity to the survey area. In addition, no isolated artefacts were located during this archaeological survey.

It is therefore recommended that the Project may proceed as planned with a low risk of breaching section 17 of the AHA as the material recorded cannot be definitely identified to be associated with Aboriginal tool making practices.

3.11.3 Key potential impacts

Unless the 'red alignment' option is selected, the proposed alignments will not impact the scientific vales of the site. If the 'red alignment' is selected then Place ID 29352Cattlin Creek will be impacted and a Section 18 consent notice will be required under the AHA.

Neither the blue nor yellow alignment will impact the Cattlin Creek site. Re-assessment of the Site boundaries however is recommended to confirm that this Project will not impact any scientific values.

Stakeholder consultation with the Aboriginal working group confirmed there are no new Sites impacted by this Project.

3.11.1 Recommendations

It is recommended that Main Roads Western Australia be allowed to proceed with their proposal to construct a heavy haulage route at Ravensthorpe within the survey area defined in this report on the condition that they avoid any impact upon or disturbance to the registered Mt Cattlin 2 artefact scatter (Site ID 26270) and/or the Ravensthorpe Ceremonial Area (Place ID 26267) other heritage place.

If it is necessary to disturb the previously salvaged southern portion of the Site ID 26270 Mt Cattlin 2 artefact scatter, then it is recommended that Main Roads Western Australia apply to the Registrar of Aboriginal Sites in writing seeking a review of the status and extent of the Site ID 26270 Mt Cattlin 2 artefact scatter. Specifically, this review should be sought in light of the previously issued consent to use the land containing parts of the Site ID 26270 Mt Cattlin 2 artefact scatter granted to Galaxy Resources Limited by the then Minister for Aboriginal Affairs the Hon. Peter Collier MLC, on 15 June 2011 under Section 18(3) of the *Aboriginal Heritage Act 1972*, and in terms of the O'Reilly (2012a) salvage report. If such a review is sought, it is recommended that the Registrar of Aboriginal Sites amend the extent of the Site ID 26270 Mt Cattlin 2 artefact scatter to exclude the previously salvaged southern portion as detailed in the O'Reilly (2012a) report.

It is also recommended that Main Roads Western Australia seek the advice of the Registrar of Aboriginal Sites with specific regard to any further approvals that may be required in relation to that part of the Site ID 26270 Cattlin 2 artefact scatter that has been previously salvaged and which coincides with their proposed heavy haulage route.

If it is necessary to disturb any part of the Site ID 26270 Mt Cattlin 2 artefact scatter that has not been previously salvaged, Main Roads Western Australia, as required under Section 18 of the Western Australian Aboriginal Heritage Act 1972, need to apply to the Minister for Aboriginal Affairs for consent to proceed with activities that will disturb Aboriginal heritage sites. If such an application is made, it is recommended that consent should be granted to proceed with activities that will disturb part(s) of the Site ID 26270 Mt Cattlin 2 artefact scatter that has not been previously salvaged conditional upon the detailed recording of that part of the artefact assemblage contained within the area that is the subject of the application.

If it is necessary to disturb any part(s) of the Place ID 26267 Ravensthorpe Ceremonial Area, Main Roads Western Australia, as required under Section 18 of the *Western Australian Aboriginal Heritage Act 1972*, need to apply to the Minister for Aboriginal Affairs for consent to proceed with activities that will disturb Aboriginal other heritage places. If such an application is made, it is recommended that consent should be granted to proceed with activities that will disturb the Place ID 26267 Ravensthorpe Ceremonial Area unconditionally as this other heritage place does not contain any Aboriginal cultural material.

It is also recommended that, in the event of any artefactual material or skeletal material being discovered in the course of constructing a heavy haulage route at Ravensthorpe or any other

activities, work should stop while the Department of Aboriginal Affairs carry out an investigation. In the case of skeletal material being uncovered, work must cease immediately and the Western Australian Police must be notified. Furthermore, it is recommended that Main Roads Western Australia personnel and contractors be advised of their obligations under Section 15 of the *Aboriginal Heritage Act 1972*, to report the discovery of any Aboriginal cultural material which may be uncovered in the course of their work or any other activities.

Indigenous Heritage measures will be included in the Project EMP, and actioned accordingly if Heritage sites are found during Project works.

3.12 Noise and vibration

3.12.1 Key aspect

A road traffic noise assessment was undertaken for the Project (GHD 2013b – Appendix F). The purpose of the assessment was to determine whether the road traffic noise impact from the planned RHHR (and changes to the surrounding road network) is likely to be significant and if so, its degree of significance.

Attended and unattended monitoring was undertaken in the Ravensthorpe area. Unattended noise logging results suggest that sounds of nature (such as wind through the trees and insects) as well as traffic noise had a significant impact on measurements, with noise measurements being higher than expected for the measured traffic flow.

Attended monitoring results better reflected traffic noise as personnel undertaking the measurements were able to observe any potential additional noise sources that may add to noise emissions.

Traffic noise impacts were modelled using CadnaA, a computer program for the calculation, assessment and prognosis of noise exposure. Noise sources were generated to simulate traffic noise for the following scenarios to simulate traffic noise sources:

- Baseline 2013
- Build day of opening 2015
- Build 2030
- No build 2030

The CadnaA model was compared to monitoring data to ensure its accuracy.

3.12.2 Key potential impacts

In general, noise impacts on the Ravensthorpe townsite receptors are predicted to decrease following construction of the Project, as the majority of the heavy vehicles will be diverted away from the SCH. Receptors closer to the Project Area are predicted to have an increase in noise impacts. However, for both the build and no-build options, noise impacts are below target noise levels at the majority of receptors.

The only predicted exceedance was during the no build scenarios at Receptor 34 (Ravensthorpe District High School). The schools proximity to the intersection of Hopetoun Road and SCH results in the additive noise exceeding the noise limits. However, the new proposed alignment diverts Hopetoun Road. This means that predicted noise impacts at the high school are below targets in the build scenarios.

As no receptors are predicted to exceed the noise targets during the build scenarios, noise mitigation is not required for the Project.

However should impacts become apparent as further development progresses any noise and vibration impacts will be managed through the Project EMP.

Construction noise will occur due to earth works, road rehabilitation works and vehicle movement within the Project Area. Management of these issues should be clearly outlined in the EMP for the Project.

3.13 Air quality

3.13.1 Key aspect

An air assessment was undertaken for the Project (GHD 2013c – Appendix G). The purpose of the assessment was to determine whether the local air quality impact from the planned RHHR (and changes to the surrounding road network) is likely to be significant and if so, its degree of significance.

The major vehicle pollutants include products of combustion such as carbon monoxide (CO), oxides of nitrogen (NO_x), particulate matter with an aerodynamic size of less than 10 micron (PM_{10}) and less than 2.5 micron ($PM_{2.5}$), polycyclic aromatic hydrocarbons (PAHs) and volatile organic compounds (VOCs), including benzene, toluene, xylenes, formaldehyde and acetaldehyde. The air assessment estimated pollution generated by vehicles using projected traffic volumes and vehicle emission rates as inputs to a dispersion model.

- Scenario 1: Current network (no build 2013)
- Scenario 2: Day of opening (assumed to be 2015) (build 2015)
- Scenario 3: 15 years after day of opening (build 2030)
- Scenario 4: Current network 15 years after planned opening (no build 2030)

Emission rates from petrol and diesel vehicles for different vehicle types, speeds and road gradients were derived as required.

Air quality impacts are assessed by comparing monitoring results or model predictions with appropriate ambient air criteria. The criteria referred to in this assessment include National Environment Protection Measures (NEPM) and World Health Organisation (WHO) criteria.

Ambient concentrations of PM_{10} are monitored in Albany (approximately 280 km south west of the Project Area). The 75^{th} percentile concentration was adopted as a background value for PM_{10}. Background concentrations of other pollutants assessed are not monitored routinely and are assumed as zero.

Eighty sensitive receptors (residences, schools etc.) adjacent to the alignment were identified and assessed.

Traffic emissions were modelled using the AUSROADS dispersion model for a representative model year. Predicted ground level concentrations were assessed against air quality criteria at appropriate averaging periods for each pollutant.

3.13.2 Key potential impacts

The highest predicted pollutant concentrations at both user-defined and automatically generated receptors were compared to predetermined assessment criteria. The modelling results show that for all scenarios predicted concentrations for each modelled pollutant comply with the relevant air quality criteria.

The results of this air assessment demonstrate that the Project is not predicted to have an adverse impacts on local air quality, and that receptors within the townsite have lower predicted pollutant concentrations after construction of the RHHR.

No impacts are identified or recommendations warranted for this environmental aspect.

3.14 Visual amenity

3.14.1 Key aspect

The proposed alignment is located, for the majority, in land zoned rural. A mixture of native and introduced flora species is present in the two areas zoned recreational. From the aerial photography, it appears as though there are two residences, a motel and a Caravan Park within 100 m of the Project Area.

3.14.2 Key potential impacts

The local visual amenity will be impacted as a consequence of:

- Vegetation Clearing;
- Machinery movements;
- Traffic noise exposure;
- Increased traffic flow;
- Visibility of the highway and safety barriers; and
- Demolition of properties.

Given the current land use adjacent to the Project Area (i.e. generally agricultural), and the strip of vegetation expected to be impacted, the road may become more visible to residences along the highway.

The Project design includes the construction of safety barriers potentially impacting the visual amenity of residents adjacent the Project. To mitigate these impacts, Main Roads has prepared a Landscape and Revegetation Plan.

Management of these issues should be clearly defined through the preparation and implementation of the EMP for the Project.

3.15 Dieback

3.15.1 Key aspect

Great Southern Bio Logic was commissioned to prepare a Dieback Assessment and Associated Management Plan for the Project (GSB 2013b – Appendix H).

The presence or absence of Phytophthora is commonly determined by the impact of disease on species known to be susceptible to the plant pathogen. Where vegetation contains no or few susceptible species, it is typically referred to as uninterpretable. Little Phytophthora survey effort has been undertaken in vegetation units across the survey area and therefore testing of the susceptibility of the specific species that occur in these vegetation types has not been undertaken.

In an attempt to provide some meaningful data for the Phytophthora survey of the proposed Ravensthorpe Bypass Project Area, potential indicator species were identified based on susceptibility of other species within the same genus, family or order. Where deaths of these species were identified, soil and tissue samples were collected for analysis.

All vegetation within the Project Area has been classified as uninterpretable due to the insufficient density of susceptible species. However, several susceptible species and potentially susceptible species were identified in low densities across the Project Area.

Accordingly, six samples were collected from indicator species deaths and all samples returned negative results for Phytophthora. While this suggests that the area is likely to be free of the pathogen it is not possible to categorically determine the absence of the disease due to the low density of susceptible species.

Several unmappable areas were also identified and not surveyed as no disease distribution information can be gained from areas where native vegetation has been removed or degraded.

3.15.2 Key potential impacts

Despite the area being classified as uninterpretable, possible introduction of the disease would have a detrimental influence to the health of vegetation in neighbouring areas, including the Fitzgerald River National Park.

3.15.3 Recommendation

General operational best practice hygiene is recommended and should be incorporated into the EMP including:

- All machinery, vehicles, equipment and materials must be effectively cleaned down prior to arrival at the Project Area and prior to commencing construction works.
- Effective cleandown should be performed at a controlled location where all cleandown effluent can be contained and restricted from entering receiving environments that may impact native vegetation that may be uninfested by Phytophthora.
- Imported materials, such as gravel, to be used as road base must not be sourced from an area known to be infested with Phytophthora in accordance with the Dieback Management Plan.
- All cleared vegetation may be mulched and re-used onsite.

3.16 Construction phase impacts

A range of impacts requiring consideration and management during the Project's construction phase are predicted or possible. These include:

- Noise and vibration
- Dust production
- Fire
- Pollution through the use of fuels, chemicals or from general construction litter
- Traffic management requirements.

These impacts are expected to be short term (approximately 15-18 months) and are likely to be limited to the construction site and its near environs, including the local road system. The management of these impacts should include the following consideration and general actions where appropriate.

Management of these issues should be clearly defined through the preparation and implementation of the EMP for the Project.

3.16.1 Noise and vibration

Construction noise will occur due to earth works, road rehabilitation works and vehicle movement within the Project area. Management of these issues should be clearly outlined in the EMP for the Project.

3.16.2 Dust emissions

Dust is likely to result from road construction and materials cartage operations, with impacts expected to be localised to the Project Area and transport routes.

Dust emissions may result from construction activities, particularly during summer. Dust can impact the amenity of local residents and regional air quality. Dust emissions may result from traffic movement, earth moving, operation of vehicles and plant equipment, excavation, vegetation clearing and stockpiled materials.

These emissions are typically short term impacts during construction, and will be managed through the EMP.

3.16.3 Fire

Fire can pose a threat to human life, property and livestock as well as flora and fauna. The Project is located in an area that is mostly cleared for livestock grazing and farming, however a portion (approximately 2 km) of the Project is located within uncleared land. As such fire management is recommended to ensure no significant impact to existing fire regimes occur.

Fire management including vehicle restrictions will be detailed in the EMP.

3.16.4 Pollution and litter

There is a minor risk that the construction works will create temporary or localised pollution/contamination as a result of fuel or chemical spills or mismanagement of construction materials. This should be managed through the following general actions:

- Any bulk fuel and oil stores should be bunded and managed in accordance with relevant Australian Standards;
- If vehicle or machinery servicing is to occur on site, it should occur in designated servicing areas which are supplied with adequate spill trays and spill response equipment; and
- All litter and construction waste should be contained in lidded bins and removed regularly to an approved waste refuge facility.

Management of these issues should be clearly outlined in the EMP for the Project.

3.16.5 Waste and hazardous materials

Construction works are likely to generate general waste as well as construction 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 terrestrial ecosystems.

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 may result in contamination of adjacent land. Consequently, hazardous materials will require management during construction.

Appropriate storage and use of hazardous substances will be included in the EMP to decrease the likelihood of spills and regulate the disposal of wastes.

3.16.6 Traffic management requirements

Increased traffic volumes arising from the movement of construction and transport vehicles may result in some localised short-term adverse impacts on local and regional traffic movements. The following potential impacts have been identified:

- Injury to pedestrians, cyclists and road users due to construction vehicles operating at the sites;
- Potential damage to roads and spillage of carted materials, particularly sand; and
- Altered public access to Gibson Park and the Fremantle Public Golf Course.

Management strategies to be employed should include:

- The use of appropriate personal safety and traffic management signs;
- Advance notification of construction activities, particularly to local residents and golf course users; and
- Any significant amounts of material spilled from construction vehicles should be cleaned up on occurrence.

Management of these issues should be clearly outlined in the EMP for the Project.

4. Environmental approvals

4.1 Commonwealth approvals

4.1.1 Referral to the Department of the Environment

The Commonwealth EPBC Act provides legislative protection for MNES, including all nationally threatened fauna and flora species and ecological communities. An action must be referred to DotE under the EPBC Act if it will have, or is likely to have, a significant impact on any of the MNES.

GHD has prepared and submitted an EPBC referral on behalf o MRWA to address the potential impacts of the Project to relevant MNES.

The desktop and field assessments have assessed potential impacts on MNES and determined that there are three (3) EPBC Act-listed species that may be impacted by this Project:

- Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*) – Endangered;
- Chuditch (*Dasyurus geoffroii*) – Vulnerable; and
- Rainbow Bee-Eater *(Merops ornatus)* – Terrestrial Migratory.

It was determined after reviewing the DotE Significant Impact Policy Statement 1.1 (DotE 2013b) that the Clearing of up to 19.5 ha of fauna habitat for the Project is unlikely to have a significant impact on either the Chuditch or Rainbow Bee-Eater.

The key potential issue to the Carnaby's Black Cockatoo resulting from the Project is habitat loss including the:

- Loss of up to 19.5 ha of foraging habitat from the Project Area.
- Loss of suitable diurnal (loafing) and potential night roosting habitat in sections 2 and 3 of the Project Area.
- Loss of potentially suitable breeding habitat in the form of 150 potential breeding trees (including 13 trees with hollows deemed potentially suitable for nesting) located in close proximity to water in sections 2 and 3 of the Project Area.

An assessment of the Significant Impact Criteria was undertaken according to the DotE Significant Impact Policy Statement 1.1 (DotE 2013b) and it was determined that the proposed Project is unlikely to have a significant impact on Carnaby's Black Cockatoo.

4.2 State approvals

4.2.1 Referral to the Environmental Protection Authority

Significant proposals (e.g. subdivision and development applications) must be referred to the EPA under Section 38 of the *Environmental Protection Act 1986* (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 EPA considers that environmental significance is a function of:

- The extent and consequence of impacts on biophysical aspects.
- The environmental values of the areas affected.

- The extent of emissions and their potential to unreasonably interfere with the health, welfare, convenience, comfort or amenity of people;
- The extent and rigour to which potential impacts have been investigated and described in the referral, and the confidence in the reliability of predicted impacts;
- The extent to which the proposal implements the principles of sustainability;
- The ability of decision-making authorities to place conditions on the proposals to ensure required environmental outcomes are achieved; and
- The likely level of public interest and the extent to which the proponent has consulted with interested and affect people and responded to issues raised.

Based on this assessment it does not appear that the Project will have a significant environmental impact, assuming appropriate Project design and implementation of environmental management measures. However, for regulatory certainty and public assurance Main Roads has chosen to refer the Project.

4.2.2 Department of Environmental Regulation

Vegetation clearing

The clearing of any native vegetation is regulated by the DER and requires a permit under Part V of the EP Act. Main Roads has been issued with a Statewide Purpose Clearing Permit (CPS 818/9) which allows for road works clearing and prescribes specific management and offset requirements. This Project would be assessed under the CPS 818/9.

5. Environmental Management Plan

5.1 Purpose of the Environmental Management Plan

The purpose of this Environmental Management Plan (EMP) is to provide a document to guide the development of each section of the Project prior to, during and post construction in order to comply with environmental licences, approvals and reflect the environmental commitments made by Main Roads WA.

This EMP has been developed with reference to Main Road's Preliminary *Environmental Impact Assessment and Environmental Management Plan (Minor Projects)* (Document No 6767/047) and *Environmental Impact Assessment and/or Environmental Management Plan (Internal)* (Document 6707/013).

5.2 Key environmental issues

The Project has the potential to impact a number of existing environmental aspects of the Project Area and immediate surrounds. Potential impacts to the existing environment include:

- Disturbance and loss of native vegetation, flora and fauna habitats;
- Disruption to native fauna;
- Introduction and/or spread of weeds;
- Spread of dieback;
- Changes to visual amenity; and
- Contaminated sites.

5.3 Construction phase impacts

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

- Noise and vibration;
- Dust emissions;
- Fire;
- Pollution and contamination;
- Waste and hazardous materials;
- Traffic access and safety;
- Aboriginal heritage salvage and monitoring;
- Materials transport to site and supply of construction materials;
- Use of water in construction; and
- Gravel and limestone aggregates.

These impacts are expected to be short term and limited to the construction site and its near environs, including the local road system. Management of these issues will be defined through the preparation and implementation of the EMP.

5.4 Communication

5.4.1 Communication Plan

Environmental issues specific to the project will be communicated as follows:

Method	Frequency	Participants	Reference	Record
Project Site				
Induction	Prior to Work	All personnel and subcontractors	EMP and Contractor Environmental Policy	Induction Records
Toolbox Meetings	Weekly	Project Personnel	Contractor Safety Plan	Minutes of Meeting
Contract Meetings	As required	Main Roads' Project Manager and Contractor Project Manager	EMP	Minutes of Meeting
Authority Consultation				
Department of Environment Regulation	As required	Main Roads' Project Manager and Contractor Project Manager	-	Minutes of meeting
Department of Water	As required	Main Roads' Project Manager and Contractor Project Manager	-	Minutes of meeting
Department of Aboriginal Affairs	As required	Main Roads' Project Manager and Contractor Project Manager	-	Minutes of meeting

Main Roads should consult with media representatives and members of the public as required. The construction contractor should respond to complaints from external organisations or individuals promptly to minimise the potential for environmental damage and to ensure ongoing compliance. There should be a mechanism to capture and share this correspondence with Main Roads.

5.4.2 External Communication and Complaints

A complaints register shall be maintained by the contractor. All complaints received shall be forwarded to the Main Roads' Project Manager for action. Serious complaints, for example spillages or excessive dust, shall be investigated within 24 hours of the complaint being received.

5.4.3 Inductions and training

Construction personnel should be made aware of the environmental considerations of the potential impacts associated with the Project and required management commitments to ensure they do not unknowingly damage the environment. It is recommended that emergency training in relation to fires, chemical spills and/or other risks be carried out as early as practicable in the construction phase.

5.5 Management of environmental incidents

The process that will be followed in the event of an environmental incident occurring should specify:

- Reporting of the incident in an incident log;
- Time limits for incident reporting and response;
- Assessment of the significance of each incident;
- Discontinuation of the work which gave rise to the incident;
- Reporting incidents to regulatory authorities and stakeholders; and
- Satisfactory and timely remediation/mitigation of impacts.

5.5.1 Contingency and corrective action

The construction contractor should establish, implement and maintain an Incident and Improvement system to deal with actual and potential incidents and for taking corrective and preventive actions that arise from the Project.

The system should define requirements to:

- Identify and correct any associated non-conformity(ies) and take action(s) to mitigate their environmental impacts
- Investigate incidents, determine their cause(s) and take action to prevent their recurrence;
- Evaluate the need for action(s) to prevent a similar incident and implement appropriate actions designed to avoid their occurrence;
- Record the results of corrective action(s) and preventive action(s) taken; and
- Review the effectiveness of corrective action(s) and preventive action(s).

5.6 Record keeping

It is expected that document control associated with this Project will include an appropriate and auditable record system. This should be maintained throughout the Project life. Main Roads and the Construction Contractor should implement and maintain an environmental record keeping system to identify, store, protect, retrieve, retain and dispose of records and reports. The Project records and reports should be legible, identifiable and traceable; and include:

- Inspection, maintenance and calibration records;
- Training and induction attendance records;
- Pertinent sub-contractor and supplier records;
- Legal compliance records;
- Internal and external audit reports;
- Monitoring and measurement results;
- Complaint records;
- Internal and external communication records;
- Non-conformance reports;
- Incident reports; and
- Remedial actions taken following incident reports.

5.7 Inspections and monitoring

An environmental inspection and monitoring program should be developed to verify the management of environmental risks and the compliance with the management plan(s). Main Roads should ensure the person completing the inspection and monitoring program has the necessary competency, impartiality and objectivity to complete this workto the standard required. An indicative inspection schedule is listed in Table 17.

Table 17 Indicative inspection and monitoring schedule

Inspection frequency	Aspect to be inspected	Scope
At installation of clean-down facilities	Drainage Management	Compliance of clean-down facilities
Following heavy rainfall events	Drainage Management	Minimisation of soil loss from the work areas; and Minimisation of modified existing drainage patterns.
6 months post-construction	Landscape and Revegetation Plan	Landscaping and revegetation consistent with plan
Monthly	Drainage Management	Minimisation of pollution of the surrounding environment due to contaminated surface water runoff.
	Weed Management	Adequacy of Project weed control measures
	Noise Management	Compliance with the *Environmental Protection (Noise) Regulations 1997* with regard to construction work hours and noise management.
	Storage and Handling of Hydrocarbons and Chemicals	Chemicals stored on-site are compliant with AS1940-1993 and AS/NZ 3833-1998 and potential spill risks are mitigated.
	Waste Management	Compliance with waste storage/transfer and disposal legislative requirements.
During clearing operations	Vegetation clearing, topsoil management and rehabilitation	Compliance with native vegetation clearing permit. Clearing of native vegetation minimised. Visual inspection for spread of weeds.
	Fauna Management	Disturbance of fauna habitats minimised.
Daily during dry conditions	Dust Management	Dust generated during construction minimised. No complaints received regarding dust produced from Project works.

5.8 Auditing

The implementation of the EMP will be audited by a Main Roads staff six (6) weeks after the contractor takes possession of site. member. Audits will be repeated every three (3) months until the Project reaches practical completion.

5.9 Environmental management

5.9.1 Section 1

Table 18 Environmental Management Plan - Section 1

Aspect	Potential Impact	Objective	Management Actions	Monitoring/ Audit Compliance Measures	Responsible Person	Timeframe
Pre-Construction						
Vegetation	Loss of fauna habitat. Loss of native vegetation	Reduce the footprint of the Project to minimise impacts to vegetation and retain fauna habitat.	Detailed design will take into account native vegetation and clearing will be avoided where possible in these areas.	Detailed design drawings	Project Manager	During detailed design
			Significant trees along the Project alignment will be retained where possible by altering the design on a micro-level.	Detailed design drawings	Project Manager	During detailed design
			Potential black cockatoo habitat will be retained where possible.	Detailed design drawings	Project Manager	During detailed design
			Plan and develop storage sites, laydown areas, hardstands and other areas which require clear space to occur within areas which are already cleared or otherwise disturbed. The location of the storage sites, laydown areas, hardstands and other areas which require clear space would be detailed on a map when finalised.	Laydown, handstand and infrastructure mapping	Project Manager	During detailed design. Prior to commence-ment of clearing
			A Revegetation Plan will be prepared prior to construction to minimise impacts and determine the rehabilitation of remaining areas. The plan will include as a minimum the following: • A figure showing areas to be cleared and any requirements for retention of specific habitat trees or other significant vegetation; • A figure indicating areas to be revegetated; • Weed management – including hygiene protocols, requirements for imported materials and ongoing weed management;	Revegetation Plan submitted to DER	Project Manager	Pre-Construction

Aspect	Potential Impact	Objective	Management Actions	Monitoring/ Audit Compliance Measures	Responsible Person	Timeframe
			• Requirements for vegetation chipping and re-use; • Requirements for topsoil use and /or soil preparation or treatment ; • Species lists and planting and/or seeding zones • Estimates of quantities and costs; and • Completion criteria for revegetation success.			
			The induction program will include relevant vegetation and flora information.	Induction	Project Manager	Pre-construction
Weeds and Dieback	Spread of weeds and dieback.	To prevent the spread of weeds and dieback on site.	The induction shall include information regarding dieback and weed impacts and management actions outlined in this table.	Induction	Project Manager	Pre-construction
Surface Water	Changes to / increases in flooding regimes and surface water flows due to construction works.	Prevent damage to environment from changes to flood regimes and surface water flows.	Drainage design for the final alignment will maintain existing surface water drainage patterns and avoid exacerbating waterlogging in susceptible areas.	Detailed design drawings	Project Manager	During detailed design
			Design to maintain hydrological balance between each side of the road.	Detailed design, Hydrological modelling.	Project Manager	Pre-construction
			Stormwater management shall be designed and implemented wherever relevant on road construction areas and within laydown areas and at offices.	Designs	Construction Contractor Environmental Coordinator	Pre-Construction
Site Contamination	Spread of contamination as a result of works.	Prevent contamination on site.	Contamination management requirements will be included in the site induction.	Induction	Project Manager	Pre-construction
Acid Sulphate Soils	Impacts to soil and water as a result of Acid Sulphate Soils.	Prevent contamination caused by Acid Sulphate Soils.	If works below the water table are required, investigations into the presence of ASS in the area will be conducted and a separate Acid Sulphate Soils Management Plan will be developed if required.	ASS investigations ASSMP	Project Manager	Pre-construction
Hydrocarbon and chemical management	Hydrocarbon or chemical spills onsite resulting in	To prevent environmental impacts resulting from incorrect use	All staff shall be trained in the use of spill kits	Induction	Project Manager	Pre-construction

Aspect	Potential Impact	Objective	Management Actions	Monitoring/ Audit Compliance Measures	Responsible Person	Timeframe
	contamination.	of spill kits.				
Construction Waste	Impacts to vegetation, fauna habitat and visual amenity.	To prevent impacts to the environment from construction waste.	The induction will outline the requirements for waste minimisation and management practices.	Induction	Project Manger	Pre-construction
Air Quality	Impacts to nearby receptors and plant life.	Reduce potential impacts to air quality including dust.	Workforce inductions will include education in relation to the minimisation of dust including the required response if excessive dust emissions occur	Induction	Project manager	Pre-construction
Noise and vibration	Noise and vibration impacts due to lack of staff awareness.	To prevent noise and vibration impacts.	Workforce inductions will include education in relation to the minimisation of noise and vibration.	Induction	Project Manager	Pre-construction
			Select machinery that will produce the lowest practical level of noise and vibration. All machinery to be fitted with mufflers prior to construction.		Project Manager	Pre-Construction
			Property condition surveys will be conducted and reports prepared by an independent qualified assessor for all properties within 50 m of works.	Property condition surveys	Project Manager	Pre-Construction
			A complaints register will be established and maintained.	Complaints register	Project Manager	Pre-Construction
			Staff facilities and laydown areas will be planned to prevent noise impacts to nearby sensitive receptors.	Laydown maps	Project Manager	Pre-Construction
Fire	Fire risk to adjoining vegetation and businesses.	Fire prevention	Consultation with relevant authorities will be undertaken and compliance with all relevant fire restrictions and notification requirements will be met.	Consult with FESA with regards to fire restrictions. All permits and regulatory requirements have been met.	Construction Contractor	Pre-construction
			The construction workforce is to be trained in fire risks and emergency procedures.	Training certificates available for staff	Construction Contractor	Pre-construction

Aspect	Potential Impact	Objective	Management Actions	Monitoring/ Audit Compliance Measures	Responsible Person	Timeframe
				trained in fire fighting.		
Public Consultation	Community complains and potential damage to company reputation.	Maintain company reputation and prevent complaints where possible.	Nearby sensitive receptors will be consulted regarding the proposed works and management of potential impacts prior to construction commencement.	Records of community consultation	Project Manager	Pre-construction
Visual Amenity	Loss of visual amenity and potential for community complaints.	Prevent loss of visual amenity and complaints where possible.	Selection of design with the lowest possible profile and footprint where possible.	Detailed design drawings	Project Manager	Pre-construction
			Reduce the amount of cut and fill through vegetated areas.	Detailed design drawings	Project Manager	Pre-construction
			Retention of significant Salmon Gum trees will be maintained adjacent to the South Coast Highway where possible to maintain the 'entrance statement' to Ravensthorpe.	Detailed design drawings	Project Manager	Pre-construction
Environmental Management	Environmental impacts due to lack of staff awareness.	To confirm that all persons involved in the project area are aware of the environmental constraints involved.	A copy of this EMP will be provided to the Construction Contractor. All relevant environmental management measures or other specifications prepared for the project will be provided to the Construction Contractor.	EMP Non-conformance register	Project Manager	Pre-construction
During Construction						
Vegetation	Loss of fauna habitat. Loss of native vegetation. Loss of habitat connectivity. Increase in erosion and land degradation.	Minimise impacts to native vegetation and loss of fauna habitat. Minimise impacts to black cockatoos.	Prior to the start of clearing operations the Construction Contractor will mark out the clearing line and this will be checked by the Supervisor.	Supervisor to check prior to clearing.	Construction Supervisor Construction Contractor	Prior to clearing
			Maps of significant trees will be provided to the Construction Contractor and trees to be retained will be adequately marked prior to clearing.	Supervisor to check prior to clearing.	Construction Supervisor Construction Contractor	Prior to clearing
			Fencing (temporary or otherwise) shall be placed to delineate the project area from areas to be retained.	Weekly site inspection	Environmental Coordinator	During construction

Aspect	Potential Impact	Objective	Management Actions	Monitoring/ Audit Compliance Measures	Responsible Person	Timeframe
			Areas where cleared plant material can be chipped will be marked. These areas will be specified in the Revegetation Plan	Revegetation Plan	Construction Supervisor Construction Contractor	Prior to clearing
			During construction there will be no dumping of materials/wastes.	Weekly site inspection	Environmental Coordinator	During construction
			Materials, equipment, parking or any other use which disturbs native vegetation will not be allowed outside the clearing lines.	Weekly site inspection	Construction Contractor Weekly inspection by Environmental Coordinator	During construction
			Vegetation which can be retained will be pruned with a chainsaw in preference to clearing where practicable.	Weekly site inspection	Construction Contractor Weekly inspection by Environmental Coordinator	During construction
			Trees to be removed shall be felled in a manner that they fall within the approved clearing area.		Construction Contractor	During clearing
			Vehicles and material storage should not be within 4 metres of the base of trees.	Weekly site inspection	Construction Contractor Weekly inspection by Environmental Coordinator	During construction
			Any pollution events that occur will be cleaned up as soon as possible with minimal disturbance to adjoining vegetation.	Incident Reports	Construction Contractor Weekly check by Environmental Coordinator	At all times
			Clearing will not be undertaken any further than 4 m from the boundary of earthworks unless required for safety reasons.	Weekly inspection	Weekly inspection by Environmental	During construction

Aspect	Potential Impact	Objective	Management Actions	Monitoring/ Audit Compliance Measures	Responsible Person	Timeframe
					Coordinator	
Weeds and Dieback	Section 1 is heavily impacted by weeds. Construction in this area may result in the spread and exacerbation of weed presence. Spread of dieback to the Project area and potentially to the larger area including the Fitzgerald River National Park.	Prevent the spread of weeds and Dieback in the Project area.	All works will comply with topsoil and weed management outlined in the Revegetation Plan.	Revegetation Plan	Construction Supervisor	At all times
			Monitor weeds in the Project area as per the requirements of the Revegetation Plan.	Weekly inspection	Weekly inspection by Environmental Coordinator	Weekly during construction
			Weeds will be sprayed prior to commencement of clearing.	Weed contractor compliance reports	Construction Supervisor	Prior to clearing
			Where noxious weeds are observed, their location is to be recorded and the area sprayed with a relevant herbicide before seed dispersal occurs.	Weed contractor compliance reports	Construction Supervisor	When noted
			All machinery, vehicles, equipment and materials must be effectively cleaned down prior to arrival at the Project area and whenever re-entering the Project area. Effective clean down will involve the removal of all soil and plant material from machinery, vehicles, equipment, tools and footwear so it cannot be transported. Attention will be given to removing soil and plant material from under vehicles and machinery, especially from running boards, belly plates, spare tyres and wheels.	Weekly site inspection	Construction Contractor Weekly check by Environmental Coordinator	Prior to entering or re-entering the construction area
			The number of access points to the Project shall be reduced as far as practicable.	Site access maps	Construction Contractor	During Construction
			Effective cleandown will be performed at a controlled location where all cleandown effluent can be contained and restricted from entering receiving environments that may impact native vegetation that may be uninfested by Phytophthora.	Weekly site inspection	Construction Contractor Weekly check by Environmental Coordinator	At all times
			Imported materials, such as gravel, to be used as road base will not be sourced from an area known to be infested with Phytophthora in accordance with the Dieback Management Plan.		Project Manager	Prior to materials being imported

Aspect	Potential Impact	Objective	Management Actions	Monitoring/ Audit Compliance Measures	Responsible Person	Timeframe
			Hand held equipment, tools and footwear will be sterilised using methylated spirits. Other equipment will be sterilised by soaking in a disinfectant such as bleach if appropriate. Water will be sterilised by adding 6 ml of sodium hypochlorite (bleach or pool chlorine) to every 10 L of water.	Weekly Site Inspection	Construction Supervisor	Prior to entering or re-entering the construction area.
Topsoil	Spread of weeds and dieback through unappropriated use of topsoil. Loss of suitable seek bank through inadequate topsoil management.	Retain seed bank for the Project area. Prevent the spread of weeds and/or dieback.	Soil in Section 1 will be treated as being contaminated with weed propagules. Soils from Section 1 will not be reused in other sections of the Project. Any soil moved from Section 1 will be disposed of to landfill or used as deep embankment fill at least 2 m below finished level.	Revegetation Plan	Construction Contractor	During clearing
			Topsoil stripping and management will be in accordance with proposed treatments outlined in the Revegetation Plan, including: • Topsoil will be stripped to a minimum depth of 100 mm along all sections of the works; • Where topsoil is not suitable for reuse it will be disposed of to a site agreed by Local Authorities and/or adjoining landholders; • Topsoil that is to be reused will be stored as close as possible to the source of the area or target area for reuse; and • Topsoil will be stored in an area as free as possible from weeds and in windrows or heaps ideally 1 metre high (maximum 2 metres). It should be reused as soon as possible after stripping, and as close as possible to its source.	Revegetation Plan	Construction Contractor	During clearing
			Topsoil will be stored in already cleared areas where possible.	Revegetation Plan	Construction Contractor	During clearing
Fauna	Harm and disruption to native fauna.	Minimise the impact to native fauna species.	Vegetation clearing lines will be clearly marked and checked prior to the commencement of clearing operations by the Supervisor. Clearing will not occur outside the marked clearing lines.	Clearing lines checked prior to clearing	Construction Supervisor	Prior to Clearing

Aspect	Potential Impact	Objective	Management Actions	Monitoring/ Audit Compliance Measures	Responsible Person	Timeframe
			Habitat trees will be clearly marked and retained where possible and confirmed by the Supervisor. Damage to trees by plant and other construction vehicles will also be minimised by following management options outlined in the "Vegetation" aspect above.	Habitat trees to be clearly marked prior to clearing and confirmed by the Supervisor.	Construction Supervisor	Prior to and During Clearing
			No pets, traps or firearms will be allowed on the project site.		Construction Supervisor	During Construction
			Clearing will be undertaken from degraded areas towards better quality bushland areas on one front, to provide an opportunity for fauna to move out of the clearing area.	Induction Clearing records	Construction Supervisor	During Clearing
			Any animals disturbed by the works will be allowed to leave the site before further works occur.	Incident reports of fauna mortality	Construction Contractor	During clearing
			Machinery will start up at least 10 minutes prior to clearing to potentially 'scare' fauna away from the area.	Induction Clearing records	Construction Supervisor	During Clearing
			Native fauna encounters will be recorded and reported to DEPaW.	Fauna register	Environmental Coordinator	During Construction
			Removal of any fauna from the project area will only be undertaken by a designated trained person.	Fauna register	Environmental Coordinator	During Construction
			If injured/sick animals are encountered, or eggs are removed from trees, a nominated licenced fauna carer shall be called to care for the animal. The carer may only enter site if escorted by the Construction Supervisor. This action is restricted to mammal and avian species, and medium to large reptiles. Alternatively animals may be taken to the local veterinary centre.	Fauna register	Construction Supervisor	During Construction
			No native fauna (including venomous snakes) will be impaired or killed by construction personnel.	Incident reports of fauna mortality	Environmental Coordinator	During clearing
			Any trenches or open excavations will be checked daily prior to the commencement of construction works for fauna and any fauna will be removed as soon as possible without damage to the animal.	Fauna register	Environmental Coordinator Construction Supervisor	During Construction

Aspect	Potential Impact	Objective	Management Actions	Monitoring/ Audit Compliance Measures	Responsible Person	Timeframe
			Temporary fencing shall be placed around high use fauna areas, such as cockatoo feeding areas, once clearing has concluded.	Weekly site inspection	Environmental Coordinator	Post- clearing
			Speed restrictions shall be implemented for all access tracks on site.		Construction Supervisor	During Construction
			Lighting shall be directed toward the intended target to prevent excessive light spill.		Construction Supervisor	During Construction
Surface Water	Disturbance to surface water features.	Prevent disturbance to surface water features.	During construction there will be no diversion of drainage lines that will impact on vegetation.	Weekly Inspection	Construction Contractor Environmental Coordinator	During Construction
			Erosion controls shall be applied upstream of all permanent discharge points.	Weekly Inspection	Construction Contractor Environmental Coordinator	During Construction
			Stormwater management will include the use of low bunds, silt fencing, bales or other erosion and siltation prevention equipment where necessary.	Weekly Inspection	Construction Contractor Environmental Coordinator	During Construction
			Stockpiles which will remain on site for more than a day during high rainfall periods will be bunded where necessary to minimise runoff. Stockpiles will not be placed within 15 m of a drainage line.	Weekly Inspection	Construction Contractor Environmental Coordinator	During Construction
			Wash down of vehicles and plant will not occur except in designated areas such as the wash down bays.	Weekly Inspection	Construction Contractor Environmental Coordinator	During Construction
			Wash down of concrete trucks, apart from the truck chute, will not occur on site. Concrete water from the chute wash down will be confined onsite and removed once hardened. It will not be released into vegetated areas.	Weekly Inspection	Construction Contractor Environmental Coordinator	During Construction

Aspect	Potential Impact	Objective	Management Actions	Monitoring/ Audit Compliance Measures	Responsible Person	Timeframe
Aboriginal heritage Sites	Unlicensed removal or disturbance to Registered Aboriginal Heritage Sites. Removal or disturbance of unregistered and/or newly discovered Aboriginal heritage sites.	Prevent unlicensed impacts to aboriginal heritage sites. Prevent unlicensed impacts to newly discovered Aboriginal Heritage Sites.	Clearing areas will be clearly defined and indigenous heritage sites in the immediate area flagged to prevent unauthorised damage.	Clearing areas checked by Supervisor prior to clearing Weekly Inspection to verify flagging	Construction Supervisor Environmental Coordinator	Prior to Clearing During Construction
			In the event of any artefact material being uncovered in the course of the ground disturbing activities, work will stop in the vicinity of the site while the Department of Aboriginal Affairs carries out an investigation.	Discussions with Department of Indigenous Affairs	Project Manager	If required
			Should any Aboriginal Heritage objects be identified they shall be salvaged and managed according to advice from an indigenous representative.	Documentation of heritage site	Project Manager	If required
			In the case of skeletal material being uncovered, work will cease immediately and the Western Australian Police will be notified.	Incident Report	Project Manager	If required.
Site Contamination	Spread of contamination from existing contaminated sites encountered during works.	Prevent spread of contaminated soil or water.	Should unexpected contamination be encountered the Construction Supervisor and Environmental Coordinator will be notified. An assessment of the risk to human health and the environment will be undertaken. The removal of contaminated soils will be undertaken in accordance with DER guidelines and soils will be treated as appropriate.	Incident report	Construction Supervisor Environmental Coordinator	If encountered
			Analysis of any site contamination if required will be undertaken at an accredited laboratory.	Lab accreditation Lab receipts	Project Manager Environmental Coordinator	If encountered
			During intrusive works such as excavations, if visual and or olfactory evidence suggests potential for contamination (e.g. fill material, building rubble, odours, soil staining), works will cease, the Construction Supervisor will be notified, and the material sampled and analysed. Works will commence once the status of the material has been confirmed and corrective actions implemented (if required).	Incident report	Construction Supervisor	If encountered
			Determination of contamination and requirements for	Incident report	Construction	If encountered

Aspect	Potential Impact	Objective	Management Actions	Monitoring/ Audit Compliance Measures	Responsible Person	Timeframe
			remediation will be undertaken on advice from the Environmental Coordinator. The site of potential contamination will be contained (i.e. bunded) to prevent any spread of contaminates, and will be fenced to prevent any unauthorised access.		Supervisor Environmental Coordinator	
			Any contaminated soil shall be disposed of at an appropriate licenced facility and records of disposal maintained.	Disposal receipts	Project Manager Environmental Coordinator	During construction
Hydrocarbon and Chemical Management	Contamination of soil or water resulting from hydrocarbon spills.	Prevent contamination of soil and water.	Hydrocarbon spills will be cleaned up immediately and reported following clean up.	Incident Report	Construction Contractor	Immediately following spill. Incident report to be completed within 24 hours.
			Hydrocarbon spill kits will be kept on site at all times and readily available.	Weekly site inspection	Environmental Coordinator	During construction
			All hydrocarbons, chemicals, pesticides and herbicides on site shall be stored in purpose built containers or tanks in a bunded storage are with adequate capacity to contain spills.	Weekly site inspection	Environmental Coordinator	During construction
			No hydrocarbons or chemicals will be stored within 50 m of any drains or drainage lines.	Weekly site inspection	Environmental Coordinator	During construction
			No refuelling will be undertaken within 50 m of a drain or drainage line.	Weekly site inspection	Environmental Coordinator Construction Supervisor	During construction
			Waste chemicals shall be disposed of in accordance with the corresponding MSDS.	MSDS	Construction Supervisor	During construction
			Refuelling on site shall be undertaken on a sealed or bunded surface or if practicable, using a catch tray.	Weekly site inspection	Environmental Coordinator Construction Supervisor	During construction

Aspect	Potential Impact	Objective	Management Actions	Monitoring/ Audit Compliance Measures	Responsible Person	Timeframe
Waste	Inappropriate disposal of general construction waste.	Minimise the risk of contamination as the result of waste. Encourage recycling.	Confirm that non-recyclable materials/wastes (including regulated and controlled wastes) are disposed of at licensed landfill facilities or according to Council regulations.	Appointed waste carriers hold valid licenses. Disposal receipts checked periodically.	Construction Contractor	During Construction
		Minimise the environmental and health risk of waste exposure.	Confirm that employees whose activities include the storage and handling of wastes have been appropriately trained and are competent at undertaking tasks required.	Maintain training records.	Construction Contractor	During Construction
			Supply recycling bins at work sites for glass, aluminium cans, paper and other products, and provide transport to the appropriate recycling facility.	Weekly site inspection	Environmental Coordinator	During Construction
			Stockpile reusable and recyclable products for collection and reuse.	Weekly site inspection	Environmental Coordinator	During Construction
			Wastes will be stored in clearly labelled containers and in such a manner that they will not escape to open land, stormwater drains or surface water courses in accordance with the requirements of the Environmental Protection (Unauthorised Discharges) Regulations, 2004.	Weekly site inspection	Environmental Coordinator	During Construction
			Collection and removal of all domestic wastes from work sites regularly.	Weekly site inspection	Environmental Coordinator	During Construction
			Stockpiled spoil and wastewater will be sampled and analysed according to the DEC's 'Guidelines for Acceptance of Solid Waste to Landfill and Waste Classification and Landfill Waste Definitions, 2005', to identify those acceptable as clean waste.	Weekly site inspection	Environmental Coordinator	During Construction
		Correct storage of liquid waste.	All liquid wastes will be stored within bunded areas to contain any potential spills.	Weekly site inspection	Environmental Coordinator	During Construction
		Prevent accidents during transportation.	All loads carrying spoil should be covered, irrespective of whether they pose a potential risk.	Weekly site inspection	Construction Contractor	During Construction
Sedimentation and Erosion Control	Soil loss and degradation.	Minimise soil loss and degradation.	Use existing access roads and access ways to avoid creation of new ground and soil instability problems.	Weekly site inspection	Environmental Coordinator	During Construction
			As far as is practicable, stockpiles will be kept to a maximum height of 2 m to reduce risk of erosion by surface runoff or	Weekly site inspection	Construction Contractor	During Construction

Aspect	Potential Impact	Objective	Management Actions	Monitoring/ Audit Compliance Measures	Responsible Person	Timeframe
			wind.		Environmental Coordinator	
			The period for which the soil is left open to erosion will be minimised.		Construction Contractor	During Construction
			Suitable stabilising measures will be used for temporary stabilisation and when revegetating areas as appropriate.	Evidence of stability measures used on site.	Construction Contractor	During Construction
Air Pollution	Dust Generation	Minimise the generation of dust and particulates during construction activities.	Vehicle speeds will be restricted to minimise dust.	Speeding to be recorded on the non-conformance register	Construction Contractor	During Construction
			Water unsealed roads and construction site(s) during dry and windy conditions, as required.	Evidence of dust lift	Construction Contractor	During Construction
			Stockpiles will be stabilised against wind and rain if they are to be left for extended periods of time.	Weekly site inspection	Environmental Coordinator	During Construction
			Soil stockpiles created during construction will be kept to a maximum of 2 metres to prevent dust issues.	Weekly site inspection	Environmental Coordinator	During Construction
			No burning of vegetation or other materials will be permitted on site.	Weekly site inspection	Environmental Coordinator	During Construction
			Licences from the Department of Water will be obtained if water for dust suppression is required.	Appropriate licences	Environmental Coordinator	During Construction
			Dusty loads will be covered when travelling around sensitive receptors.	Weekly inspection	Environmental Coordinator	During Construction
			Maintenance schedules will be followed and pre-start inspections shall be undertaken to ensure all vehicles are in good working order	Maintenance reports Prestart inspections	Project manager	During Construction
			All surfaces disturbed as a result of construction activities will be revegetated or otherwise stabilised to reduce the potential for dust issues.	Revegetation Plan	Construction Contractor	During Construction
Noise and Vibration	Noise and vibration impacts to nearby sensitive	To reduce noise and vibration impacts. Ensure that noise	Drum rollers to be on oscillating mode by default		Project Manager	Construction
			Construction activities (including materials transport) shall be limited between 0600 and 1800 Monday to Sunday, excluding public holidays (standard work hours) unless approval is	Approval from the local government	Construction Supervisor	During Construction

Aspect	Potential Impact	Objective	Management Actions	Monitoring/ Audit Compliance Measures	Responsible Person	Timeframe
	receptors and potential disturbance to fauna.	and vibration management complies with current industry standards. Minimise noise and vibration emissions consistent with the provisions of the *Environmental Protection (Noise) Regulations 1997*.	obtained from the local government.			
			Reversing beepers will be used during standard work hours. Less invasive alarms such as croakers may be used if works are required outside standard working hours.		Construction Supervisor	During Construction
			The idling of all plant is to be kept to a minimum.		Construction Supervisor	During Construction
			Radios used on site will be kept to reasonable volumes to prevent disturbance to surrounding receptors.	Weekly site inspection	Construction Supervisor	During Construction
			Residents and businesses in proximity to works will be notified of the work schedule to minimise disruption where possible.	Community communications	Project Manager	During Construction
			Acoustic screens will be utilised where necessary.		Project Manager	During Construction
			Stationary fixed noise generating equipment will be located away from residential areas where possible.		Project Manager	During Construction
Fire	Destruction of property or vegetation.	Prevent fires on site.	All personnel will be educated on bushfire prevention, including the risk of disposing of cigarette butts on the ground.	Induction	Construction Contractor	During Construction
			Appropriate fire fighting equipment will be available at all work sites and in all vehicles in accordance with WA Fire Protection Regulations.	Regular inspections	Construction Supervisor	During Construction
			Clear all flammable materials from around fire ignition sources.		Construction Contractor	During works
			Fire extinguishers and fire fighting equipment will be available for the welding crews.	Regular inspections	Construction Supervisor	During Construction
			Heavy earthmoving machinery and water trucks will be available during construction.	During construction, the work areas will be regularly inspected to access the implementation of the Environmental Management Plan.	Construction Contractor	Construction
			Any bushfire incidents and corrective actions will be documented by the contractor and reported to the appropriate	Incident Reports	Construction Contractor	Construction

Aspect	Potential Impact	Objective	Management Actions	Monitoring/ Audit Compliance Measures	Responsible Person	Timeframe
			authorities as required.			
			Machinery will be maintained and operated to comply with relevant fire safety standards.	Maintenance Records	Construction Contractor	Construction
			Cease work in the event of high fire danger as designated by FESA.	Induction	Construction Contractor	Construction
			All activities involving hot works shall have a valid Hot Works permit.	Induction Hot Works Permit	Construction Contractor	Construction
			Hot works shall not be undertaken on total fire ban days unless an exemption has been approved by Department of Fire and Emergency Services.	Induction Hot Works Permit	Construction Contractor	Construction
			In the event of a fire that exceeds on-site capabilities, documented emergency procedures will be in place to evacuate project workers and local business workers.	Emergency Management Plan	Construction Contractor	Construction
Traffic	Vehicle Movements and potential for accidents.	Minimise the disturbance to traffic. Minimise the risk of injury to road users due to construction vehicles entering and leaving the site.	Construction vehicles will travel along specifically designated routes that have been selected to minimise disturbance on other traffic and the community. This will be based on the size of the vehicle.	Record and report traffic incidents accidents	Construction Contractor	During Construction
			Road access will be maintained in the project area.		Construction Contractor	During Construction
			Use appropriate personal safety and traffic management signs.	Staff wearing PPE onsite Traffic signs in use as per relevant Traffic Control Standards	Construction Contractor	During Construction
Environmental Monitoring	Lack of environmental monitoring for compliance.	To confirm that environmental management measures have been complied with.	During the Project construction phase, compliance with environmental management measures will be monitored. Any non-conformance will be addressed in the first instance, while the non-conformance and the corrective action will be detailed in a Non-Conformance Register.	Non-conformance register.	Project Manager	Construction
Post-Construction						

Aspect	Potential Impact	Objective	Management Actions	Monitoring/ Audit Compliance Measures	Responsible Person	Timeframe
Rehabilitation	Inadequate rehabilitation resulting in reduced regrowth and minimising fauna habitat.	Manage and remediate construction impacts to native vegetation where possible.	Develop a Rehabilitation and Landscape Management Plan	Revegetation Plan	Project Manager	Post-construction
			Soft landscaping will include rehabilitation with native species	Revegetation Plan	Project Manager	Post-construction
			Avoid establishment of foraging habitat immediately adjacent to the road alignment to minimise the risk of vehicle strike.	Revegetation Plan	Project Manager	Post-construction
			Any logs or other material which has value as habitat for fauna is to be stockpiled and replaced on the revegetation area (where possible).	Revegetation Plan	Project Manager	Post-construction
			Landforms will be returned to their original contours (where possible).	Revegetation Plan	Project Manager	Prior to clearing for use post-construction
			Flora species used for rehabilitation will be endemic to the area.	Revegetation Plan	Project Manager	Post-Construction
			The construction area will be rehabilitated to within the existing contours, in as far as is practicable.	Revegetation Plan	Project Manager	Post-Construction
			Salvaged topsoil must be respread as close as possible to the areas from which it was sourced.	Revegetation Plan	Project Manager	Post-Construction
			Revegetation works will be carried out in accordance with the Main Roads *Environmental Guideline Revegetation Planning and Techniques.*	Revegetation Plan	Project Manager	Post-Construction
Visual Amenity	Visual impacts to and from the road.	To reduce the visual impacts and restore the visual amenities of the project area.	Encourage revegetation during, or soon after road construction is complete. Revegetation of the Project Area will follow those specifications outlined in the Revegetation Plan. Confirm the construction area is left clean and tidy with all waste and spoil heaps removed and the area contoured to a suitable shape.	Revegetation Plan	Project Manager Construction Contractor	Post-construction
			Revegetated areas will be maintained to prevent the loss of plant species. Weed management of these areas will be carried out as per the Revegetation Plan.	Monitor revegetation success as per completion criteria.	Project Manager Construction Contractor	Post-construction
			Revegetation should include the use of vegetation as	Revegetation Plan	Project Manager	Post-

Aspect	Potential Impact	Objective	Management Actions	Monitoring/ Audit Compliance Measures	Responsible Person	Timeframe
			screening along road verges adjacent to residential areas.			construction

5.9.1 Section 2

Table 19 Environmental Management Plan - Section 2

Aspect	Potential Impact	Objective	Management Actions	Monitoring/ Audit Compliance Measures	Responsible Person	Timeframe
Pre-Construction						
Vegetation	Loss of fauna habitat. Loss of native vegetation. Loss of black cockatoo habitat.	Reduce the footprint of the project to minimise impacts to vegetation in Section 2.	Detailed design will take into account native vegetation including Priority flora species known from the Project area and clearing will be avoided where possible in these areas.	Detailed design drawings	Project Manager	During detailed design
			Significant trees (e.g. hollow-bearing trees) identified along the Project alignment will be retained where possible by altering the design on a micro-level..	Detailed design drawings	Project Manager	During detailed design
			Detailed design will take into account native vegetation and clearing will be avoided where possible in these areas.	Detailed design drawings	Project Manager	During detailed design
			Potential black cockatoo habitat will be retained where possible.	Detailed design drawings	Project Manager	During detailed design
			Plan and develop storage sites, laydown areas, hardstands and other areas which require clear space to occur within areas which are already cleared or otherwise disturbed.	Laydown, handstand and infrastructure mapping	Project Manager	During detailed design. Prior to commence-ment of clearing
			A Revegetation Plan will be prepared prior to construction	Revegetation Plan	Project Manager	Pre-Construction

Aspect	Potential Impact	Objective	Management Actions	Monitoring/ Audit Compliance Measures	Responsible Person	Timeframe
			to minimise impacts and determine the rehabilitation of remaining areas. The plan will include as a minimum the following: • A figure showing areas to be cleared and any requirements for retention of specific habitat trees or other significant vegetation; • A figure indicating areas to be revegetated; • Weed management – including hygiene protocols, requirements for imported materials and ongoing weed management; • Requirements for vegetation chipping and re-use; • Requirements for topsoil use and /or soil preparation or treatment ; • Species lists and planting and/or seeding zones; • Estimates of quantities and costs; and • Completion criteria for revegetation success.	submitted to DER		
			The induction program will include relevant vegetation and flora information.	Induction	Project Manager	Pre-construction
Weeds and Dieback	Spread of weeds and dieback.	To prevent the spread of weeds and dieback on site.	The induction shall include information regarding dieback and weed impacts and management actions outlined in this table.	Induction	Project Manager	Pre-construction
Surface Water	Changes to / increases in flooding regimes and surface water flows due to construction works.	Prevent damage to environment from changes to flood regimes and surface water flows.	Drainage design for the final alignment will maintain existing surface water drainage patterns and avoid exacerbating waterlogging in susceptible areas.	Detailed design drawings	Project Manager	During detailed design
			Design to maintain hydrological balance between each side of the road.	Detailed design, Hydrological modelling.	Project Manager	Pre-construction
			Stormwater management shall be designed and implemented wherever relevant on road construction areas and within laydown areas and at offices.	designs	Construction Contractor Environmental Coordinator	Pre-Construction
Site Contamination	Spread of contamination as a	Prevent contamination on	Contamination management requirements will be included in the site induction.	Induction	Project Manager	Pre-construction

Aspect	Potential Impact	Objective	Management Actions	Monitoring/ Audit Compliance Measures	Responsible Person	Timeframe
	result of works.	site.	Prior to commencement of intrusive works, the Asbestos Contaminated Materials (ACM) fragments identified at two locations within Section 2 should be appropriately removed from the site and disposed at a licenced facility. This should be undertaken in accordance with all relevant legislation and guidelines.	Record of removal of fragments	Project Manager	Pre-construction
Acid Sulphate Soils	Impacts to soil and water as a result of Acid Sulphate Soils.	Prevent contamination caused by Acid Sulphate Soils.	If works below the water table are required, investigations into the presence of ASS in the area will be conducted and a separate Acid Sulphate Soils Management Plan will be developed if required.	ASS investigations ASSMP	Project Manager	Pre-construction
Hydrocarbon and chemical management	Hydrocarbon or chemical spills onsite resulting in contamination.	To prevent environmental impacts resulting from incorrect use of spill kits.	All staff shall be trained in the use of spill kits	Induction	Project Manager	Pre-construction
Hydrocarbon and chemical management	Hydrocarbon or chemical spills onsite resulting in contamination.	To prevent environmental impacts resulting from incorrect use of spill kits.	All staff shall be trained in the use of spill kits	Induction	Project Manager	Pre-construction
Construction Waste	Impacts to vegetation, fauna habitat and visual amenity.	To prevent impacts to the environment from construction waste.	The induction will outline the requirements for waste minimisation and management practices.	Induction	Project Manger	Pre-construction
Air Quality	Impacts to nearby receptors and plant life.	Reduce potential impacts to air quality including dust.	Workforce inductions will include education in relation to the minimisation of dust.	Induction	Project manager	Pre-construction
Noise and vibration	Noise and vibration impacts due to lack of staff awareness.	To prevent noise and vibration impacts.	Workforce inductions will include education in relation to the minimisation of noise and vibration.	Induction	Project Manager	Pre-construction
			Select machinery that will produce the lowest practical level of noise and vibration. All machinery to be fitted with mufflers prior to construction.		Project Manager	Pre-Construction

Aspect	Potential Impact	Objective	Management Actions	Monitoring/ Audit Compliance Measures	Responsible Person	Timeframe
			Property condition surveys will be conducted and reports prepared by an independent qualified assessor for all properties within 50 m of works.	Property condition surveys	Project Manager	Pre-Construction
			A complaints register will be established and maintained.	Complaints register	Project Manager	Pre-Construction
			Staff facilities and laydown areas will be planned to prevent noise impacts to nearby sensitive receptors.	Laydown maps	Project Manager	Pre-Construction
Fire	Fire risk to adjoining vegetation and businesses.	Fire prevention	Consultation with relevant authorities will be undertaken and compliance with all relevant fire restrictions and notification requirements will be met.	Consult with FESA with regards to fire restrictions. All permits and regulatory requirements have been met.	Construction Contractor	Pre-construction
			The construction workforce is to be trained in fire risks and emergency procedures.	Training certificates available for staff trained in fire fighting.	Construction Contractor	Pre-construction
Public Consultation	Community complains and potential damage to company reputation.	Maintain company reputation and prevent complaints where possible.	Nearby sensitive receptors will be consulted regarding the proposed works and management of potential impacts prior to construction commencement.	Records of community consultation	Project Manager	Pre-construction
Visual Amenity	Loss of visual amenity and potential for community complaints.	Prevent loss of visual amenity and complaints where possible.	Selection of design with the lowest possible profile and footprint where possible.	Detailed design drawings	Project Manager	Pre-construction
			Reduce the amount of cut and fill through vegetated areas.	Detailed design drawings	Project Manager	Pre-construction
			Retention of significant Salmon Gum trees will be maintained adjacent to the South Coast Highway where possible to maintain the ‘entrance statement’ to Ravensthorpe.	Detailed design drawings	Project Manager	Pre-construction
Environmental Management	Environmental impacts due to lack of staff awareness.	To confirm that all persons involved in the project area	A copy of this EMP will be provided to the Construction Contractor. All relevant environmental management measures or other	EMP Non-conformance	Project Manager	Pre-construction

Aspect	Potential Impact	Objective	Management Actions	Monitoring/ Audit Compliance Measures	Responsible Person	Timeframe
		are aware of the environmental constraints involved.	specifications prepared for the project will be provided to the Construction Contractor.	register		
During Construction						
Vegetation	Loss of fauna habitat. Loss of native vegetation. Loss of habitat connectivity. Increase in erosion and land degradation.	Minimise impacts to native vegetation and loss of fauna habitat. Minimise impacts to black cockatoo	Prior to the start of clearing operations the Construction Contractor will mark out the clearing line and this will be checked by the Supervisor.	Supervisor to check prior to clearing.	Construction Supervisor Construction Contractor	Prior to clearing
			Maps of significant trees will be provided to the Construction Contractor and trees to be retained will be adequately marked prior to clearing.	Supervisor to check prior to clearing.	Construction Supervisor Construction Contractor	Prior to clearing
			Vegetation adjacent to Section 2 in excellent condition will be retained where possible.	Supervisor to check prior to clearing.	Construction Supervisor Construction Contractor	Prior to clearing
			Fencing (temporary or otherwise) shall be placed to delineate the project area from areas to be retained.	Weekly site inspection	Environmental Coordinator	During construction
			Areas where cleared plant material can be chipped will be marked. These areas will be specified in the Revegetation Plan	Revegetation Plan	Construction Supervisor Construction Contractor	Prior to clearing
			During construction there will be no dumping of materials/wastes.	Weekly site inspection	Environmental Coordinator	During construction
			Materials, equipment, parking or any other use which disturbs native vegetation will not be allowed outside the clearing lines.	Weekly site inspection	Construction Contractor Weekly inspection by Environmental Coordinator	During construction
			Vegetation which can be retained will be pruned with a	Weekly site	Construction	During

Aspect	Potential Impact	Objective	Management Actions	Monitoring/ Audit Compliance Measures	Responsible Person	Timeframe
			chainsaw in preference to clearing where practicable.	inspection	Contractor Weekly inspection by Environmental Coordinator	construction
			Trees to be removed shall be felled in a manner that they fall within the approved clearing area.		Construction Contractor	During clearing
			Vehicles and material storage should not be within 4 metres of the base of trees.	Weekly site inspection	Construction Contractor Weekly inspection by Environmental Coordinator	During construction
			Any pollution events that occur will be cleaned up as soon as possible with minimal disturbance to adjoining vegetation.	Incident Reports	Construction Contractor Weekly check by Environmental Coordinator	At all times
			Clearing will not be undertaken any further than 4 m from the boundary of earthworks unless required for safety reasons.	Weekly inspection	Weekly inspection by Environmental Coordinator	During construction
Weeds and Dieback	Section 2 has been impacted by weeds species in disturbed areas such as firebreaks. Project construction could result in the spread of weeds to undisturbed areas. Spread of dieback to the Project area and potentially to	Prevent the spread of weeds and Dieback in the Project area.	All works will comply with topsoil and weed management outlined in the Revegetation Plan.	Revegetation Plan	Construction Supervisor	At all times
			Monitor weeds in the Project area as per the requirements of the Revegetation Plan.	Weekly inspection	Weekly inspection by Environmental Coordinator	Weekly during construction
			Weeds will be sprayed prior to commencement of clearing.	Weed contractor compliance reports	Construction Supervisor	Prior to clearing
			Where noxious weeds are observed, their location is to be recorded and the area sprayed with a relevant herbicide	Weed contractor compliance reports	Construction Supervisor	When noted

Aspect	Potential Impact	Objective	Management Actions	Monitoring/ Audit Compliance Measures	Responsible Person	Timeframe
	the larger area including the Fitzgerald River National Park.		before seed dispersal occurs.			
			The number of access points to the project shall be reduced as far as practicable.	Site access maps	Construction Contractor	During Construction
			All machinery, vehicles, equipment and materials must be effectively cleaned down prior to arrival at the Project area and whenever re-entering the Project area. Effective clean down will involve the removal of all soil and plant material from machinery, vehicles, equipment, tools and footwear so it cannot be transported. Attention will be given to removing soil and plant material from under vehicles and machinery, especially from running boards, belly plates, spare tyres and wheels.	Weekly site inspection	Construction Contractor Weekly check by Environmental Coordinator	Prior to entering or re-entering the construction area
			Effective cleandown will be performed at a controlled location where all cleandown effluent can be contained and restricted from entering receiving environments that may impact native vegetation that may be uninfested by Phytophthora.	Weekly site inspection	Construction Contractor Weekly check by Environmental Coordinator	At all times
			Imported materials, such as gravel, to be used as road base will not be sourced from an area known to be infested with Phytophthora in accordance with the Dieback Management Plan.		Project Manager	Prior to materials being imported
			Cleared vegetation may be mulched and re-used onsite.	Revegetation Plan	Construction Contractor	When needed
			Hand held equipment, tools and footwear will be sterilised using methylated spirits. Other equipment will be sterilised by soaking in a disinfectant such as bleach if appropriate. Water will be sterilised by adding 6 ml of sodium hypochlorite (bleach or pool chlorine) to every 10 L of water.	Weekly Site Inspection	Construction Supervisor	Prior to entering or re-entering the construction area.
Topsoil	Spread of weeds and dieback through	Retain seed bank for the Project	Soil in degraded parts of Section 2 will be treated as being contaminated with weed propagules. Soils will be used on site , preferably as deep embankment fill at least 2 m below	Revegetation Plan	Construction Contractor	During clearing

Aspect	Potential Impact	Objective	Management Actions	Monitoring/ Audit Compliance Measures	Responsible Person	Timeframe
	unappropriated use of topsoil. Loss of suitable seek bank through inadequate topsoil management.	area. Prevent the spread of weeds and/or dieback.	finished level.			
			Topsoil from the *Eucalyptus oleosa* subsp. *corvina* and *Melaleuca hamata* will be stockpiled for road rehabilitation.	Revegetation Plan	Construction Contractor	During clearing
			Topsoil stripping and management will be in accordance with proposed treatments outlined in the Revegetation Plan, including: • Topsoil will be stripped to a minimum depth of 100 mm along all sections of the works; • Where topsoil is not suitable for reuse it will be disposed of to a site agreed by Local Authorities and/or adjoining landholders; and • Topsoil that is to be reused will be stored as close as possible to the source of the area or target area for reuse. Topsoil will be stored in an area as free as possible from weeds and in windrows or heaps ideally 1 metre high (maximum 2 metres). It should be reused as soon as possible after stripping, and as close as possible to its source.	Revegetation Plan	Construction Contractor	During clearing
			Topsoil will be stored in already cleared areas where possible.	Revegetation Plan	Construction Contractor	During clearing
Fauna	Harm and disruption to native fauna.	Minimise the impact to native fauna species.	Vegetation clearing lines will be clearly marked and checked prior to the commencement of clearing operations by the Supervisor. Clearing will not occur outside the marked clearing lines.	Clearing lines checked prior to clearing	Construction Supervisor	Prior to Clearing
			Habitat trees will be clearly marked and retained where possible and confirmed by the Supervisor. Damage to trees by plant and other construction vehicles will also be minimised by following management options outlined in the "Vegetation" aspect above.	Habitat trees to be clearly marked prior to clearing and confirmed by the Supervisor.	Construction Supervisor	Prior to and During Clearing
			No pets, traps or firearms will be allowed on the project site.		Construction Supervisor	During Construction
			Immediately prior to the clearing of vegetation, a pre-clearance fauna survey will be conducted by a trained fauna ecologist to remove any fauna that may be displaced	Pre-clearance fauna survey	Fauna Ecologists Environmental	Prior to Clearing

Aspect	Potential Impact	Objective	Management Actions	Monitoring/ Audit Compliance Measures	Responsible Person	Timeframe
			in the clearing process.		Coordinator Construction Supervisor	
			Clearing should be undertaken from degraded areas towards better quality bushland areas on one front, to provide an opportunity for fauna to move out of the clearing area.	Induction Clearing records	Construction Supervisor	During Clearing
			Any animals disturbed by the works should be allowed to leave the site before further works occur.	Incident reports of fauna mortality	Construction Contractor	During clearing
			Machinery should start up at least 10 minutes prior to clearing to potentially 'scare' fauna away from the area.	Induction Clearing records	Construction Supervisor	During Clearing
			Native fauna encounters will be recorded and reported to DEPaW.	Fauna register	Environmental Coordinator	During Construction
			Removal of any fauna from the project area will only be undertaken by a designated and trained person.	Fauna register	Environmental Coordinator	During Construction
			If injured/sick animals are encountered, or eggs are removed from trees, a nominated licenced fauna carer shall be called to care for the animal. The carer may only enter site if escorted by the Construction Supervisor. This action is restricted to mammal and avian species, and medium to large reptiles. Alternatively animals may be taken to the local veterinary centre.	Fauna register	Construction Supervisor	During Construction
			No native fauna (including venomous snakes) will be impaired or killed by construction personnel.	Incident reports of fauna mortality	Environmental Coordinator	During clearing
			Any trenches or open excavations will be checked daily for fauna and any fauna will be removed as soon as possible without damage to the animal.	Fauna register	Environmental Coordinator Construction Supervisor	During Construction
			Temporary fencing shall be placed around high use fauna areas, such as cockatoo feeding areas, once clearing has concluded.	Weekly site inspection	Environmental Coordinator	Post- clearing
			Speed restrictions shall be implemented for all access tracks on site.		Construction Supervisor	During Construction

Aspect	Potential Impact	Objective	Management Actions	Monitoring/ Audit Compliance Measures	Responsible Person	Timeframe
			Lighting shall be directed toward the intended target to prevent excessive light spill.		Construction Supervisor	During Construction
			Control of feral/pest animals shall be undertaken if deemed necessary.	Fauna register	Environmental Coordinator	During Construction
Surface Water	Disturbance to surface water features.	Prevent disturbance to surface water features.	During construction there will be no diversion of drainage lines that will impact on vegetation.	Weekly Inspection	Construction Contractor Environmental Coordinator	During Construction
			Erosion controls shall be applied upstream of all permanent discharge points.	Weekly Inspection	Construction Contractor Environmental Coordinator	During Construction
			Stormwater management will include the use of low bunds, silt fencing, bales or other erosion and siltation prevention equipment where necessary.	Weekly Inspection	Construction Contractor Environmental Coordinator	During Construction
			Stockpiles which will remain on site for more than a day during high rainfall periods will be bunded where necessary to minimise runoff. Stockpiles will not be placed within 15 m of a drainage line.	Weekly Inspection	Construction Contractor Environmental Coordinator	During Construction
			Wash down of vehicles and plant will not occur except in designated areas such as the wash down bays.	Weekly Inspection	Construction Contractor Environmental Coordinator	During Construction
			Wash down of concrete trucks, apart from the truck chute, will not occur on site. Concrete water from the chute wash down will be confined onsite and removed once hardened. It will not be released into vegetated areas.	Weekly Inspection	Construction Contractor Environmental Coordinator	During Construction
Aboriginal heritage Sites	Unlicensed removal or disturbance to Registered Aboriginal Heritage Sites.	Prevent unlicensed impacts to aboriginal heritage sites.	Clearing areas will be clearly defined and indigenous heritage sites in the immediate area flagged to prevent unauthorised damage.	Clearing areas checked by Supervisor prior to clearing Weekly Inspection	Construction Supervisor Environmental Coordinator	Prior to Clearing During Construction

Aspect	Potential Impact	Objective	Management Actions	Monitoring/ Audit Compliance Measures	Responsible Person	Timeframe
	Removal or disturbance of unregistered and/or newly discovered Aboriginal heritage sites.	Prevent unlicensed impacts to newly discovered Aboriginal Heritage Sites.		to verify flagging		
			In the event of any artefact material being uncovered in the course of the ground disturbing activities, work will stop in the vicinity of the site while the Department of Indigenous Affairs carries out an investigation.	Discussions with Department of Indigenous Affairs	Project Manager	If required
			Should any Aboriginal Heritage objects be identified they shall be salvaged and managed according to advice from an indigenous representative.	Documentation of heritage site	Project Manager	If required
			In the case of skeletal material being uncovered, work will cease immediately and the Western Australian Police will be notified.	Incident Report	Project Manager	If required.
Site Contamination	Spread of contamination from existing contaminated sites encountered during works.	Prevent spread of contaminated soil or water.	Should further ACM be identified during the works, this should also be appropriately removed.	Records of removal	Project Manager Environmental Coordinator	If encountered
			Where ACM has been identified and removed, the resulting ground surface should be suitably validated.	inspection	Project Manager Environmental Coordinator	If encountered
			Should unexpected contamination be encountered the Construction Supervisor and Environmental Coordinator will be notified. An assessment of the risk to human health and the environment will be undertaken. The removal of contaminated soils will be undertaken in accordance with DER guidelines and soils will be treated as appropriate.	Incident report	Construction Supervisor Environmental Coordinator	If encountered
			Analysis of any site contamination if required will be undertaken at an accredited laboratory.	Lab accreditation Lab receipts	Project Manager Environmental Coordinator	If encountered
			During intrusive works such as excavations, if visual and or olfactory evidence suggests potential for contamination (e.g. fill material, building rubble, odours, soil staining), works will cease, the Construction Supervisor will be notified, and the material sampled and analysed. Works will commence once the status of the material has been confirmed and corrective actions implemented (if required).	Incident report	Construction Supervisor	If encountered

Aspect	Potential Impact	Objective	Management Actions	Monitoring/ Audit Compliance Measures	Responsible Person	Timeframe
			Determination of contamination and requirements for remediation will be undertaken on advice from the Environmental Coordinator. The site of potential contamination will be contained (i.e. bunded) to prevent any spread of contaminates, and will be fenced to prevent any unauthorised access.	Incident report	Construction Supervisor Environmental Coordinator	If encountered
			Any contaminated soil shall be disposed of at an appropriate licenced facility and records of disposal maintained.	Disposal receipts	Project Manager Environmental Coordinator	During construction
Hydrocarbon and Chemical Management	Contamination of soil or water resulting from hydrocarbon spills.	Prevent contamination of soil and water.	Hydrocarbon spills will be cleaned up immediately and reported following clean up.	Incident Report	Construction Contractor	Immediately following spill. Incident report to be completed within 24 hours.
			Hydrocarbon spill kits will be kept on site at all times and readily available.	Weekly site inspection	Environmental Coordinator	During construction
			All hydrocarbons, chemicals, pesticides and herbicides on site shall be stored in purpose built containers or tanks in a bunded storage are with adequate capacity to contain spills.	Weekly site inspection	Environmental Coordinator	During construction
			No hydrocarbons or chemicals will be stored within 50 m of any drains or drainage lines.	Weekly site inspection	Environmental Coordinator	During construction
			No refuelling will be undertaken within 50 m of a drain or drainage line.	Weekly site inspection	Environmental Coordinator Construction Supervisor	During construction
			Waste chemicals shall be disposed of in accordance with the corresponding MSDS.	MSDS	Construction Supervisor	During construction
			Refuelling on site shall be undertaken on a sealed or bunded surface or if practicable, using a catch tray.	Weekly site inspection	Environmental Coordinator Construction Supervisor	During construction
Waste	Inappropriate	Minimise the risk	Confirm that non-recyclable materials/wastes (including	Appointed waste	Construction	During

Aspect	Potential Impact	Objective	Management Actions	Monitoring/ Audit Compliance Measures	Responsible Person	Timeframe
	disposal of general construction waste.	of contamination as the result of waste. Encourage recycling. Minimise the environmental and health risk of waste exposure.	regulated and controlled wastes) are disposed of at licensed landfill facilities or according to Council regulations.	carriers hold valid licenses. Disposal receipts checked periodically.	Contractor	Construction
			Confirm that employees whose activities include the storage and handling of wastes have been appropriately trained and are competent at undertaking tasks required.	Maintain training records.	Construction Contractor	During Construction
			Supply recycling bins at work sites for glass, aluminium cans, paper and other products, and provide transport to the appropriate recycling facility.	Weekly site inspection	Environmental Coordinator	During Construction
			Stockpile reusable and recyclable products for collection and reuse.	Weekly site inspection	Environmental Coordinator	During Construction
			Wastes will be stored in clearly labelled containers and in such a manner that they will not escape to open land, stormwater drains or surface water courses in accordance with the requirements of the Environmental Protection (Unauthorised Discharges) Regulations, 2004.	Weekly site inspection	Environmental Coordinator	During Construction
			Collection and removal of all domestic wastes from work sites regularly.	Weekly site inspection	Environmental Coordinator	During Construction
			Stockpiled spoil and wastewater will be sampled and analysed according to the DEC's 'Guidelines for Acceptance of Solid Waste to Landfill and Waste Classification and Landfill Waste Definitions, 2005', to identify those acceptable as clean waste.	Weekly site inspection	Environmental Coordinator	During Construction
		Correct storage of liquid waste.	All liquid wastes will be stored within bunded areas to contain any potential spills.	Weekly site inspection	Environmental Coordinator	During Construction
		Prevent accidents during transportation.	All loads carrying spoil should be covered, irrespective of whether they pose a potential risk.	Weekly site inspection	Construction Contractor	During Construction
Sedimentation and Erosion Control	Soil loss and degradation.	Minimise soil loss and degradation.	Use existing access roads and access ways to avoid creation of new ground and soil instability problems.	Weekly site inspection	Environmental Coordinator	During Construction
			As far as is practicable, stockpiles will be kept to a maximum height of 2 m to reduce risk of erosion by surface	Weekly site inspection	Construction Contractor	During Construction

Aspect	Potential Impact	Objective	Management Actions	Monitoring/ Audit Compliance Measures	Responsible Person	Timeframe
			runoff or wind.		Environmental Coordinator	
			The period for which the soil is left open to erosion will be minimised.		Construction Contractor	During Construction
			Suitable stabilising measures will be used for temporary stabilisation and when revegetating areas as appropriate.	Evidence of stability measures used on site.	Construction Contractor	During Construction
Air Pollution	Dust Generation	Minimise the generation of dust and particulates during construction activities.	Vehicle speeds will be restricted to minimise dust.	Speeding to be recorded on the non-conformance register	Construction Contractor	During Construction
			Water unsealed roads and construction site(s) during dry and windy conditions, as required.	Evidence of dust lift	Construction Contractor	During Construction
			Stockpiles will be stabilised against wind and rain if they are to be left for extended periods of time.	Weekly site inspection	Environmental Coordinator	During Construction
			Soil stockpiles created during construction will be kept to a maximum of 2 metres to prevent dust issues.	Weekly site inspection	Environmental Coordinator	During Construction
			No burning of vegetation or other materials will be permitted on site.	Weekly site inspection	Environmental Coordinator	During Construction
			Licences from the Department of Water will be obtained if water for dust suppression is required.	Appropriate licences	Environmental Coordinator	During Construction
			Dusty loads will be covered when travelling around sensitive receptors.	Weekly inspection	Environmental Coordinator	During Construction
			Maintenance schedules will be followed and pre-start inspections shall be undertaken to ensure all vehicles are in good working order	Maintenance reports Prestart inspections	Project manager	During Construction
			All surfaces disturbed as a result of construction activities will be revegetated or otherwise stabilised to reduce the potential for dust issues.	Revegetation Plan	Construction Contractor	During Construction
Noise and Vibration	Noise and vibration impacts to nearby sensitive receptors and potential	To reduce noise and vibration impacts.	Drum rollers to be on oscillating mode by default		Project Manager	Construction
			Construction activities (including materials transport) shall be limited between 0700 -0600 and 1900 -1800 Monday to SaturdaySunday, excluding public holidays (standard work	Approval from the local government	Construction Supervisor	During Construction

Aspect	Potential Impact	Objective	Management Actions	Monitoring/ Audit Compliance Measures	Responsible Person	Timeframe
	disturbance to fauna.	Ensure that noise and vibration management complies with current industry standards. Minimise noise and vibration emissions consistent with the provisions of the *Environmental Protection (Noise) Regulations 1997*.	hours) unless approval is obtained from the local government.			
			Reversing beepers will be used during standard work hours. Less invasive alarms such as croakers may be used if works are required outside standard working hours.		Construction Supervisor	During Construction
			The idling of all plant is to be kept to a minimum.		Construction Supervisor	During Construction
			Radios used on site will be kept to reasonable volumes to prevent disturbance to surrounding receptors.	Weekly site inspection	Construction Supervisor	During Construction
			Residents and businesses in proximity to works will be notified of the work schedule to minimise disruption where possible.	Community communications	Project Manager	During Construction
			Acoustic screens will be utilised where necessary.		Project Manager	During Construction
			Stationary fixed noise generating equipment will be located away from residential areas where possible.		Project Manager	During Construction
Fire	Destruction of property or vegetation.	Prevent fires on site.	All personnel will be educated on bushfire prevention, including the risk of disposing of cigarette butts on the ground.	Induction	Construction Contractor	During Construction
			Appropriate fire fighting equipment will be available at all work sites and in all vehicles in accordance with WA Fire Protection Regulations.	Regular inspections	Construction Supervisor	During Construction
			Clear all flammable materials from around fire ignition sources.		Construction Contractor	During works
			Fire extinguishers and fire fighting equipment will be available for the welding crews.	Regular inspections	Construction Supervisor	During Construction
			Heavy earthmoving machinery and water trucks will be available during construction.	During construction, the work areas will be regularly inspected to access the implementation of the Environmental	Construction Contractor	Construction

Aspect	Potential Impact	Objective	Management Actions	Monitoring/ Audit Compliance Measures	Responsible Person	Timeframe
				Management Plan.		
			Any bushfire incidents and corrective actions will be documented by the contractor and reported to the appropriate authorities as required.	Incident Reports	Construction Contractor	Construction
			Machinery will be maintained and operated to comply with relevant fire safety standards.	Maintenance Records	Construction Contractor	Construction
			Cease work in the event of high fire danger as designated by FESA.	Induction	Construction Contractor	Construction
			All activities involving hot works shall have a valid Hot Works permit.	Induction Hot Works Permit	Construction Contractor	Construction
			Hot works shall not be undertaken on total fire ban days unless an exemption has been approved by Department of Fire and Emergency Services.	Induction Hot Works Permit	Construction Contractor	Construction
			In the event of a fire that exceeds on-site capabilities, documented emergency procedures will be in place to evacuate project workers and local business workers.	Emergency Management Plan	Construction Contractor	Construction
Traffic	Vehicle Movements and potential for accidents.	Minimise the disturbance to traffic. Minimise the risk of injury to road users due to construction vehicles entering and leaving the site.	Construction vehicles will travel along specifically designated routes that have been selected to minimise disturbance on other traffic and the community. This will be based on the size of the vehicle.	Record and report traffic incidents accidents	Construction Contractor	During Construction
			Road access will be maintained in the project area.		Construction Contractor	During Construction
			Use appropriate personal safety and traffic management signs.	Staff wearing PPE onsite Traffic signs in use as per relevant Traffic Control Standards	Construction Contractor	During Construction
Environmental Monitoring	Lack of environmental monitoring for compliance.	To confirm that environmental management measures have been complied	During the project construction phase, compliance with environmental management measures will be monitored. Any non-conformance will be addressed in the first instance, while the non-conformance and the corrective action will be detailed in a Non-Conformance Register.	Non-conformance register.	Project Manager	Construction

Aspect	Potential Impact	Objective	Management Actions	Monitoring/ Audit Compliance Measures	Responsible Person	Timeframe
		with.				
Post-Construction						
Rehabilitation	Inadequate rehabilitation resulting in reduced regrowth and minimising fauna habitat.	Manage and remediate construction impacts to native vegetation where possible.	Develop a Rehabilitation and Landscape Management Plan.	Revegetation Plan	Project Manager	Post-construction
			Soft landscaping will include rehabilitation with native species.	Revegetation Plan	Project Manager	Post-construction
			Avoid establishment of foraging habitat immediately adjacent to the road alignment to minimise the risk of vehicle strike.	Revegetation Plan	Project Manager	Post-construction
			Any logs or other material which has value as habitat for fauna is to be stockpiled and replaced on the revegetation area (where possible).	Revegetation Plan	Project Manager	Post-construction
			Landforms will be returned to their original contours (where possible).	Revegetation Plan	Project Manager	Prior to clearing for use post-construction
			Flora species used for rehabilitation will be endemic to the area.	Revegetation Plan	Project Manager	Post-Construction
			The construction area will be rehabilitated to within the existing contours, in as far as is practicable.	Revegetation Plan	Project Manager	Post-Construction
			Salvaged topsoil must be respread as close as possible to the areas from which it was sourced.	Revegetation Plan	Project Manager	Post-Construction
			Revegetation works will be carried out in accordance with the Main Roads *Environmental Guideline Revegetation Planning and Techniques.*	Revegetation Plan	Project Manager	Post-Construction
Visual Amenity	Visual impacts to and from the road.	To reduce the visual impacts and restore the visual amenities of the project area.	Encourage revegetation during, or soon after road construction is complete. Revegetation of the project area will follow those specifications outlined in the Revegetation Plan. Confirm the construction area is left clean and tidy with all waste and spoil heaps removed and the area contoured to a suitable shape.	Revegetation Plan	Project Manager Construction Contractor	Post-construction
			Revegetated areas will be maintained to prevent the loss of	Monitor	Project Manager	Post-construction

Aspect	Potential Impact	Objective	Management Actions	Monitoring/ Audit Compliance Measures	Responsible Person	Timeframe
			plant species. Weed management of these areas will be carried out as per the Revegetation Plan.	revegetation success as per completion criteria.	Construction Contractor	
			Revegetation should include the use of vegetation as screening along road verges adjacent to residential areas.	Revegetation Plan	Project Manager	Post-construction

5.9.1 Section 3

Table 20 Environmental Management Plan - Section 3

Aspect	Potential Impact	Objective	Management Actions	Monitoring/ Audit Compliance Measures	Responsible Person	Timeframe
Pre-Construction						
Vegetation	Loss of fauna habitat. Loss of native vegetation.	Reduce the footprint of the Project to minimise impacts to vegetation and retain fauna habitat.	Detailed design will take into account native vegetation including Priority flora species known from the Project area and clearing will be avoided where possible in these areas.	Detailed design drawings	Project Manager	During detailed design
			Significant trees (e.g. hollow-bearing trees) identified along the Project alignment will be retained where possible by altering the design on a micro-level..	Detailed design drawings	Project Manager	During detailed design
			Potential black cockatoo habitat will be retained where possible.	Detailed design drawings	Project Manager	During detailed design
			Plan and develop storage sites, laydown areas, hardstands and other areas which require clear space to occur within areas which are already cleared or otherwise disturbed.	Laydown, handstand and infrastructure mapping	Project Manager	During detailed design. Prior to commence-ment of clearing
			A Revegetation Plan will be prepared prior to construction to minimise impacts and determine the rehabilitation of remaining areas. The plan will include as a minimum the following: • A figure showing areas to be cleared and any requirements for retention of specific habitat trees or other significant vegetation; • A figure indicating areas to be revegetated; • Weed management – including hygiene protocols, requirements for imported materials and ongoing weed management; • Requirements for vegetation chipping and re-use; • Requirements for topsoil use and /or soil preparation or	Revegetation Plan submitted to DER	Project Manager	Pre-Construction

Aspect	Potential Impact	Objective	Management Actions	Monitoring/ Audit Compliance Measures	Responsible Person	Timeframe
			treatment ; • Species lists and planting and/or seeding zones; • Estimates of quantities and costs; and • Completion criteria for revegetation success.			
			The induction program will include relevant vegetation and flora information.	Induction	Project Manager	Pre-construction
Weeds and Dieback	Spread of weeds and dieback.	To prevent the spread of weeds and dieback on site.	The induction shall include information regarding dieback and weed impacts and management actions outlined in this table.	Induction	Project Manager	Pre-construction
Surface Water	Changes to / increases in flooding regimes and surface water flows due to construction works.	Prevent damage to environment from changes to flood regimes and surface water flows.	Drainage design for the final alignment will maintain existing surface water drainage patterns and avoid exacerbating waterlogging in susceptible areas.	Detailed design drawings	Project Manager	During detailed design
			Design to maintain hydrological balance between each side of the road.	Detailed design, Hydrological modelling.	Project Manager	Pre-construction
			Stormwater management shall be designed and implemented wherever relevant on road construction areas and within laydown areas and at offices.	designs	Construction Contractor Environmental Coordinator	Pre-Construction
Site Contamination	Spread of contamination as a result of works.	Prevent contamination on site.	Contamination management requirements will be included in the site induction.	Induction	Project Manager	Pre-construction
Acid Sulphate Soils	Impacts to soil and water as a result of Acid Sulphate Soils.	Prevent contamination caused by Acid Sulphate Soils.	If works below the water table are required, investigations into the presence of ASS in the area will be conducted and a separate Acid Sulphate Soils Management Plan will be developed if required.	ASS investigations ASSMP	Project Manager	Pre-construction
Hydrocarbon and chemical management	Hydrocarbon or chemical spills onsite resulting in contamination.	To prevent environmental impacts resulting from incorrect use of spill kits.	All staff shall be trained in the use of spill kits.	Induction	Project Manager	Pre-construction
Construction Waste	Impacts to vegetation, fauna	To prevent impacts to the	The induction will outline the requirements for waste minimisation and management practices.	Induction	Project Manger	Pre-construction

Aspect	Potential Impact	Objective	Management Actions	Monitoring/ Audit Compliance Measures	Responsible Person	Timeframe
	habitat and visual amenity.	environment from construction waste.				
Air Quality	Impacts to nearby receptors and plant life.	Reduce potential impacts to air quality including dust.	Workforce inductions will include education in relation to the minimisation of dust.	Induction	Project manager	Pre-construction
Noise and vibration	Noise and vibration impacts due to lack of staff awareness.	To prevent noise and vibration impacts.	Workforce inductions will include education in relation to the minimisation of noise and vibration.	Induction	Project Manager	Pre-construction
			Select machinery that will produce the lowest practical level of noise and vibration. All machinery to be fitted with mufflers prior to construction.		Project Manager	Pre-Construction
			Property condition surveys will be conducted and reports prepared by an independent qualified assessor for all properties within 50 m of works.	Property condition surveys	Project Manager	Pre-Construction
			A complaints register will be established and maintained.	Complaints register	Project Manager	Pre-Construction
			Staff facilities and laydown areas will be planned to prevent noise impacts to nearby sensitive receptors.	Laydown maps	Project Manager	Pre-Construction
Fire	Fire risk to adjoining vegetation and businesses.	Fire prevention	Consultation with relevant authorities will be undertaken and compliance with all relevant fire restrictions and notification requirements will be met.	Consult with FESA with regards to fire restrictions. All permits and regulatory requirements have been met.	Construction Contractor	Pre-construction
			The construction workforce is to be trained in fire risks and emergency procedures.	Training certificates available for staff trained in fire fighting.	Construction Contractor	Pre-construction
Public Consultation	Community complains and potential damage to company reputation.	Maintain company reputation and prevent	Nearby sensitive receptors will be consulted regarding the proposed works and management of potential impacts prior to construction commencement.	Records of community consultation	Project Manager	Pre-construction

Aspect	Potential Impact	Objective	Management Actions	Monitoring/ Audit Compliance Measures	Responsible Person	Timeframe
		complaints where possible.				
Visual Amenity	Loss of visual amenity and potential for community complaints.	Prevent loss of visual amenity and complaints where possible.	Selection of design with the lowest possible profile and footprint where possible.	Detailed design drawings	Project Manager	Pre-construction
			Reduce the amount of cut and fill through vegetated areas.	Detailed design drawings	Project Manager	Pre-construction
			Retention of significant Salmon Gum trees will be maintained adjacent to the South Coast Highway where possible to maintain the 'entrance statement' to Ravensthorpe.	Detailed design drawings	Project Manager	Pre-construction
European Heritage	Loss of integrity of European heritage site. Impacts to fauna linkages in the region as a result of clearing in the Fitzgerald River Ravensthorpe Range Area biodiversity hotspot.	To prevent impacts to the Fitzgerald River Ravensthorpe Range Area.	Detailed design will take into account the National Heritage Site and clearing will be avoided where possible in these areas.	Detailed design drawings	Project Manager	During detailed design
			If clearing is required in the National Heritage area, approval from the Commonwealth Department of the Environment (DotE) will be obtained prior to conduction.	Approval from the DotE	Project Manager	Pre-Contraction
Environmental Management	Environmental impacts due to lack of staff awareness.	To confirm that all persons involved in the project area are aware of the environmental constraints involved.	A copy of this EMP will be provided to the Construction Contractor. All relevant environmental management measures or other specifications prepared for the project will be provided to the Construction Contractor.	EMP Non-conformance register	Project Manager	Pre-construction
During Construction						
Vegetation	Loss of fauna habitat. Loss of native	Minimise impacts to native vegetation and loss of fauna	Vegetation in the remnant corridor with high conservation value will be retained where possible.	Clearing maps	Project Manager	Prior to and during clearing
			Maps of significant trees will be provided to the Construction	Supervisor to check	Construction	Prior to

Aspect	Potential Impact	Objective	Management Actions	Monitoring/ Audit Compliance Measures	Responsible Person	Timeframe
	vegetation. Loss of habitat connectivity. Increase in erosion and land degradation.	habitat. Minimise impacts to black cockatoo habitat. Retain significant vegetation.	Contractor and trees to be retained will be adequately marked prior to clearing.	prior to clearing.	Supervisor Construction Contractor	clearing
			The vegetation in excellent condition adjacent to Section 3 will be retained where possible.	Clearing maps	Project Manager	Prior to and during clearing
			Salmon Gum woodland in Section 3 will be retained where possible.	Clearing maps	Project Manager	Prior to and during clearing
			Prior to the start of clearing operations the Construction Contractor will mark out the clearing line and this will be checked by the Supervisor.	Supervisor to check prior to clearing.	Construction Supervisor Construction Contractor	Prior to clearing
			Fencing (temporary or otherwise) shall be placed to delineate the project area from areas to be retained.	Weekly site inspection	Environmental Coordinator	During construction
			Areas where cleared plant material can be chipped will be marked. These areas will be specified in the Revegetation Plan	Revegetation Plan	Construction Supervisor Construction Contractor	Prior to clearing
			During construction there will be no dumping of materials/wastes.	Weekly site inspection	Environmental Coordinator	During construction
			Materials, equipment, parking or any other use which disturbs native vegetation will not be allowed outside the clearing lines.	Weekly site inspection	Construction Contractor Weekly inspection by Environmental	During construction

Aspect	Potential Impact	Objective	Management Actions	Monitoring/ Audit Compliance Measures	Responsible Person	Timeframe
					Coordinator	
			Vegetation which can be retained will be pruned with a chainsaw in preference to clearing where practicable.	Weekly site inspection	Construction Contractor Weekly inspection by Environmental Coordinator	During construction
			Trees to be removed shall be felled in a manner that they fall within the approved clearing area.		Construction Contractor	During clearing
			Vehicles and material storage should not be within 4 metres of the base of trees.	Weekly site inspection	Construction Contractor Weekly inspection by Environmental Coordinator	During construction
			Any pollution events that occur will be cleaned up as soon as possible with minimal disturbance to adjoining vegetation.	Incident Reports	Construction Contractor Weekly check by Environmental Coordinator	At all times
			Clearing will not be undertaken any further than 4 m from the boundary of earthworks unless required for safety reasons.	Weekly inspection	Weekly inspection by Environmental Coordinator	During construction
Weeds and Dieback	Section 3 has been heavily disturbed and works could	Prevent the spread of weeds and Dieback in	All works will comply with topsoil and weed management outlined in the Revegetation Plan.	Revegetation Plan	Construction Supervisor	At all times

Aspect	Potential Impact	Objective	Management Actions	Monitoring/ Audit Compliance Measures	Responsible Person	Timeframe
	exacerbate the spread of weeds. Spread of dieback to the Project area and potentially to the larger area including the Fitzgerald River National Park.	the Project area.	Monitor weeds in the Project area as per the requirements of the Revegetation Plan.	Weekly inspection	Weekly inspection by Environmental Coordinator	Weekly during construction
			Weeds will be sprayed prior to commencement of clearing.	Weed contractor compliance reports	Construction Supervisor	Prior to clearing
			Where noxious weeds are observed, their location is to be recorded and the area sprayed with a relevant herbicide before seed dispersal occurs.	Weed contractor compliance reports	Construction Supervisor	When noted
			All machinery, vehicles, equipment and materials must be effectively cleaned down prior to arrival at the Project area and whenever re-entering the Project area. Effective clean down will involve the removal of all soil and plant material from machinery, vehicles, equipment, tools and footwear so it cannot be transported. Attention will be given to removing soil and plant material from under vehicles and machinery, especially from running boards, belly plates, spare tyres and wheels.	Weekly site inspection	Construction Contractor Weekly check by Environmental Coordinator	Prior to entering or re-entering the construction area
			The number of access points to the project shall be reduced as far as practicable.	Site access maps	Construction Contractor	During Construction
			Effective cleandown will be performed at a controlled location where all cleandown effluent can be contained and restricted from entering receiving environments that may impact native vegetation that may be uninfested by Phytophthora.	Weekly site inspection	Construction Contractor Weekly check by Environmental Coordinator	At all times
			Imported materials, such as gravel, to be used as road base will not be sourced from an area known to be infested with Phytophthora in accordance with the Dieback Management Plan.		Project Manager	Prior to materials being imported
			Hand held equipment, tools and footwear will be sterilised using methylated spirits. Other equipment will be sterilised by soaking in a disinfectant such as bleach if appropriate. Water will be	Weekly Site Inspection	Construction Supervisor	Prior to entering or re-entering

Aspect	Potential Impact	Objective	Management Actions	Monitoring/ Audit Compliance Measures	Responsible Person	Timeframe
			sterilised by adding 6 ml of sodium hypochlorite (bleach or pool chlorine) to every 10 L of water.			the construction area.
Topsoil	Spread of weeds and dieback through unappropriated use of topsoil Loss of suitable seek bank through inadequate topsoil management.	Retain seed bank for the Project area Prevent the spread of weeds and/or dieback.	Soil in Section 3, will be treated as being contaminated with weed propagules. Soils in Section 3 will not be used in other Sections of the Project. Any soil removed from Section 3 will be disposed of to landfill or used as deep embankment fill at least 2 m below finished level.	Revegetation Plan	Construction Contractor	During clearing
			Topsoil stripping and management will be in accordance with proposed treatments outlined in the Revegetation Plan, including: • Topsoil will be stripped to a minimum depth of 100 mm along all sections of the works; • Where topsoil is not suitable for reuse it will be disposed of to a site agreed by Local Authorities and/or adjoining landholders; • Topsoil that is to be reused will be stored as close as possible to the source of the area or target area for reuse; and • Topsoil will be stored in an area as free as possible from weeds and in windrows or heaps ideally 1 metre high (maximum 2 metres). It should be reused as soon as possible after stripping, and as close as possible to its source.	Revegetation Plan	Construction Contractor	During clearing
			Topsoil will be stored in already cleared areas where possible.	Revegetation Plan	Construction Contractor	During clearing
Fauna	Harm and disruption to native fauna.	Minimise the impact to native fauna species.	Vegetation clearing lines will be clearly marked and checked prior to the commencement of clearing operations by the Supervisor. Clearing will not occur outside the marked clearing lines.	Clearing lines checked prior to clearing	Construction Supervisor	Prior to Clearing
			Habitat trees will be clearly marked and retained where possible and confirmed by the Supervisor. Damage to trees by plant and other construction vehicles will also be minimised by following management options outlined in the “Vegetation” aspect above.	Habitat trees to be clearly marked prior to clearing and confirmed by the Supervisor.	Construction Supervisor	Prior to and During Clearing

Aspect	Potential Impact	Objective	Management Actions	Monitoring/ Audit Compliance Measures	Responsible Person	Timeframe
			No pets, traps or firearms will be allowed on the project site.		Construction Supervisor	During Construction
			Immediately prior to the clearing of vegetation, a pre-clearance fauna survey will be conducted by a trained fauna ecologist to remove any fauna that may be displaced in the clearing process.	Pre-clearance fauna survey	Fauna Ecologists Environmental Coordinator Construction Supervisor	Prior to Clearing
			Clearing should be undertaken from degraded areas towards better quality bushland areas on one front, to provide an opportunity for fauna to move out of the clearing area.	Induction Clearing records	Construction Supervisor	During Clearing
			Any animals disturbed by the works should be allowed to leave the site before further works occur.	Incident reports of fauna mortality	Construction Contractor	During clearing
			Machinery should start up at least 10 minutes prior to clearing to potentially 'scare' fauna away from the area.	Induction Clearing records	Construction Supervisor	During Clearing
			Native fauna encounters will be recorded and reported to DEPaW.	Fauna register	Environmental Coordinator	During Construction
			Removal of any fauna from the project area will only be undertaken by a designated and trained person.	Fauna register	Environmental Coordinator	During Construction
			If injured/sick animals are encountered, or eggs are removed from trees, a nominated licenced fauna carer shall be called to care for the animal. The carer may only enter site if escorted by the Construction Supervisor. This action is restricted to mammal and avian species, and medium to large reptiles. Alternatively animals may be taken to the local veterinary centre.	Fauna register	Construction Supervisor	During Construction
			No native fauna (including venomous snakes) will be impaired or killed by construction personnel.	Incident reports of fauna mortality	Environmental Coordinator	During clearing
			Any trenches or open excavations will be checked daily for fauna and any fauna will be removed as soon as possible without damage to the animal.	Fauna register	Environmental Coordinator Construction Supervisor	During Construction
			Temporary fencing shall be placed around high use fauna areas, such as cockatoo feeding areas, once clearing has concluded.	Weekly site inspection	Environmental Coordinator	Post-clearing

Aspect	Potential Impact	Objective	Management Actions	Monitoring/ Audit Compliance Measures	Responsible Person	Timeframe
			Speed restrictions shall be implemented for all access tracks on site.		Construction Supervisor	During Construction
			Lighting shall be directed toward the intended target to prevent excessive light spill.		Construction Supervisor	During Construction
			Control of feral/pest animals shall be undertaken if deemed necessary.	Fauna register	Environmental Coordinator	During Construction
Surface Water	Disturbance to surface water features.	Prevent disturbance to surface water features.	During construction there will be no diversion of drainage lines that will impact on vegetation.	Weekly Inspection	Construction Contractor Environmental Coordinator	During Construction
			Erosion controls shall be applied upstream of all permanent discharge points.	Weekly Inspection	Construction Contractor Environmental Coordinator	During Construction
			Stormwater management will include the use of low bunds, silt fencing, bales or other erosion and siltation prevention equipment where necessary.	Weekly Inspection	Construction Contractor Environmental Coordinator	During Construction
			Stockpiles which will remain on site for more than a day during high rainfall periods will be bunded where necessary to minimise runoff. Stockpiles will not be placed within 15 m of a drainage line.	Weekly Inspection	Construction Contractor Environmental Coordinator	During Construction
			Wash down of vehicles and plant will not occur except in designated areas such as the wash down bays.	Weekly Inspection	Construction Contractor Environmental Coordinator	During Construction
			Wash down of concrete trucks, apart from the truck chute, will not occur on site. Concrete water from the chute wash down will be confined onsite and removed once hardened. It will not be released into vegetated areas.	Weekly Inspection	Construction Contractor Environmental Coordinator	During Construction

Aspect	Potential Impact	Objective	Management Actions	Monitoring/ Audit Compliance Measures	Responsible Person	Timeframe
Aboriginal heritage Sites	Unlicensed removal or disturbance to Registered Aboriginal Heritage Sites. Removal or disturbance of unregistered and/or newly discovered Aboriginal heritage sites.	Prevent unlicensed impacts to aboriginal heritage sites. Prevent unlicensed impacts to newly discovered Aboriginal Heritage Sites.	Clearing areas will be clearly defined and indigenous heritage sites in the immediate area flagged to prevent unauthorised damage.	Clearing areas checked by Supervisor prior to clearing Weekly Inspection to verify flagging	Construction Supervisor Environmental Coordinator	Prior to Clearing During Construction
			In the event of any artefact material being uncovered in the course of the ground disturbing activities, work will stop in the vicinity of the site while the Department of Indigenous Affairs carries out an investigation.	Discussions with Department of Indigenous Affairs	Project Manager	If required
			Should any Aboriginal Heritage objects be identified they shall be salvaged and managed according to advice from an indigenous representative.	Documentation of heritage site	Project Manager	If required
			In the case of skeletal material being uncovered, work will cease immediately and the Western Australian Police will be notified.	Incident Report	Project Manager	If required.
Site Contamination	Spread of contamination from existing contaminated sites encountered during works.	Prevent spread of contaminated soil or water.	Should unexpected contamination be encountered the Construction Supervisor and Environmental Coordinator will be notified. An assessment of the risk to human health and the environment will be undertaken. The removal of contaminated soils will be undertaken in accordance with DER guidelines and soils will be treated as appropriate.	Incident report	Construction Supervisor Environmental Coordinator	If encountered
			Analysis of any site contamination if required will be undertaken at an accredited laboratory.	Lab accreditation Lab receipts	Project Manager Environmental Coordinator	If encountered
			During intrusive works such as excavations, if visual and or olfactory evidence suggests potential for contamination (e.g. fill material, building rubble, odours, soil staining), works will cease, the Construction Supervisor will be notified, and the material sampled and analysed. Works will commence once the status of the material has been confirmed and corrective actions implemented (if required).	Incident report	Construction Supervisor	If encountered
			Determination of contamination and requirements for remediation will be undertaken on advice from the Environmental Coordinator. The site of potential contamination will be contained	Incident report	Construction Supervisor Environmental	If encountered

Aspect	Potential Impact	Objective	Management Actions	Monitoring/ Audit Compliance Measures	Responsible Person	Timeframe
			(i.e. bunded) to prevent any spread of contaminates, and will be fenced to prevent any unauthorised access.		Coordinator	
			Any contaminated soil shall be disposed of at an appropriate licenced facility and records of disposal maintained.	Disposal receipts	Project Manager Environmental Coordinator	During construction
Hydrocarbon and Chemical Management	Contamination of soil or water resulting from hydrocarbon spills.	Prevent contamination of soil and water.	Hydrocarbon spills will be cleaned up immediately and reported following clean up.	Incident Report	Construction Contractor	Immediately following spill. Incident report to be completed within 24 hours.
			Hydrocarbon spill kits will be kept on site at all times and readily available.	Weekly site inspection	Environmental Coordinator	During construction
			All hydrocarbons, chemicals, pesticides and herbicides on site shall be stored in purpose built containers or tanks in a bunded storage are with adequate capacity to contain spills.	Weekly site inspection	Environmental Coordinator	During construction
			No hydrocarbons or chemicals will be stored within 50 m of any drains or drainage lines.	Weekly site inspection	Environmental Coordinator	During construction
			No refuelling will be undertaken within 50 m of a drain or drainage line.	Weekly site inspection	Environmental Coordinator Construction Supervisor	During construction
			Waste chemicals shall be disposed of in accordance with the corresponding MSDS.	MSDS	Construction Supervisor	During construction
			Refuelling on site shall be undertaken on a sealed or bunded surface or if practicable, using a catch tray.	Weekly site inspection	Environmental Coordinator Construction Supervisor	During construction
Waste	Inappropriate disposal of general construction waste.	Minimise the risk of contamination as the result of	Confirm that non-recyclable materials/wastes (including regulated and controlled wastes) are disposed of at licensed landfill facilities or according to Council regulations.	Appointed waste carriers hold valid licenses.	Construction Contractor	During Construction

Aspect	Potential Impact	Objective	Management Actions	Monitoring/ Audit Compliance Measures	Responsible Person	Timeframe
		waste. Encourage recycling. Minimise the environmental and health risk of waste exposure.		Disposal receipts checked periodically.		
			Confirm that employees whose activities include the storage and handling of wastes have been appropriately trained and are competent at undertaking tasks required.	Maintain training records.	Construction Contractor	During Construction
			Supply recycling bins at work sites for glass, aluminium cans, paper and other products, and provide transport to the appropriate recycling facility.	Weekly site inspection	Environmental Coordinator	During Construction
			Stockpile reusable and recyclable products for collection and reuse.	Weekly site inspection	Environmental Coordinator	During Construction
			Wastes will be stored in clearly labelled containers and in such a manner that they will not escape to open land, stormwater drains or surface water courses in accordance with the requirements of the Environmental Protection (Unauthorised Discharges) Regulations, 2004.	Weekly site inspection	Environmental Coordinator	During Construction
			Collection and removal of all domestic wastes from work sites regularly.	Weekly site inspection	Environmental Coordinator	During Construction
			Stockpiled spoil and wastewater will be sampled and analysed according to the DEC's 'Guidelines for Acceptance of Solid Waste to Landfill and Waste Classification and Landfill Waste Definitions, 2005', to identify those acceptable as clean waste.	Weekly site inspection	Environmental Coordinator	During Construction
		Correct storage of liquid waste.	All liquid wastes will be stored within bunded areas to contain any potential spills.	Weekly site inspection	Environmental Coordinator	During Construction
		Prevent accidents during transportation.	All loads carrying spoil should be covered, irrespective of whether they pose a potential risk.	Weekly site inspection	Construction Contractor	During Construction
Sedimentation and Erosion Control	Soil loss and degradation.	Minimise soil loss and degradation.	Use existing access roads and access ways to avoid creation of new ground and soil instability problems.	Weekly site inspection	Environmental Coordinator	During Construction
			As far as is practicable, stockpiles will be kept to a maximum height of 2 m to reduce risk of erosion by surface runoff or wind.	Weekly site inspection	Construction Contractor Environmental Coordinator	During Construction

Aspect	Potential Impact	Objective	Management Actions	Monitoring/ Audit Compliance Measures	Responsible Person	Timeframe
			The period for which the soil is left open to erosion will be minimised.		Construction Contractor	During Construction
			Suitable stabilising measures will be used for temporary stabilisation and when revegetating areas as appropriate.	Evidence of stability measures used on site.	Construction Contractor	During Construction
Air Pollution	Dust Generation	Minimise the generation of dust and particulates during construction activities.	Vehicle speeds will be restricted to minimise dust.	Speeding to be recorded on the non-conformance register	Construction Contractor	During Construction
			Water unsealed roads and construction site(s) during dry and windy conditions, as required.	Evidence of dust lift	Construction Contractor	During Construction
			Stockpiles will be stabilised against wind and rain if they are to be left for extended periods of time.	Weekly site inspection	Environmental Coordinator	During Construction
			Soil stockpiles created during construction will be kept to a maximum of 2 metres to prevent dust issues.	Weekly site inspection	Environmental Coordinator	During Construction
			No burning of vegetation or other materials will be permitted on site.	Weekly site inspection	Environmental Coordinator	During Construction
			Licences from the Department of Water will be obtained if water for dust suppression is required.	Appropriate licences	Environmental Coordinator	During Construction
			Dusty loads will be covered when travelling around sensitive receptors.	Weekly inspection	Environmental Coordinator	During Construction
			Maintenance schedules will be followed and pre-start inspections shall be undertaken to ensure all vehicles are in good working order	Maintenance reports Prestart inspections	Project manager	During Construction
			All surfaces disturbed as a result of construction activities will be revegetated or otherwise stabilised to reduce the potential for dust issues.	Revegetation Plan	Construction Contractor	During Construction
Noise and Vibration	Noise and vibration impacts to nearby sensitive receptors and potential disturbance to fauna.	To reduce noise and vibration impacts. Ensure that noise and vibration	Drum rollers to be on oscillating mode by default		Project Manager	Construction
			Construction activities (including materials transport) shall be limited between 0700 - 0600 and 1900 - 1800 Monday to SaturdaySunday, excluding public holidays (standard work hours) unless approval is obtained from the local government.	Approval from the local government	Construction Supervisor	During Construction
			Reversing beepers will be used during standard work hours.		Construction	During

Aspect	Potential Impact	Objective	Management Actions	Monitoring/ Audit Compliance Measures	Responsible Person	Timeframe
		management complies with current industry standards. Minimise noise and vibration emissions consistent with the provisions of the *Environmental Protection (Noise) Regulations 1997*.	Less invasive alarms such as croakers may be used if works are required outside standard working hours.		Supervisor	Construction
			The idling of all plant is to be kept to a minimum.		Construction Supervisor	During Construction
			Radios used on site will be kept to reasonable volumes to prevent disturbance to surrounding receptors.	Weekly site inspection	Construction Supervisor	During Construction
			Residents and businesses in proximity to works will be notified of the work schedule to minimise disruption where possible.	Community communications	Project Manager	During Construction
			Acoustic screens will be utilised where necessary.		Project Manager	During Construction
			Stationary fixed noise generating equipment will be located away from residential areas where possible.		Project Manager	During Construction
Fire	Destruction of property or vegetation.	Prevent fires on site.	All personnel will be educated on bushfire prevention, including the risk of disposing of cigarette butts on the ground.	Induction	Construction Contractor	During Construction
			Appropriate fire fighting equipment will be available at all work sites and in all vehicles in accordance with WA Fire Protection Regulations.	Regular inspections	Construction Supervisor	During Construction
			Clear all flammable materials from around fire ignition sources.		Construction Contractor	During works
			Fire extinguishers and fire fighting equipment will be available for the welding crews.	Regular inspections	Construction Supervisor	During Construction
			Heavy earthmoving machinery and water trucks will be available during construction.	During construction, the work areas will be regularly inspected to access the implementation of the Environmental Management Plan.	Construction Contractor	Construction
			Any bushfire incidents and corrective actions will be documented by the contractor and reported to the appropriate authorities as	Incident Reports	Construction Contractor	Construction

Aspect	Potential Impact	Objective	Management Actions	Monitoring/ Audit Compliance Measures	Responsible Person	Timeframe
			required.			
			Machinery will be maintained and operated to comply with relevant fire safety standards.	Maintenance Records	Construction Contractor	Construction
			Cease work in the event of high fire danger as designated by FESA.	Induction	Construction Contractor	Construction
			All activities involving hot works shall have a valid Hot Works permit.	Induction Hot Works Permit	Construction Contractor	Construction
			Hot works shall not be undertaken on total fire ban days unless an exemption has been approved by Department of Fire and Emergency Services.	Induction Hot Works Permit	Construction Contractor	Construction
			In the event of a fire that exceeds on-site capabilities, documented emergency procedures will be in place to evacuate project workers and local business workers.	Emergency Management Plan	Construction Contractor	Construction
Traffic	Vehicle Movements and potential for accidents.	Minimise the disturbance to traffic. Minimise the risk of injury to road users due to construction vehicles entering and leaving the site.	Construction vehicles will travel along specifically designated routes that have been selected to minimise disturbance on other traffic and the community. This will be based on the size of the vehicle.	Record and report traffic incidents accidents	Construction Contractor	During Construction
			Road access will be maintained in the project area.		Construction Contractor	During Construction
			Use appropriate personal safety and traffic management signs.	Staff wearing PPE onsite Traffic signs in use as per relevant Traffic Control Standards	Construction Contractor	During Construction
European Heritage	Loss of integrity of European heritage site. Impacts to fauna linkages in the region as a result of clearing in the Fitzgerald River	To prevent impacts to the Fitzgerald River Ravensthorpe Range Area.	Detailed design will take into account the National Heritage Site and clearing will be avoided where possible in these areas.	Detailed design drawings	Project Manager	During detailed design

Aspect	Potential Impact	Objective	Management Actions	Monitoring/ Audit Compliance Measures	Responsible Person	Timeframe
	Ravensthorpe Range Area biodiversity hotspot.					
Environmental Monitoring	Lack of environmental monitoring for compliance.	To confirm that environmental management measures have been complied with.	During the project construction phase, compliance with environmental management measures will be monitored. Any non-conformance will be addressed in the first instance, while the non-conformance and the corrective action will be detailed in a Non-Conformance Register.	Non-conformance register.	Project Manager	Construction
Post-Construction						
Rehabilitation	Inadequate rehabilitation resulting in reduced regrowth and minimising fauna habitat.	Manage and remediate construction impacts to native vegetation where possible.	Develop a Rehabilitation and Landscape Management Plan	Revegetation Plan	Project Manager	Post-construction
			Soft landscaping will include rehabilitation with native species	Revegetation Plan	Project Manager	Post-construction
			Avoid establishment of foraging habitat immediately adjacent to the road alignment to minimise the risk of vehicle strike.	Revegetation Plan	Project Manager	Post-construction
			Any logs or other material which has value as habitat for fauna is to be stockpiled and replaced on the revegetation area (where possible).	Revegetation Plan	Project Manager	Post-construction
			Landforms will be returned to their original contours (where possible).	Revegetation Plan	Project Manager	Prior to clearing for use post-construction
			Flora species used for rehabilitation will be endemic to the area.	Revegetation Plan	Project Manager	Post-Construction
			The construction area will be rehabilitated to within the existing contours, in as far as is practicable.	Revegetation Plan	Project Manager	Post-Construction

Aspect	Potential Impact	Objective	Management Actions	Monitoring/ Audit Compliance Measures	Responsible Person	Timeframe
			Salvaged topsoil must be respread as close as possible to the areas from which it was sourced.	Revegetation Plan	Project Manager	Post-Construction
			Revegetation works will be carried out in accordance with the Main Roads *Environmental Guideline Revegetation Planning and Techniques.*	Revegetation Plan	Project Manager	Post-Construction
Visual Amenity	Visual impacts to and from the road.	To reduce the visual impacts and restore the visual amenities of the project area.	Encourage revegetation during, or soon after road construction is complete. Revegetation of the project area will follow those specifications outlined in the Revegetation Plan. Confirm the construction area is left clean and tidy with all waste and spoil heaps removed and the area contoured to a suitable shape.	Revegetation Plan	Project Manager Construction Contractor	Post-construction
			Revegetated areas will be maintained to prevent the loss of plant species. Weed management of these areas will be carried out as per the Revegetation Plan.	Monitor revegetation success as per completion criteria.	Project Manager Construction Contractor	Post-construction
			Revegetation should include the use of vegetation as screening along road verges adjacent to residential areas.	Revegetation Plan	Project Manager	Post-construction

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Appendices

Conservations codes – Appendix A

Ravensthorpe Heavy Haulage Preliminary Site Contamination Investigation (GHD 2013d) – Appendix B

Ravensthorpe Heavy Haulage Route Botanical Survey (Great Southern Biologic 2013a) – Appendix C

Ravensthorpe Heavy Haulage Route Targeted Spring Flora Survey (Great Southern Biologic 2013b) – Appendix C

Survey of Ravensthorpe Heavy Haulage Route as re-aligned (Great Southern Biologic 2014) – Appendix C

Ravensthorpe Heavy Haulage Route Fauna assessment and targeted fauna surveys (GHD 2014a) – Appendix D

Report of an Aboriginal Heritage Survey for the Proposed Ravensthorpe Heavy Haulage Route in Ravensthorpe, Western Australia (Brad Goode and Associated 2013) – Appendix E

Ravensthorpe Heavy Haulage Route Noise Assessment (GHD 2013b) – Appendix F

Ravensthorpe Heavy Haulage Route Air Assessment (GHD 2013c) – Appendix G

Phytophthora Dieback Assessment and Associated Management Plan for the Proposed Ravensthorpe Bypass Heavy Haulage Route, Ravensthorpe (Great Southern Biologic 2013c) – Appendix H

Ravensthorpe Heavy Haulage Route EPBC Act Referral (GHD 2013e) – Appendix I

South Coast Highway - Alignment Selection Study for : the RHHR Summary Planning Report (Main Roads 2012) – Appendix J

Ravensthorpe Heavy Haulage Route Short Range Endemic surveys (GHD 2014b) – Appendix K