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BHP Billiton
Nickel West Pipelines
Biological Survey
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Executive Summary

GHD Pty Ltd (GHD) were commissioned by BHP Nickel West Pty Ltd to conduct a Vegetation Survey and Clearing Permit Application for the proposed replacement of three Nickel West pipelines near Baldivis. The Project Area extends approximately 7 km from the Kwinana Nickel West Refinery off Patterson Road, East Rockingham, to the Baldivis staging pond enclosure located on Millar Road, Baldivis. The existing polyethylene (PE) pipelines are 110mm, 160mm, and 250mm in diameter. The replacement pipelines will be the same diameters and material as the existing pipelines and will be laid in a common trench to minimise disturbance. The total disturbance footprint is approximately 7 hectares, however approximately only 1 hectare of native vegetation will require clearing. The vegetation survey and fauna habitat assessment is required to provide the necessary information to support a Native Vegetation Clearing Permit Application which may be required for the proposed activities.

The flora and fauna assessment included a field survey that was conducted on the 10th November 2009. The results of the assessments are summarised below:

- ▶ An 'A Class' conservation area, Leda Nature Reserve, is situated adjacent to the southern section of the Project Area, east of the railway and pipeline route;
- ▶ A Conservation Category Wetland intersects the Project Area south-east of the Dixon Rd and Mandurah Rd intersection. This wetland is associated with Lake Cooloongup which is located on the south-western side of Mandurah Road, approximately 500 m from the Project Area. This wetland has been divided by the existing road, rail and pipeline;
- ▶ The desktop assessment on the extent and status of previously mapped vegetation identified for the survey area indicates that the Quindalup Complex and Cottesloe Complex – Central and South are considered *Depleted*, with more than 30% and less than 50% of the pre-European extent of these vegetation communities considered to be remaining;
- ▶ A search of the DEC's Threatened and Priority Ecological Communities database was conducted for a 10 km radius of the Project Area. Five Threatened Ecological Communities (TECs) and four Priority Ecological Communities (PECs) were identified within the search area;
- ▶ The Project Area traverses through the buffer zone of two TECs known as SCP19b. This TEC is currently listed as Critically Endangered and occurs on the western side of Mandurah Road, whilst the project area occurs on the eastern side. This TEC already has infrastructure that traverses through its buffer zone including Mandurah Road, a railway and the existing pipeline;
- ▶ A search of the DEC's Native Vegetation Map Viewer identified that approximately 1 km of the Project Area is within an Environmentally Sensitive Area (ESA). This ESA appears to be related to a TEC buffer, Conservation Category Wetland and Conservation Reserve;
- ▶ A total of six vegetation types were identified within the Project Area. The vegetation types are described as:
 - V1: Planted native species over weed species.
 - V2: *Eucalyptus gomphocephalus* over weed species.
 - V3: Open Woodland of *Eucalyptus gomphocephalus* over Tall Scrub of *Spyridium globulosum* and/or *Acacia rostellifera* over weed species.



- V4: Tall Closed Scrub of *Acacia saligna* over Closed Sedges of *Gahnia trifida* and *Tetraria capillaries* over Open Herbland of *Muehlenbeckia adpressa* over weed species.
- V5: Closed Forest of *Eucalyptus gomphocephalus* over Open Woodland of *Melaleuca preissiana* and *M. raphiophylla* over Open Sedgeland of *Gahnia trifida* and weed species.
- V6: Open Woodland of *Eucalyptus gomphocephalus* over Tall Scrub of *Banksia sessilis* over Shrubland of *Acacia saligna* and *Templetonia retusa* over weed species.
- ▶ The majority of the Project Area was considered *Degraded to Completely Degraded*. This is as a direct result of previous clearing when the Kwinana-Mundijong Junction Railway and other infrastructure was constructed. Vegetation types V4 and V5 were rated as *Good to Degraded* in condition. Weeds species were dominant throughout the Project Area;
- ▶ A total of 89 plant taxa, representing 71 genera and 36 plant families, were recorded in the survey area. This total is comprised of 39 native species and 50 introduced species;
- ▶ A total of 50 weed species were recorded within the survey area. Two weed species, *Asparagus asparagoides* (Bridal creeper) and *Echium plantagineum* (Paterson's Curse), are listed as category P1 Declared Plant species pursuant to Section 37 of the *Agricultural and Related Resources Protection Act 1976 (WA)*;
- ▶ No Declared Rare Flora or Priority species were recorded during the targeted significant flora survey;
- ▶ No TECs or PECs were identified within the survey area;
- ▶ The TEC buffer zone within the project area has already been split by Mandurah Road and an adjacent railway. It is unlikely any TECs or PECs in close proximity to the Project Area will be impacted by the proposed clearing;
- ▶ A total of eighteen bird, three mammal and five reptile species were recorded during the reconnaissance survey within the study area;
- ▶ The Project Area was not considered to contain significant fauna habitat as it was predominately cleared, with few native plant species present;
- ▶ One invertebrate that may require consideration as potentially occurring within the area is the Graceful Sun Moth (GSM). The GSM would previously have been considered not likely to occur within the project area given the fact that its common food sources were not identified and that the moth is currently only known from limited locations in the northern Perth metropolitan area. However, recent advice from the DEC (November 2009) indicates that all suitable habitat areas for the GSM within the Swan Coastal Plain will require an autumn study to determine the presence or absence of GSM prior to development being approved (DEC 2009), regardless of the presence, or absence of *Lomandra maritima* and *L. hermaphrodita*; and
- ▶ This project is considered unlikely to be at variance with the Ten Clearing Principles. It is considered unlikely that there will be any local or significant impacts on the vegetation types within the area proposed for clearing as these vegetation types are well represented within the area.



1. Introduction

1.1 Background

BHP Billiton Nickel West (Nickel West) plans to replace existing pipeline infrastructure connecting the refinery in East Rockingham with the Baldivis staging pond enclosure located on Millar Road. GHD Pty Ltd (GHD) was commissioned by Nickel West to conduct a biological assessment of the pipeline. The assessment consisted of a Level 2 flora and vegetation survey and a Level 1 fauna survey assuming that native vegetation will need to be cleared five metres either side of the existing 160mm pipeline. The biological assessment considered the environmental features of the site and pipeline route, and identified any likely ecological constraints to development in this area. This report will support an application for a vegetation clearing permit.

1.2 Scope of Work

The scope of the biological assessment included:

- ▶ Undertake a desktop biological assessment to identify and map any actual and potential environmental constraints along the pipeline route.
- ▶ Undertake a field vegetation and fauna survey to assess the pipeline route. This will provide:
 - Vegetation community type (as per Swan Coastal Plain recorded communities) and its condition (as per Bush Forever rating Scale);
 - Identification, mapping and analysis of any Declared Rare or priority flora present along the impact area of the pipelines;
 - An assessment of the significance of the vegetation as fauna habitat (as per the requirements of the Ten Clearing Principles);
 - An assessment of the vegetation in the wetland community, its condition and significance;
 - An estimate of the amount of vegetation which will be cleared, by community and condition;
 - Photographs of vegetation along the pipeline route.
- ▶ Prepare a report (including an assessment of the 10 Clearing Principles) as required for clearing permit applications. The report will provide a map of the vegetation and the locations of any species of significance, an assessment of the local and regional significance of the vegetation to be cleared and of the habitat significance.
- ▶ Prepare and submit a Clearing Permit Application, using the report provided.

1.3 Location and Site Description

The existing Nickel West pipeline is approximately seven kilometres in length. The pipeline extends from the Kwinana Nickel West Refinery off Patterson Road, East Rockingham, to the Baldivis staging pond enclosure located on Millar Road, Baldivis. The route is aligned to Office Road to the north and runs adjacent to the Kwinana-Mundijong Junction railway until dissecting Millar Road to the south. The total size of the survey area (assuming a 10m wide corridor) is approximately 7 hectares. A vegetation survey of the section of the Project Area within the Refinery was not undertaken. This section of the Project



Area makes up 0.6118 hectares of the total area to be disturbed and was not surveyed as it was either cleared or contained planted species. The location of the Project Area is shown in Figure 1, Appendix A.



2. Desktop Assessment

2.1 Conservation Reserves

An 'A Class' conservation area, Leda Nature Reserve, is situated adjacent to the southern section of the Project Area, east of the railway and pipeline route. The Leda Nature Reserve is managed by the Department of Environment and Conservation (DEC). The location of this conservation reserve has been mapped on Figure 4, Appendix A.

2.2 Wetlands

Wetlands of the Swan Coastal Plain have been classified according to management categories and levels of protection. There are three management levels;

- ▶ Conservation Category Wetlands are wetlands that support high levels of attributes and functions;
- ▶ Resource Enhancement Wetlands are those that have been partly modified but still support substantial functions and attributes; and
- ▶ Multiple Use Wetlands are classified as those wetlands with few attributes that still provide important wetland functions.

A Conservation Category Wetland intersects the Project Area south-east of the Dixon Rd and Mandurah Rd intersection. This wetland is associated with Lake Coo-longup which is located on the south-western side of Mandurah Road, approximately 500 m from the Project Area.

The Environmental Protection Authority (EPA), states the management objectives for Conservation Category Wetlands is to “preserve and enhance the existing conservation values of the wetlands through various mechanisms including: reservation in national parks, crown reserves and State owned land, protection under Environmental Protection Policies, and wetland covenanting by landowners” (EPA 2005).

This wetland has been divided by the existing road, rail and pipeline.

2.3 Vegetation Associations

2.3.1 Vegetation Complexes

Vegetation communities have been mapped by Heddle *et al.* (1980), based on a pattern of vegetation at a regional scale as it reflects the underlying key factors of landforms, soils and climate. Vegetation complexes are defined where plant communities form regularly repeating complexes associated with a particular soil unit. Heddle *et al.* (1980) indicates that the survey area covers two different vegetation systems: Quindalup Complex and Cottesloe Complex – Central and South.

The Quindalup Complex is described as a coastal dune complex consisting mainly of two alliances – the strand and the fore dune alliance and the mobile and stable dune alliance. Local variations include the low closed forest of *Melaleuca lanceolata* – *Callitris preissii* and the closed scrub of *Acacia rostellifera*.

The Cottesloe Complex – Central and South is described as mosaic of woodland of *Eucalyptus gomphocephala* and open forest of *E. gomphocephala* – *E. marginata* – *Corymbia calophylla* (Marri): closed heath on limestone outcrops.



2.3.2 Vegetation Type, Extent, and Status

A vegetation type is considered under-represented if there is less than 30 percent of its original distribution remaining. From a purely biodiversity perspective, and not taking into account any other land degradation issues, there are several key criteria now being applied to vegetation in States where clearing is still occurring (EPA, 2000).

- ▶ The “threshold level” below which species loss appears to accelerate exponentially at an ecosystem level is regarded as being at a level of 30% of the pre-European/ pre-1750 extent of the vegetation type;
- ▶ A level of 10% of the original extent is regarded as being a level representing *Endangered*; and
- ▶ Clearing which would put the threat level into the class below should be avoided.

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

- ▶ *Presumed Extinct*: Probably no longer present in the bioregion
- ▶ *Endangered**: < 10% of pre-European extent remains
- ▶ *Vulnerable**: 10-30% of pre-European extent exists
- ▶ *Depleted**: > 30% and up to 50% of pre-European extent exists
- ▶ *Least Concern*: > 50% pre-European extent exists and subject to little or no degradation over a majority of this area.

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

Native vegetation types represented in the study area, their regional extent and reservation status have been drawn from Heddle, *et al.* (1980). These are shown in Table 1.

Table 1 Vegetation extent and status in the Pilbara IBRA region of the vegetation associations within the study area

Vegetation Complex	Total pre-1750 extent (ha)	Present extent (1997/98) in the System 6/part System 1 area (ha)	% remaining (1997/98) in the system 6/part System 1 area	Area in secure tenure (2002) (ha)	% remaining of pre-1750 extent in secure tenure (2002)
Quindalup Complex	38,238	18,000	47.1	1,971	5.2
Cottesloe Complex – Central and South	44,995	18,474	41.1	3,951	8.8

Source: Shepherd *et al* (2002), Shepherd *pers com* (2005)

The extent of the vegetation in the study area is considered *Depleted*, with more than 30% and less than 50% of the pre-European extent of these vegetation communities considered to be remaining.



2.4 Significant Flora

A search of the DEC's Rare Flora Databases and the Western Australian Herbarium indicates that 8 Priority Flora and 3 Declared Rare Flora occur in the general Kwinana-Baldivis area. There are no records of significant species in the Project Area. The recorded significant species in the general vicinity of the site are presented below in Table 2.

Table 2 Conservation significant flora recorded in the vicinity of the Project Area.

Species	Conservation Code	Flowering Period	Location
<i>Aotus cordifolia</i>	P3	Aug-Dec	Red Hill, Byford, Witchcliffe, Upper Swan, Dwellingup, Helena Valley, Forrestdale, Dunsborough, Jarrahdale, Banjup, Wellard.
<i>Aponogeton hexatepalus</i>	P4	July-Oct	Mundijong
<i>Boronia juncea</i> subsp. <i>juncea</i>	P1	April	Myalup, Wellard
<i>Caladenia huegelii</i>	R	Sept-Oct	Canningvale, Jandakot
<i>Cyathochaeta teretifolia</i>	P3	Dec	Whiteman Park, Lake Gnangara, Ellenbrook, Muchea, Denbarker, Yelverton, Wellard, Mundijong
<i>Diuris micrantha</i>	R	Sept-Oct	Meelon Nature Reserve, Dwellingup District, Yalgorup National Park, Mandogolup
<i>Dodonaea hackettiana</i>	P4	Jul-Oct	Wattleup, Thompson Lake, Kings Park, Jandakot, Bibra Lake-The Spectacles, Gingin, Peron, Baldivis, Beeliar, Baldivis, Harry Waring Marsupial Reserve
<i>Drakaea elastica</i>	R	Oct-Nov	Mandogalup
<i>Jacksonia sericea</i>	P4	Dec-Feb	Meadow Springs, Stakehill, Mandurah-Pinjarra
<i>Schoenus capillifolius</i>	P4	Sept-Nov	Upper Swan, Kenwick, Waterloo, Karnup, Baldivis, Carousel Swamp, Pearce, Waroona, Beauford River, Beverley, Goomalling
<i>Stylidium ireneae</i>	P3	Oct-Nov	Kwinana, North Dandalup, Augusta, Waroona, Lane



Species	Conservation Code	Flowering Period	Location
			Poole, Serpentine

2.5 Threatened Ecological Communities

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

Although TECs are not formally protected under the State *Wildlife Conservation Act 1950*, the loss of, or disturbance to, some TECs triggers the EPBC Act. The Environmental Protection Authority's (EPA's) position on TECs states that proposals that result in the direct loss of TECs are likely to require formal assessment.

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

A search of the DEC's Threatened and Priority Ecological Communities database was conducted for the Project Area prior to undertaking the field survey (DEC, 2009a; 2009b). The search was based on a 10 km radius distance from the centre point of the alignment and identified 5 threatened ecological communities (TECs) as occurring within the search area:

- ▶ **SCP19a** - Sedgelands in Holocene dune swales of the southern Swan Coastal Plain;
- ▶ **SCP19b** - Woodlands over sedgelands in Holocene dune swales of the southern Swan Coastal Plain (original description; Gibson et al. (1994);
- ▶ **SCP26a** - *Melaleuca huegeli* -*M. systema* shrublands of limestone ridges;
- ▶ **SCP30a** - *Callitris preissii* (or *Melaleuca lanceolata*) forests and woodlands; and
- ▶ **Richmond-microbial** - Stromatolite like microbialite community of coastal freshwater lakes.

Four priority ecological communities (PECs) were identified within the search area and include:

- ▶ **SCP21c** - Low lying *Banksia attenuata* woodlands or shrublands;
- ▶ **SCP22** - *Banksia illicifolia* woodlands;
- ▶ **SCP24** - Northern Spearwood shrublands and woodlands;
- ▶ **SCP25** - Southern *Eucalyptus gomphocephala*-*Agonis flexuosa* woodlands;

The results generated from the DEC's Threatened and Priority Ecological Communities database search have been mapped on Figure 4, Appendix A. Threatened and Priority ecological communities are represented within buffer zones and consequently, may overstate the true extent of a TEC/PEC.



The Project Area traverses through the buffer zone of two TECs known as SCP19b. This TEC is currently listed as Critically Endangered and occurs on the western side of Mandurah Road. This TEC already has infrastructure within its buffer zone including Mandurah Road, a railway and the existing pipeline.

2.6 Environmentally Sensitive Area

A search of the DEC's Native Vegetation Map Viewer identified that approximately 1 km of the Project Area is within an Environmentally Sensitive Area (ESA). This ESA appears to be related to a TEC buffer, Conservation Category Wetland and Conservation Reserve. ESAs within the study area are shown in Figure 4, Appendix A.



3. Field Assessment Methodology

3.1 Flora and Vegetation

On the 10th November, [REDACTED] environmental scientists from GHD Pty Ltd conducted a Level 2 Flora and Vegetation Assessment of the Project Area. The survey was undertaken to provide a description of the dominant vegetation types present, vegetation condition and flora species present at the time of the survey. Additionally, the survey was also conducted to determine whether any of the conservation significant species identified on the DEC Declared Rare and Priority Flora list for the area actually occur or are likely to occur in the study area. Assessment was based on a combination of sampling techniques, using relevés as well as intensively traversing the study area to record all plant species present at the time of the survey. This method complies with GHD's interpretation of the EPA's guidelines for flora surveys as outlined in Guidance Statement No. 51 *Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia* (EPA, 2004) and *Terrestrial Biological Surveys as an Element of Biodiversity Protection*, Position Statement No. 3 (EPA, 2002).

3.1.1 Site and Relevé Selection

Four quadrats located within representative vegetation types were selected and all plant species and floristic data recorded, including height for each species. Quadrat locations were selected to ensure that an adequate representation of the major vegetation types and flora present within the survey area was sampled. This was done using colour aerial photography, targeting different landforms and by ground-truthing on foot.

Five relevé sites were also selected within the survey area. Relevés are often used in flora and vegetation surveys to ascertain vegetation types and boundaries by recording the dominant plant species present including height and percentage and then comparing this floristic data to data recorded in established quadrats.

A targeted search for Declared Rare Flora or Priority listed species was also undertaken in the Project Area. Search effort was focused upon locations considered suitable habitat for the significant flora species identified from the DEC database search.

Quadrat dimensions are dependant on the region in which the survey is being undertaken. For the Swan Coastal Plain it is appropriate to sample quadrats of 10m x 10m in dimension (Gibson *et al.*, 1994) however due to the width of the pipeline alignment, 5m x 20m quadrat dimension were used. The following information was recorded for each site:

Location

MGA coordinates (equivalent of WGS84) were taken at each quadrat using a hand-held Magellan GPS to an accuracy of 2m;

Vegetation Description

The vegetation types were described and mapped using Keighery's (1994) vegetation structural classes (adapted from Muir (1977) and Aplin (1979) in Government of Western Australia, 2000);

Disturbance Details



Vegetation condition was assessed using the condition rating scale adapted from Bush Forever (Government of Western Australia, 2000);

Percentage Foliage Cover and Height

Cover and height was estimated visually for each species recorded within each quadrat. Estimates were made to the nearest percentage where possible and height was recorded in meters; and

Soil and Outcropping

Colour and soil texture including the presence of any rock outcropping at each quadrat was recorded.

3.1.2 Flora Identification

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

The conservation status of all recorded flora was compared against the current lists published in the Government Gazette and available from the DEC (2009) and the Department of Environment, Water, Heritage and the Arts (DEWHA) (2009).

Results obtained from a search of the Department of Environment (DEC) Priority and Rare Flora database were also reviewed to identify any significant flora and fauna potentially occurring within the search area.

3.2 Fauna

The Level 1 fauna assessment was conducted in accordance with EPA Guidance Statement No.56 *Assessment of Environmental Factors for Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia*. The assessment included a desktop investigation and opportunistic fauna field survey (vertebrate only) and a habitat assessment, undertaken in conjunction with the vegetation and flora survey. The field assessment involved visual and aural surveys for any fauna species utilizing the Project Area in addition to searches of the Project Area for any fauna signs, such as tracks, scats, bones, diggings and feeding signs. Species – specific search strategies were used to identify any protected species in the area or evidence that they utilize the Project Area. The fauna assessment did not involve any fauna trapping.



4. Survey Results

4.1 Vegetation Types

A total of six vegetation types were identified within the Project Area during the November 2009 survey. The vegetation types were described using Keighery's (1994) vegetation structural classes (adapted from Muir (1977) and Aplin (1979) in Government of Western Australia, 2000). The vegetation types are described below and mapped in Figure 2, Appendix A:

- ▶ V1: Planted native species over weed species.
- ▶ V2: *Eucalyptus gomphocephalus* over weed species.
- ▶ V3: Open Woodland of *Eucalyptus gomphocephalus* over Tall Scrub of *Spyridium globulosum* and/or *Acacia rostellifera* over weed species.
- ▶ V4: Tall Closed Scrub of *Acacia saligna* over Closed Sedges of *Gahnia trifida* and *Tetraria capillaries* over Open Herbland of *Muehlenbeckia adpressa* over weed species.
- ▶ V5: Closed Forest of *Eucalyptus gomphocephalus* over Open Woodland of *Melaleuca preissiana* and *M. raphiophylla* over Open Sedgeland of *Gahnia trifida* and weed species.
- ▶ V6: Open Woodland of *Eucalyptus gomphocephalus* over Tall Scrub of *Banksia sessilis* over Shrubland of *Acacia saligna* and *Templetonia retusa* over weed species.

4.2 Vegetation Condition

The vegetation condition of the study area was rated using the vegetation condition rating scale developed by Keighery (1994) that recognises the intactness of vegetation, which is defined by the following:

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

The scale therefore consists of six rating levels as outlined below in Table 3.

Table 3 Vegetation condition rating scale (after Keighery, 1994).

Vegetation Condition Rating	Vegetation Condition	Description
1	<i>Pristine or Nearly So.</i>	No obvious signs of disturbance.
2	<i>Excellent</i>	Vegetation structure intact, disturbance affecting individual species, and weeds are non-aggressive species.
3	<i>Very Good</i>	Vegetation structure altered, obvious signs of disturbance.
4	<i>Good</i>	Vegetation structure significantly altered by very obvious signs of multiple disturbances retains basic vegetation structure or ability to regenerate it.



Vegetation Condition Rating	Vegetation Condition	Description
5	<i>Degraded</i>	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not in a state approaching good condition without intensive management.
6	<i>Completely Degraded</i>	The structure of the vegetation is no longer intact and the area is completely or almost without native species.

The majority of the Project Area was considered *Degraded to Completely Degraded*. This is as a direct result of previous clearing when the railway and other infrastructure was constructed. Vegetation types V4 and V5 were rated as *Good to Degraded* in condition. Weeds species were dominant throughout the Project Area. The vegetation condition within the Project Area is presented in Figure 3, Appendix A.

4.3 Flora

A total of 89 plant taxa (including subspecies and varieties) representing 71 genera and 36 plant families were recorded in the survey area. This total is comprised of 39 native species and 50 introduced species. A majority of the native species recorded in the Project Area adjacent to Office Road have been planted (introduced), including *Grevillea olivaceae*. This plant is classified as a Priority 4 species according to the DEC; however, in the context of the survey, it has been introduced to the area and therefore is not representative of the natural vegetation of the area.

The dominant families represented from the survey included Poaceae (16 introduced species), Myrtaceae (10 native species), Papilionaceae (3 native species and 6 introduced species) and Asteraceae (1 native and 7 introduced species).

A comprehensive list of the flora species recorded during the survey is provided in Table 5, Appendix A.

4.4 Weeds

A total of 50 weed species were recorded within the survey area. Two weed species, *Asparagus asparagoides* (Bridal creeper) and *Echium plantagineum* (Paterson's Curse), are listed as category P1 Declared Plant species pursuant to section 37 of the *Agricultural and Related Resources Protection Act 1976* (WA). These species were recorded at several locations during the survey. The presence of these species may pose a threat to the biodiversity values of the area, however, it is of GHD's opinion that this species can be controlled and eradicated from within the area proposed for disturbance.

Asparagus asparagoides (Bridal creeper) is listed as a category P1 Declared Plant species pursuant to Section 37 of the *Agricultural and Related Resources Protection Act 1976* (WA). The movement of P1 Declared Plants or contaminated machinery and produce including livestock and fodder are prohibited within the state. It is recommended that a Weed Management Plan is implemented by BHP Nickel West to eradicate this species from the site and limit the potential spread of other invasive weeds. This would include adopting standard vehicle hygiene practice to minimise infestations to surrounding native bushland and properly disposing of any soil and plant material removed from the site

4.5 Conservation Significant Flora

No Declared Rare Flora or Priority species were recorded during the targeted significant flora survey.



The area proposed for native vegetation clearing follows the pre-existing pipeline corridor. This pipeline was built approximately 30 years ago and as a result of previous clearing, native vegetation was either absent, fragmented or sparsely scattered along the area proposed for clearing. Plant species diversity was low within the area proposed for clearing and overall, the vegetation was considered to be in a Degraded to Completely Degraded condition. The previous clearing along the proposed alignment accounts for the low diversity of native plant species recorded and the absence of any conservation significant species.

4.6 Threatened Ecological Communities

No TECs or PECs as defined by the *EPBC Act 1999* or the DEC (2007b) were identified within the survey area.

The TEC buffer zone within the project area has already been split by Mandurah Road and an adjacent railway. It is unlikely any TECs or PECs in close proximity to the Project Area will be impacted by the proposed clearing.

4.7 Fauna

The Western Australian Museum (WAM) and (DEC) *NatureMap* online search was conducted for the study area. The search identifies terrestrial vertebrate fauna species recorded in the collections of the WA Museum and DEC. The search identified the potential presence of 45 bird, 41 reptile and 3 mammal species. A full list of species recorded from the WA Museum database is presented in Appendix C.

The DEWHA maintains a database of matters of national environmental significance that are protected under the *EPBC Act 1999*. An EPBC Act Protected Matters Report was generated (from the DEWHA website), for the matters of significance that may occur in, or may relate to, the study area. From the WA Museum, DEC and DEWHA databases, a number of protected fauna species were identified as potentially occurring within the study area, these are listed in Table 6, Appendix C.

It should be noted that some species that appear in the EPBC Act Protected Matters Search Tool are often not likely to occur within the specified area, as the search provides an approximate guidance to matters of national significance that require further investigation. In addition, some of the records of the WA Museum and DEC are historical and some of the recorded species may now be locally extinct. Additionally these records may include species that are vagrants or present in the general area but not present within the study area due to lack of suitable habitat. .

A total of eighteen bird, three mammal and five reptile species were recorded during the reconnaissance survey within the study area, these are listed in Table 7, Appendix C.

This survey only provides a brief snapshot of those species present at the time of sampling (daytime), in one season, in one year. Not all potentially occurring species would be recorded during a single survey due to spatial and temporal variations in fauna population numbers.

4.7.1 Significant Fauna

The desktop surveys indicated that a number of protected fauna may occur within the study area. The habitat requirements of these species and the likelihood of their occurrence in the site (with information from the field surveys) are considered below.



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

The Forest Red-tailed Black-Cockatoo species is essentially a cockatoo of the Jarrah forest (*Eucalyptus marginata*) but also uses Marri (*Corymbia calophylla*) and woodlands for foraging, with Marri seeds (along with jarrah) being its principal food source (Johnstone and Kirkby, 1999).

The Forest Red-tailed Black Cockatoo has reduced in range on the Swan Coast Plain due to habitat loss and now persists in the Jarrah forest of the South West.

Assessment: This species is not likely to utilise the study area as no potential feeding or breeding habitat is present within the study area.

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

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

Assessment: The Baudin's Cockatoo was not recorded during the field survey and no evidence of feeding was observed within study area. This species is known to occur in the surrounding area, however, very little potential feeding habitat remains within the study area.

Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*) Schedule 1; Endangered

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

In the southern suburbs of the Perth Metropolitan area, Carnaby's Cockatoo is moderately common and would likely use the project area for feeding. Recently this species has been expanding its breeding areas and they are now known to breed on the southern Swan Coastal Plain, near Mandurah. There is the potential for Carnaby's to expand their breeding areas throughout the Swan Coastal Plain in the future.

Assessment: No Carnaby's Cockatoos were sighted during the field survey and no evidence of feeding was recorded within the study area. This species is known to occur in the surrounding area, however, very little potential feeding habitat remains within the study area.

Graceful Sun Moth (*Synemon gratiosa*) Schedule 1; Endangered

The Graceful Sun Moth (GSM) once widespread on the Swan Coastal Plain, is now only present in a few conservation areas located north of the Swan River, due to dramatically increased urban development destroying the day flying moth's habitat. The species is a Schedule 1 listed species under the *Wildlife Conservation Act 1950*, meaning it is rare or likely to become extinct. The GSM is only active in Autumn, unlike the majority of Lepidoptera that are most active during spring and summer months.



The GSM is currently only known from limited locations in the northern Perth metropolitan area. Adults of the GSM are not active during spring but evidence of habitat use can be assessed using known foodplants (*Lomandra maritima*, and *L. hermaphrodita*) as a surrogate. The larvae of *S. gratiosa* inhabit sandy soils and feed upon root mats formed by *Lomandra maritima* and *L. hermaphrodita*.

Assessment: Using historical assessment techniques, this species would have been assessed as highly unlikely to occur in the project area. This is based on the fact that neither *Lomandra maritima* or *L. hermaphrodita* was identified within the project area. However, recent advice from the DEC (November 2009) indicates that all suitable habitat areas for the GSM within the Swan Coastal Plain will require an autumn study to determine the presence or absence of GSM prior to development being approved (DEC 2009), regardless of the presence, or absence of *Lomandra maritima* and *L. hermaphrodita*. It is uncertain whether the project area can be considered a “suitable habitat” given the number of disturbances and general lack of native vegetation.

If a study to determine the presence or absence of GSM is required, the following actions should be undertaken in accordance with the study methods outlined within DEC (2009):

- ▶ Autumn study (March) for GSM, involving transects spread across the site forming the project area;
- ▶ Transects will be required to be undertaken on four separate days in order to adequately determine the presence or absence of GSM within the Project Area;
- ▶ Transects must be undertaken by a suitable trained person in Graceful Sun Moth study methodology (DEC 2009); and
- ▶ Transects must be undertaken between the hours of 10 am and 3 pm on days when local conditions are warm and sunny with wind speeds less than 18 km/h.

Chuditch, Western Quoll (*Dasyurus geoffroi*) Schedule 1; Vulnerable

The Chuditch is the largest carnivorous marsupial in Western Australia. This species occupies a wide range of habitats including woodlands, riparian vegetation, beaches and deserts. The Chuditch formerly ranged over nearly 70 % of Australia but now retains only a patchy distribution through the Jarrah forest and mixed Karri/Marri/Jarrah forest of south-western WA. This reduction in range and decline in population numbers have been caused by habitat alteration, impacts from the introduction of foxes and cats, hunting and poisoning.

Assessment: This species is believed to be locally extinct in the majority of the Swan Coastal Plain (although it may be an occasional visitor to the eastern section of the plain) and would not be expected to occur in the project area.

Red-tailed Phascogale (*Phascogale calura*) Schedule 1; Endangered

The Red-tailed Phascogale’s range is currently restricted to the Wheatbelt of Western Australia. The EPBC protected matters search tool includes this species in the project area but this is erroneous as there are no records of this species as far west as the Perth region.

Assessment: This species is highly unlikely to occur in the project area.

Quokka (*Setonix brachyurus*) Schedule 1; Vulnerable

The Quokka is a small macropod that inhabits low-lying scrub or dense heath and swamps with dense vegetation. This species is a browser, with peppermint (*Agonis flexuosa*) and *Thomasia* species being dominant in their diet. The range of the Quokka once extended across the south west of Western



Australia; however, with the impact of colonisation and the introduction of predators such as the fox this range has been highly reduced.

Assessment: This species is locally extinct on the Swan Coastal Plain and would not be expected to occur in the project area.

Southern Brown Bandicoot, Quenda (*Isoodon obesulus* subsp. *fusciventer*) Priority 5

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

Quenda populations on the Swan Coastal Plain are threatened by development in this region, which has resulted in loss of habitat. This species is relatively common in the southern suburbs of Perth. There are a number of wetland areas adjacent to and west of the study area that are likely to support Quenda.

The Quenda is listed by DEC as a Priority 5, which means that it is not considered threatened but is subject to a specific conservation program, the cessation of which would result in the species becoming threatened within five years.

Assessment: This species is likely to occur in the more dense vegetation that remains in the reserve adjacent to the study area.

Black Striped Snake (*Neelaps calonotos*) Priority 3

The Black-striped Snake is a small, moderately slender snake that inhabits dunal areas supporting heathlands and Banksia /Eucalypt woodlands. The range of this species is particularly restricted and is found only on the Swan Coastal Plain between Mandurah and Lancelin (Bush *et al.*, 1995).

Assessment: This species may occur in the study area but was not recorded during the survey.

4.7.2 Fauna Habitat

The habitat value of the Project Area is negligible as the majority of the site has previously been cleared and contains mostly introduced species with minimal native vegetation remaining. Habitat in similar and/or better condition to that of the Project Area remains in large areas of remnant vegetation adjacent to the Project Area. The vegetation types that occur within the Project Area are relatively common in the general area and do not contain rare habitats that are significant for specific species.

Impact is not only restricted to loss of habitat but also to impacts on the habitat adjacent to the alignment due to edge effects and fragmentation of the remaining vegetation. These impacts are particularly important in the areas that are adjacent to the conservation reserve and conservation category wetland. However, much of the alignment has already been disturbed and even the areas of remnant vegetation are currently subject to edge effects from disturbances such as clearing, access tracks and the railway.

Impacts to habitat linkages will be negligible considering the area has previously been cleared for the existing pipeline and railway.



5. Vegetation proposed for clearing

The maximum area applied for in the purpose permit is approximately 7 hectares. The flora and vegetation survey was undertaken assuming that native vegetation will need to be cleared five metres either side of the existing 160 mm pipeline. However, the replacement pipelines will be the same diameters and material as the existing pipelines and will be laid in a common trench to minimise disturbance. The area above the existing pipeline along the entire alignment is generally clear of any native vegetation (see **Error! Reference source not found.**).

The total area proposed to be cleared has been broken down by the vegetation types recorded during the field survey. Only the vegetation types V3 to V6 are considered representative of floristic communities previously recorded on the Swan Coastal Plain, whilst V2 contains some native tree species.

The total area of each vegetation type recorded within the survey area is as follows:

- ▶ V1: 0.4609 ha;
- ▶ V2: 0.1547 ha;
- ▶ V3: 0.5137 ha;
- ▶ V4: 0.1149 ha;
- ▶ V5: 0.0728 ha;
- ▶ V6: 0.1222 ha;
- ▶ Weeds: 4.0522 ha;
- ▶ Cleared: 0.7780 ha and
- ▶ Not assessed: 0.6118 ha (area within the BHP Refinery – contains weeds and planted species).

Of the total 7 hectares surveyed, approximately only 1 hectare contains native vegetation, whilst the remaining 6 hectares either contains weeds and/or planted species or is cleared of vegetation.

The total area proposed to be cleared has also been broken down by vegetation condition, which is as follows:

- ▶ Condition 4/5: 0.1877 ha;
- ▶ Condition 5: 0.4063 ha;
- ▶ Condition 5/6: 0.5403 ha;
- ▶ Condition 6: 5.1352; and
- ▶ Not assessed: 0.6118 (area within the BHP Refinery).



6. Assessment against the Ten Clearing Principles

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

Table 4 provides an assessment of the proposed project against the “10 Clearing Principles” as outlined in Schedule 5 of the *Environmental Protection Amendment Act 2003* to determine whether it is at variance to the Principles. These Principles aim to ensure that all potential impacts resulting from removal of native vegetation can be assessed in an integrated way.

This project is considered unlikely to be at variance with the Ten Clearing Principles. It is considered unlikely that there will be any local or significant impacts on the vegetation types within the area proposed for clearing as these vegetation types are well represented within the area.

Table 4 Assessment against the Ten Clearing Principles

Principle Number	Principle	Assessment	Outcome
(a)	Native vegetation should not be cleared if it comprises a high level of biological diversity.	The study area is not considered to be of higher biodiversity than the surrounding areas, and the proposed clearing is unlikely to have any significant impact on the biodiversity of the region.	The proposal is unlikely to be at variance with the Principle.
(b)	Native vegetation should not be cleared if it comprises the whole or part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous Western Australia.	The habitat type present within the application area occurs within the surrounding area, and the surrounding area is in better condition to that within the application area. Additionally, the application area has been subject to a number of disturbances, particularly vegetation clearing and weed invasion all of which would have impacted on the use of the application area by native fauna. The vegetation is not considered to comprise habitat necessary for the maintenance of significant fauna	The proposal is unlikely to be at variance with the Principle.
(c)	Native vegetation should not be cleared if it includes, or is necessary for the continued existence of, rare flora.	No DRF or Priority flora species were recorded during the survey of the study area.	The proposal is unlikely to be at variance with the Principle.
(d)	Native vegetation should not be cleared	No TECs or PECs were identified within the study area.	The proposal is unlikely to be at



Principle Number	Principle	Assessment	Outcome
	if it comprises the whole or a part of, or is necessary for the maintenance of, a threatened ecological community.	The Project Area lies within the buffer zone of an existing TEC (SCP19B). This TEC already has infrastructure within its buffer zone including Mandurah Road, a railway and the existing pipeline	variance with the Principle.
(e)	Native vegetation should not be cleared if it is significant as a remnant of native vegetation in an area that has been extensively cleared.	<p>Clearing native vegetation within the study areas will not significantly reduce the known extent from pre-European extents.</p> <p>It is considered unlikely that there will be local or regionally significant impacts on the vegetation types recorded within the study site as the communities are well represented within the area.</p>	The proposal is not at variance with the Principle.
(f)	Native vegetation should not be cleared if it is growing in or in association with a watercourse or wetland.	<p>There is a gully flowline in the north eastern portion of the study area however it can not be determined whether the flowline is naturally occurring or man made. Furthermore, the vegetation in this area is <i>Completely Degraded</i> and of low biodiversity value.</p> <p>A conservation category wetland intersects the Project Area south-east of the Dixon Rd and Mandurah Rd intersection. This wetland is associated with Lake Coo loongup which is located on the south-western side of Mandurah Road, approximately 500 m from the Project Area. The wetland has been divided by the existing road, rail and pipeline.</p> <p>The vegetation type V5, recorded within the Project Area, is associated with this wetland. This vegetation type occurs adjacent to the Project Area, within the conservation reserve, with only a very small portion occurring within the Project Area (0.0728 ha). In addition, this section of the Project Area was recorded as <i>Degraded to Completely Degraded</i>.</p>	The proposal is unlikely to be at variance with the Principle.
(g)	Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.	<p>The clearing of native vegetation is unlikely to have an impact upon the health of adjacent lands. Clearing has the potential to cause increased runoff, sedimentation and weed dispersal however these potential impacts can be mitigated by use of appropriate management plans.</p> <p>Two weed species, <i>Asparagus asparagoides</i> (Bridal creeper) and <i>Echium plantagineum</i> (Paterson's Curse), are listed as category P1</p>	The proposal is unlikely to be at variance with the Principle.



Principle Number	Principle	Assessment	Outcome
		<p>Declared Plant species pursuant to section 37 of the <i>Agricultural and Related Resources Protection Act 1976</i> (WA).</p> <p>A Weed Management Plan will be implemented for the project to eradicate and manage this species from the site and limit the potential spread of other invasive weeds. This would include adopting standard vehicle hygiene practice to minimise infestations to surrounding native bushland and properly disposing of any soil and plant material removed from the site.</p>	
(h)	Native vegetation should not be cleared if the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area.	<p>One 'A Class' conservation area, Leda Nature Reserve, is situated adjacent to the southern section of the Project Area, east of the railway and pipeline route.</p> <p>The majority of the Project Area was considered <i>Degraded to Completely Degraded</i> due to previous clearing. Although clearing has the potential to introduce and/or spread weeds into the nearby conservation reserve, any potential impacts can be mitigated by use of appropriate management plans.</p>	The proposal is unlikely to be at variance with the Principle
(i)	Native vegetation should not be cleared if the clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water.	<p>The clearing of native vegetation is not considered likely to alter the quality of surface or ground waters within the project area.</p> <p>Erosion may occur following any potential clearing. Erosion can be mitigated by the use of appropriate surface water management and rehabilitation techniques.</p>	The proposal is unlikely to be at variance with the Principle
(j)	Native vegetation should not be cleared if the clearing of the vegetation is likely to cause, or exacerbate, the intensity of flooding.	The clearing of native vegetation will not cause, or exacerbate the incidence or intensity of flooding due to increased runoff in localised areas.	The proposal is unlikely to be at variance with the Principle.



7. References

- Aplin, T.E.H., (1979). *The Flora*. In O'Brien, B.J. (Ed.) *Environment and Science*. University of Western Australia Press, Nedlands Western Australia.
- Bush, B., Maryan, B., Browne-Cooper, R., Robinson, D. (1995) *Reptiles and Frogs of the Perth Region*, University of Western Australia Press, Perth.
- Department of Environment and Conservation, (2009), *List of Threatened Ecological Communities* http://www.naturebase.net/component/option,com_docman/task,doc_download/Itemid,1214/grid,404/
- Department of Environment and Conservation, (2009), *Florabase*, Western Australian Herbarium <http://florabase.calm.wa.gov.au>
- Department of Environment, Water, Heritage and the Arts (2009), *Environment Protection and Biodiversity Act 1999 List of Threatened Flora* <http://www.environment.gov.au/cgi-bin/sprat/public/publicthreatenedlist.pl?wanted=flora>
- Department of Environment and Conservation (DEC) (2009). *Graceful Sun-Moth Information kit and survey methods*. November 2009, 16 pp.
- Environmental Protection Authority, (2002), *Terrestrial Biological Surveys as an Element of Biodiversity Protection: Position Statement No. 3*, Environmental Protection Authority, Perth, Western Australia.
- Environmental Protection Authority, (2004), *Guidance for the Assessment of Terrestrial Factors: Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia*, Guidance Statement No. 51, June 2004.
- English, V and Blythe, J. (1997). *Identifying and Conserving Threatened Ecological Communities in the South West Botanical Province*. Unpublished report for the Department of Conservation and Land Management to Environment Australia.
- Garnett, S.T. and Crowley, G.M. (2000) *The Action Plan for Australian Birds 2000*. Environment Australia, Canberra, ACT.
- Gibson, N., Keighery, B., Keighery, G., Burbidge, A. and Lyons, M., (1994), *A Floristic Survey of the Swan Coastal Plain*, Department of Conservation and Land Management.
- Government of Western Australia, (2000), *Bush Forever – Keeping the Bush in the City. Volume 1 – Policies, Principals and Processes*, Perth, WA.
- Hedde, E.M., Loneragan, O.W., and Havel, J.J. (1980). *Vegetation complexes of the Darling System, Western Australia in Atlas of Natural Resources Darling System Western Australia*. Department of Conservation and Environment. Perth, Western Australia.
- Johnstone, R. E. and Kirkby T. (1999). *Food of the Forest Red-tailed Black Cockatoo *Calyptorhynchus banksii naso* in south-west Western Australia*. Western Australian Naturalist 22: 167-177. Garnett, S.T. and Crowley, G.M. (2000) *The Action Plan for Australian Birds 2000*. Environment Australia, Canberra, ACT.



Muir, B.G., (1977), *Biological Survey of the Western Australian Wheatbelt. Part II: Vegetation and Habitat of Bendering Reserve*, Records of the Western Australian Museum, Supplement No. 3.

Shepherd, D.P., Beeston, G.R., and A.J.M. Hopkins (2002). *Native Vegetation in Western Australia – Extent, Type and Status. Resource Management Technical Report 249*, Department of Agriculture, Western Australia.

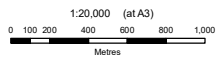
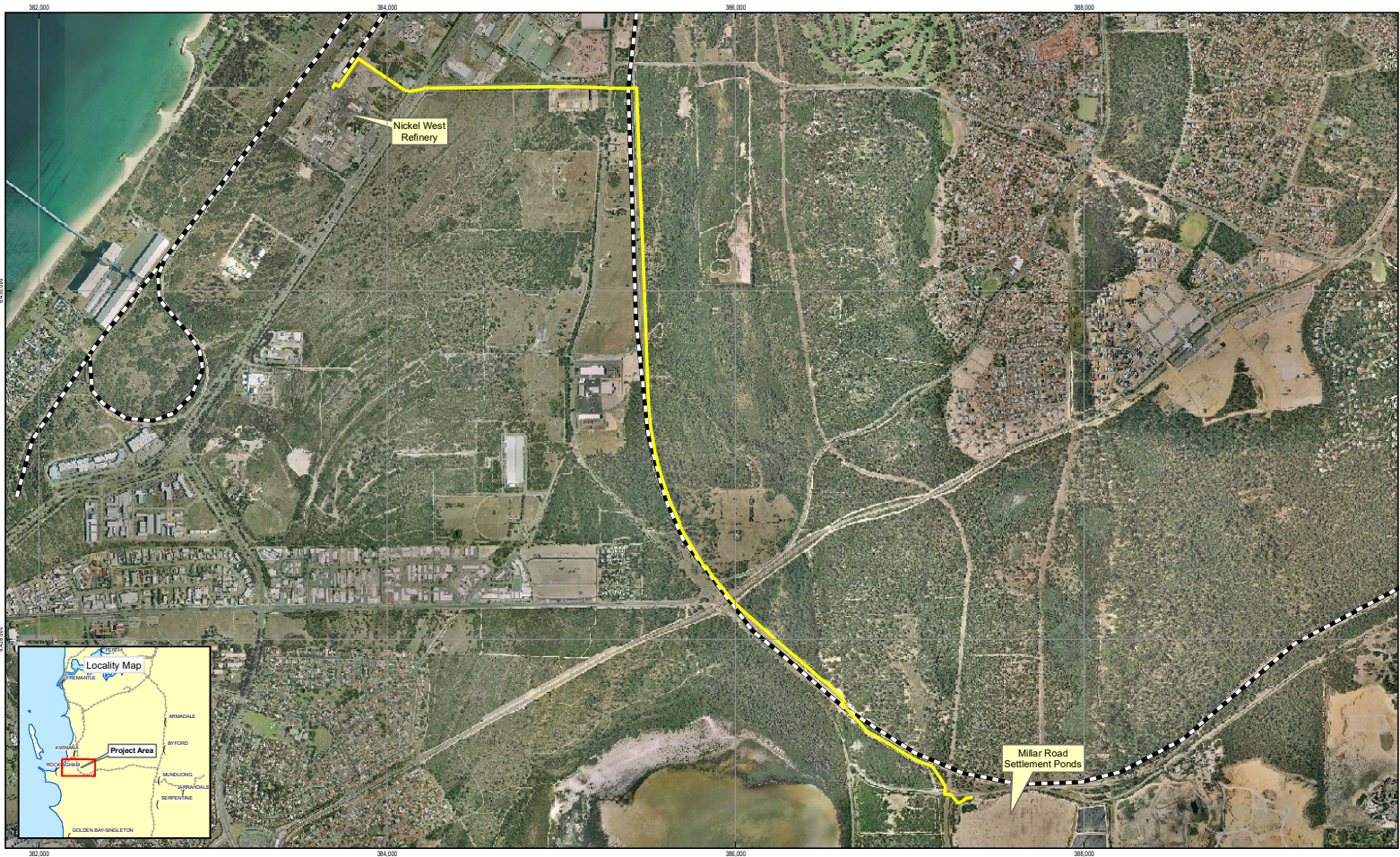
Shepherd, D.P. (2005) Personal Communication. Information updated from above reference, and available in database form



Appendix A

Figures

- Figure 1 Location**
- Figure 2 Vegetation Type**
- Figure 3 Vegetation Condition**
- Figure 4 Environmental Constraints**



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LEGEND
 — Proposed Pipeline Route
 - - - Railways

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

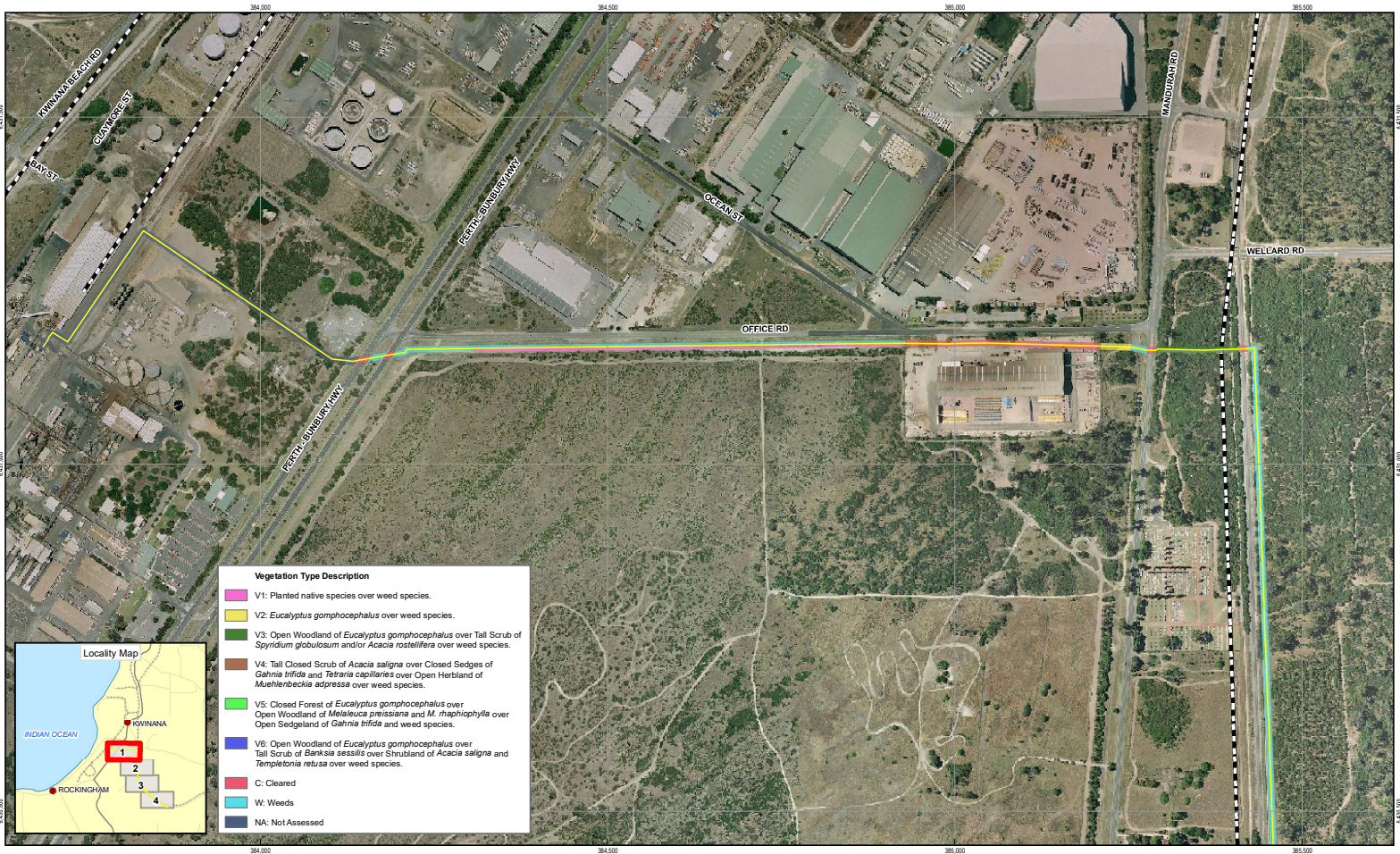


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Location Map

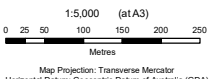
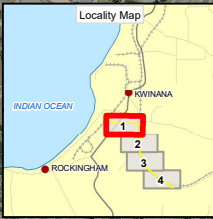
Figure 1

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Vegetation Type Description

	V1: Planted native species over weed species.
	V2: <i>Eucalyptus gomphocephalus</i> over weed species.
	V3: Open Woodland of <i>Eucalyptus gomphocephalus</i> over Tall Scrub of <i>Spyridium globulosum</i> and/or <i>Acacia rostellifera</i> over weed species.
	V4: Tall Closed Scrub of <i>Acacia saligna</i> over Closed Sedges of <i>Gahnia trifida</i> and <i>Tetaria capillaris</i> over Open Hermland of <i>Muehlenbeckia adpressa</i> over weed species.
	V5: Closed Forest of <i>Eucalyptus gomphocephalus</i> over Open Woodland of <i>Melaleuca preissiana</i> and <i>M. thymophylla</i> over Open Sedgeland of <i>Gahnia trifida</i> and weed species.
	V6: Open Woodland of <i>Eucalyptus gomphocephalus</i> over Tall Scrub of <i>Banksia sessilis</i> over Shrubland of <i>Acacia saligna</i> and <i>Templetonia retusa</i> over weed species.
	C: Cleared
	W: Weeds
	NA: Not Assessed



LEGEND
 Proposed Pipeline Route

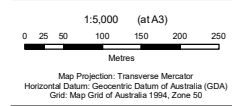
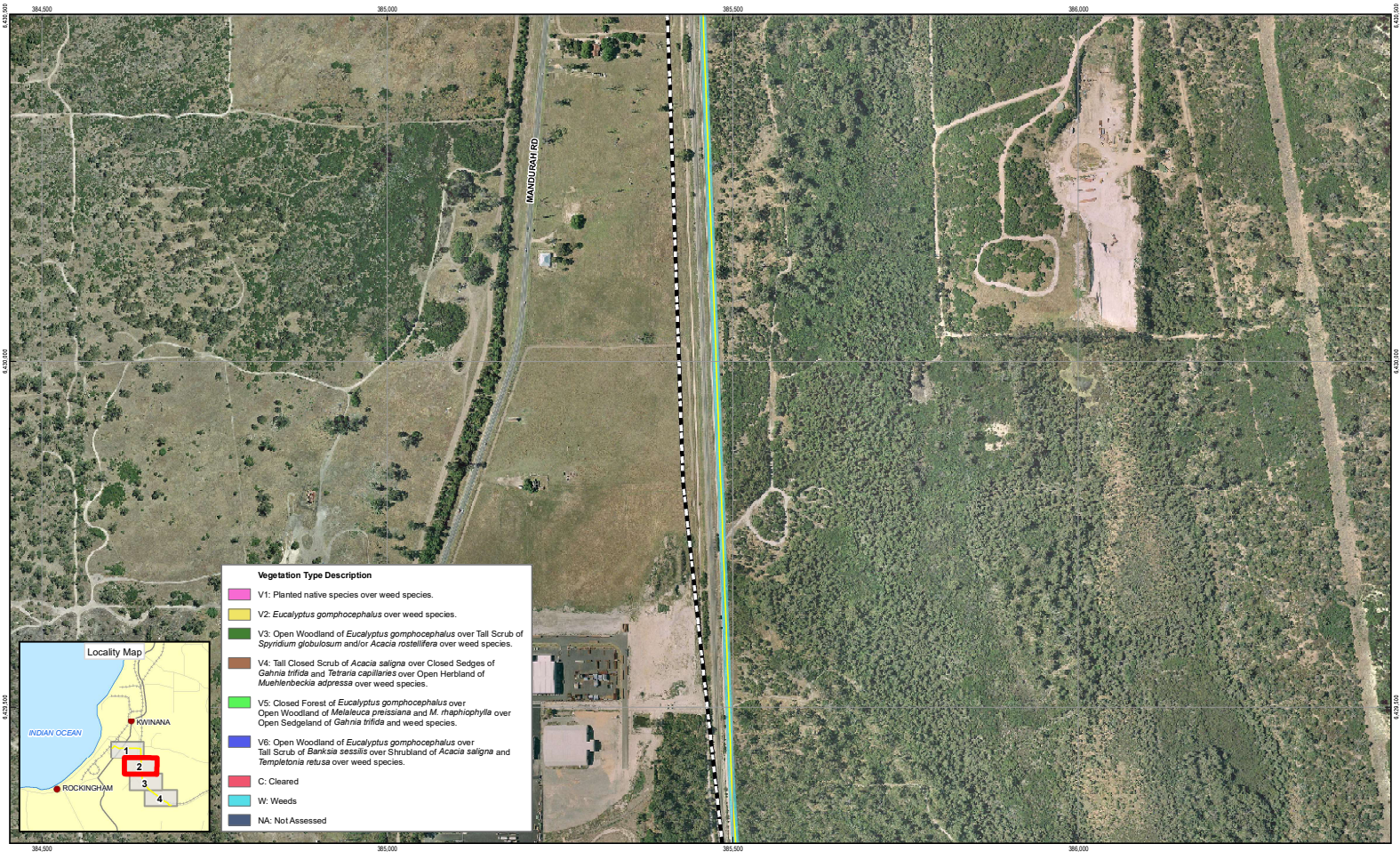


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**Vegetation Type
 Map Sheet 1 of 4**

Figure 2

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Vegetation Type
Map Sheet 2 of 4

Figure 2

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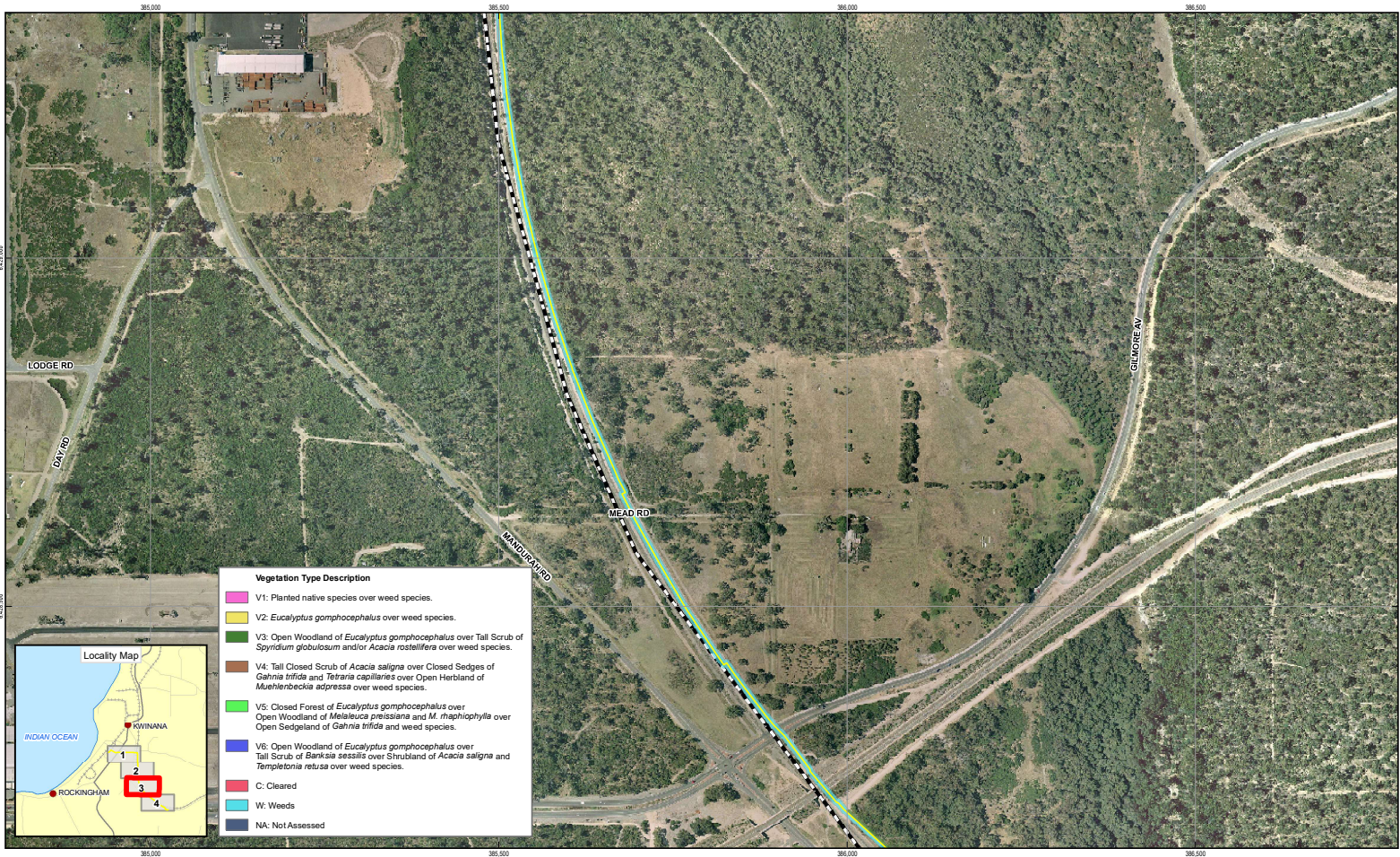
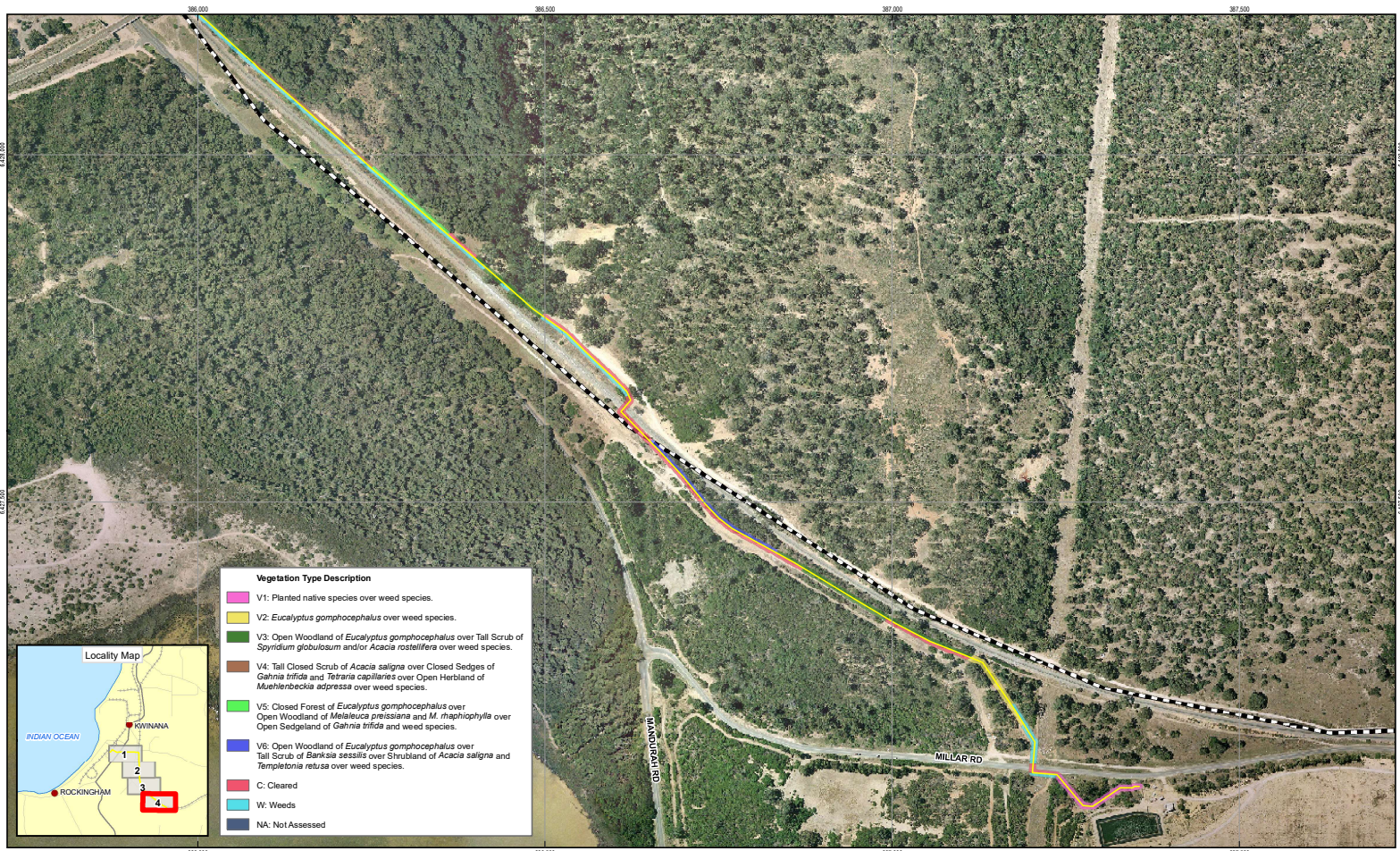
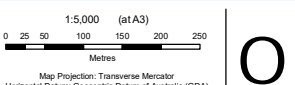
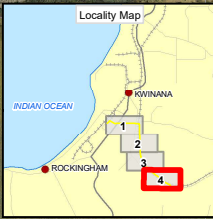


Figure 2



Vegetation Type Description

V1: Planted native species over weed species.
V2: <i>Eucalyptus gomphocephalus</i> over weed species.
V3: Open Woodland of <i>Eucalyptus gomphocephalus</i> over Tall Scrub of <i>Spyridium globulosum</i> and/or <i>Acacia rostellifera</i> over weed species.
V4: Tall Closed Scrub of <i>Acacia saligna</i> over Closed Sedges of <i>Gahnia trifida</i> and <i>Tetraria capillaris</i> over Open Hermland of <i>Muehlenbeckia adpressa</i> over weed species.
V5: Closed Forest of <i>Eucalyptus gomphocephalus</i> over Open Woodland of <i>Melaleuca preissiana</i> and <i>M. thymophylla</i> over Open Sedgeland of <i>Gahnia trifida</i> and weed species.
V6: Open Woodland of <i>Eucalyptus gomphocephalus</i> over Tall Scrub of <i>Banksia sessilis</i> over Shrubland of <i>Acacia saligna</i> and <i>Templetonia retusa</i> over weed species.
C: Cleared
W: Weeds
NA: Not Assessed



LEGEND
 Proposed Pipeline Route

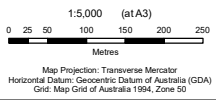


BHPB Shared Business
 Baldvis Vegetation Survey and Clearing Permit
Vegetation Type
Map Sheet 4 of 4

Job Number	61-24791
Revision	0
Date	18 JAN 2010

Figure 2

G:\6124791\GIS\Maps\MDD\61_24791_03_VegetationTypes.mxd
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 Data Source: Landgate: Metro Central Mosaic - 2009; GHD: Proposed Pipeline - 20100114; Vegetation Type - 20100114. Created by: slc2, aglgr



O

- LEGEND**
- Vegetation Conditions**
1. Pristine or nearly so
 2. Excellent
 3. Very Good
 4. Good
 5. Degraded
 6. Completely Degraded

- Proposed Pipeline Route
- Railways



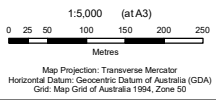
BHPB Shared Business
Baldvis Vegetation Survey and Clearing Permit

Job Number	61-24791
Revision	0
Date	18 JAN 2010

Vegetation Condition
Map Sheet 1 of 4

Figure 3

G:\6124791\GIS\Maps\MDD\61_24791_04_VegetationConditions.mxd
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Data Source: Landgate: Metro Central Mosaic - 2009; GHD: Proposed Pipeline - 2010/11; Vegetation Condition - 2010/11. Created by: slw2, agegr



- LEGEND**
- Vegetation Conditions**
1. Pristine or nearly so
 2. Excellent
 3. Very Good
 4. Good
 5. Degraded
 6. Completely Degraded

- Proposed Pipeline Route
- Railways



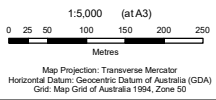
BHPB Shared Business
 Baldvis Vegetation Survey and Clearing Permit

Job Number	61-24791
Revision	0
Date	18 JAN 2010

Vegetation Condition
Map Sheet 2 of 4

Figure 3

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 Data Source: Landgate Metro Central Mosaic - 2009; GHD; Proposed Pipeline - 2010/01/14; Vegetation Condition - 2010/01/14. Created by: slw2, agejgr



- LEGEND**
- Vegetation Conditions**
1. Pristine or nearly so
 2. Excellent
 3. Very Good
 4. Good
 5. Degraded
 6. Completely Degraded

- Proposed Pipeline Route
- Railways



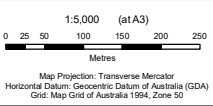
BHPB Shared Business
 Baldvis Vegetation Survey and Clearing Permit

Job Number: 61-24791
 Revision: 0
 Date: 18 JAN 2010

Vegetation Condition
Map Sheet 3 of 4

Figure 3

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 Data Source: Landgate: Metro Central Mosaic - 2009; GHD: Proposed Pipeline - 2010/01/14; Vegetation Condition - 2010/01/14. Created by: slw2, age1gr



- LEGEND**
- Vegetation Conditions**
1. Pristine or nearly so
 2. Excellent
 3. Very Good
 4. Good
 5. Degraded
 6. Completely Degraded

- Proposed Pipeline Route
- Railways



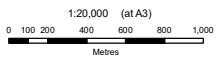
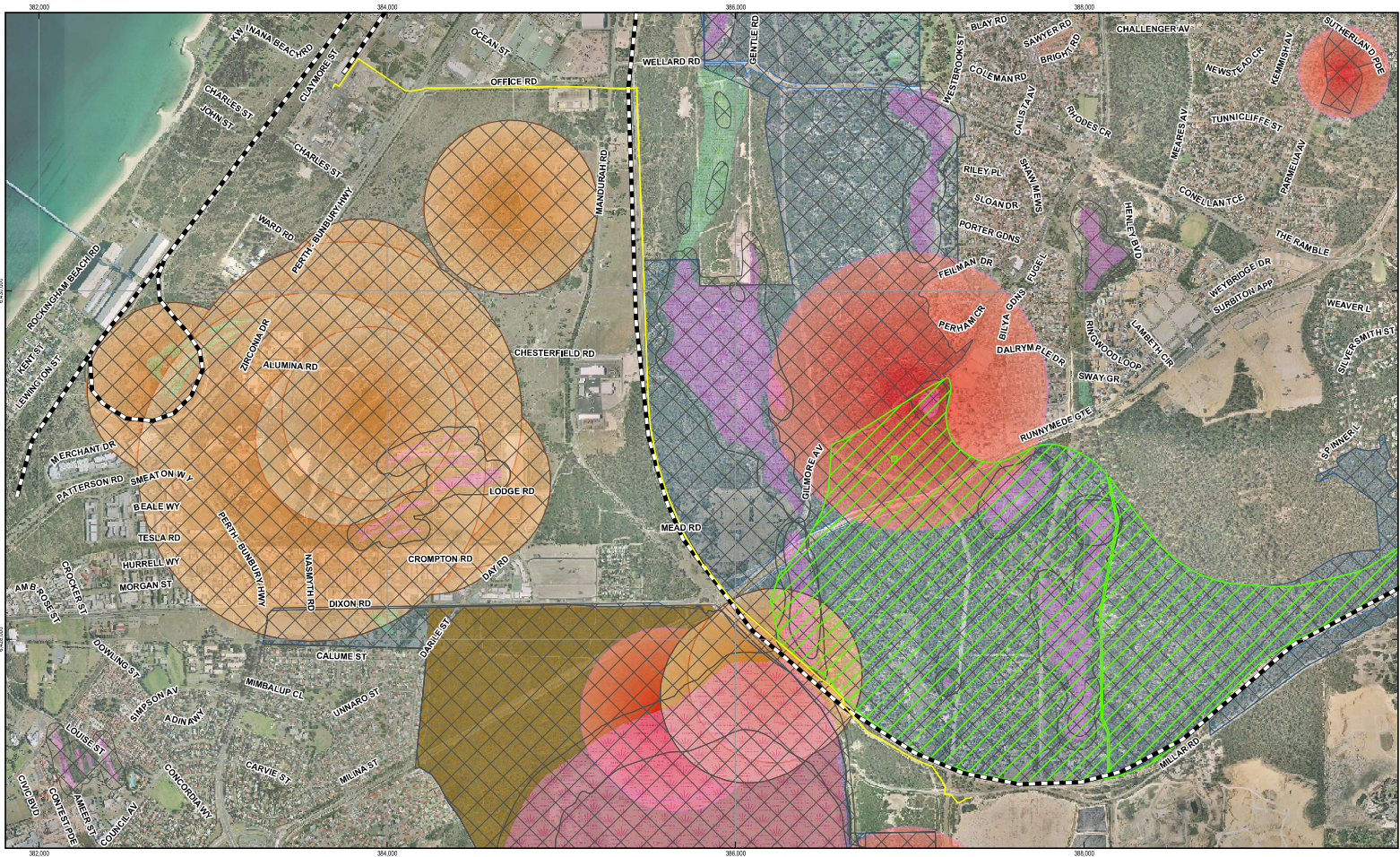
BHPB Shared Business
Baldvis Vegetation Survey and Clearing Permit

Vegetation Condition
Map Sheet 4 of 4

Job Number	61-24791
Revision	0
Date	18 JAN 2010

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 Data Source: Landgate: Metro Central Mosaic - 2009; GHD: Proposed Pipeline - 2010/11; Vegetation Condition - 2010/11. Created by: slw2, agejgr
 GHD House, 230 Adelaide Terrace Perth WA 6004 T 61 8 6222 8222 F 61 8 6222 8555 E permail@ghd.com.au W www.ghd.com.au

Figure 3



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

LEGEND

- Railway
- Proposed Pipeline Route
- DEC Estate
- TECs
- PECs
- Conservation
- Resource Enhancement
- Multiple Use
- Not Assessed
- ESA
- Bush Forever Site
- Regional Park



BHPB Shared Business
 Baldvis Vegetation Survey and Clearing Permit
 Job Number: 61-24791
 Revision: 0
 Date: 19 JAN 2010

Environmental Constraints **Figure 4**

G:\16124791\GIS\Maps\MDD\61_24791_06_EnvironmentConstraints_Rev0.mxd
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 Data Source: GHD Proposed Pipeline - 20091109; Landgate Metro Central Mosaic - 2009; DEC Estate - 20100119; TEC - PEC - 20091223; ESA - 20100119; Regional Park - 20100119; Geomorph Wetland - 20100119; DPE Bush Forever Site - 20100119. Created by: stec2, agelgr



Appendix B
Flora



Table 5 Flora species recorded within the Project Area

Family	Genus	Species	Status
Alliaceae	<i>Nothoscordum</i>	<i>gracile</i>	*
Amaranthaceae	<i>Ptilotus</i>	<i>polystachus</i>	*
Asparagaceae	<i>Asparagus</i>	<i>asparagoides</i>	*
Asphodelaceae	<i>Asphodelus</i>	<i>fistulosus</i>	*
Asteraceae	<i>Arctotheca</i>	<i>calendula</i>	*
Asteraceae	<i>Centaurea</i>	<i>melitensis</i>	*
Asteraceae	<i>Cirsium</i>	<i>vulgare</i>	*
Asteraceae	<i>Conyza</i>	<i>bonariensis</i>	*
Asteraceae	<i>Hypochaeris</i>	<i>glabra</i>	*
Asteraceae	<i>Lactuca</i>	<i>serriola</i>	*
Asteraceae	<i>Olearia</i>	<i>axillaris</i>	
Asteraceae	<i>Sochus</i>	<i>oleraceus</i>	*
Boraginaceae	<i>Echium</i>	<i>plantagineum</i>	*
Brassicaceae	<i>Brassica</i>	<i>tournefortii</i>	*
Caryophyllaceae	<i>Petrorhagia</i>	<i>dubia</i>	*
Casuarinaceae	<i>Allocasuarina</i>	sp. (planted)	*
Chenopodiaceae	<i>Rhagodia</i>	<i>baccata</i>	
Crassulaceae	<i>Crassula</i>	<i>glomerata</i>	*
Crassulaceae	<i>Crassula</i>	<i>colorata</i>	
Cyperaceae	<i>Gahnia</i>	<i>trifida</i>	
Cyperaceae	<i>Tetraria</i>	<i>capillaris</i>	
Dasypogonaceae	<i>Acanthocarpus</i>	<i>preissii</i>	
Dipsacaceae	<i>Scabiosa</i>	<i>atropurpurea</i>	*
Epacridaceae	<i>Leucopogon</i>	<i>parviflorus</i>	
Epacridaceae	<i>Leucopogon</i>	<i>australis</i>	
Euphorbiaceae	<i>Euphorbia</i>	<i>terraccina</i>	*
Euphorbiaceae	<i>Phyllanthus</i>	<i>calycinus</i>	
Euphorbiaceae	<i>Ricinus</i>	<i>communis</i>	*
Geraniaceae	<i>Pelargonium</i>	<i>capitatum</i>	*



Family	Genus	Species	Status
Hemerocallidaceae	<i>Dianella</i>	<i>revoluta</i>	
Hemerocallidaceae	<i>Tricoryne</i>	<i>elatior</i>	
Iridaceae	<i>Romulea</i>	<i>rosea</i>	*
Iridaceae	<i>Watsonia</i>	<i>meriana var. bulbifera</i>	*
Juncaceae	<i>Juncus</i>	sp.	
Mimosaceae	<i>Acacia</i>	<i>pulchella var. glaberrima</i>	
Mimosaceae	<i>Acacia</i>	<i>pulchella var. goadbyi</i>	
Mimosaceae	<i>Acacia</i>	<i>rostelifera</i>	
Mimosaceae	<i>Acacia</i>	<i>saligna</i>	
Mimosaceae	<i>Acacia</i>	<i>cyclops</i>	
Myrtaceae	<i>Calothamnus</i>	<i>quadrifidus</i> (planted)	
Myrtaceae	<i>Chamelaucium</i>	<i>uncinatum</i>	
Myrtaceae	<i>Eucalyptus</i>	<i>decipiens</i> (planted)	
Myrtaceae	<i>Eucalyptus</i>	<i>gomphocephalus</i>	
Myrtaceae	<i>Eucalyptus</i>	sp. (planted)	
Myrtaceae	<i>Melaleuca</i>	<i>lanceolata</i> (planted)	
Myrtaceae	<i>Melaleuca</i>	<i>teretifolia</i>	
Myrtaceae	<i>Melaleuca</i>	<i>huegelii</i> subsp. <i>huegelii</i>	
Myrtaceae	<i>Melaleuca</i>	<i>preissiana</i>	
Myrtaceae	<i>Melaleuca</i>	<i>rhopiophylla</i>	
Orchidaceae	<i>Orbanche</i>	<i>minor</i>	*
Oxalidaceae	<i>Oxalis</i>	<i>pes-caprae</i>	*
Papaveraceae	<i>Fumaria</i>	<i>capreolata</i>	*
Papilionaceae	<i>Chamaecytisus</i>	<i>palmensis</i>	*
Papilionaceae	<i>Hardenbergia</i>	<i>comptoniana</i>	
Papilionaceae	<i>Jacksonia</i>	<i>furcellata</i>	
Papilionaceae	<i>Lupinus</i>	<i>cosentinii</i>	*
Papilionaceae	<i>Medicago</i>	<i>minima</i>	*
Papilionaceae	<i>Templetonia</i>	<i>retusa</i>	
Papilionaceae	<i>Trifolium</i>	<i>angustifolium</i>	*
Papilionaceae	<i>Trifolium</i>	<i>campestre var. campestre</i>	*



Family	Genus	Species	Status
Papilionaceae	<i>Vicia</i>	<i>sativa</i>	*
Pinaceae	<i>Pinus</i>	<i>pinaster</i>	*
Poaceae	<i>Avena</i>	<i>fatua</i>	*
Poaceae	<i>Avena</i>	<i>barbata</i>	*
Poaceae	<i>Briza</i>	<i>minor</i>	*
Poaceae	<i>Bromus</i>	<i>diandrus</i>	*
Poaceae	<i>Cynodon</i>	<i>dactylon</i>	*
Poaceae	<i>Ehrharta</i>	<i>calycina</i>	*
Poaceae	<i>Ehrharta</i>	<i>longiflora</i>	*
Poaceae	<i>Eragrostis</i>	<i>curvula</i>	*
Poaceae	<i>Festuca</i>	<i>arundinaceae</i>	*
Poaceae	<i>Lagarus</i>	<i>ovatus</i>	*
Poaceae	<i>Lolium</i>	<i>perenne</i>	*
Poaceae	<i>Melinis</i>	<i>repens</i>	*
Poaceae	<i>Paspalum</i>	<i>dilitatum</i>	*
Poaceae	<i>Pennisetum</i>	<i>setaceum</i>	*
Poaceae	<i>Phalaris</i>	<i>paradoxa</i>	*
Poaceae	<i>Stenotaphrum</i>	<i>secundatum</i>	*
Polygonaceae	<i>Muehlenbeckia</i>	<i>adpressa</i>	
Primulaceae	<i>Anagallis</i>	<i>arvensis</i> var. <i>arvensis</i>	*
Primulaceae	<i>Anagallis</i>	<i>arvensis</i> var. <i>caerulea</i>	*
Proteaceae	<i>Banksia</i>	<i>sessilis</i>	
Proteaceae	<i>Grevillea</i>	<i>olivaceae</i> (planted)	
Proteaceae	<i>Grevillea</i>	<i>vestita</i>	
Ranunculaceae	<i>Clematis</i>	<i>pubescens</i>	
Rhamnaceae	<i>Spyridium</i>	<i>globulosum</i>	
Santalaceae	<i>Santalum</i>	<i>acuminatum</i>	
Xanthorrhoeaceae	<i>Xanthorrhoea</i>	<i>preissii</i>	
Zamiaceae	<i>Macrozamia</i>	<i>riedlei</i>	



Appendix C
Fauna

NatureMap Species Report

Created By Guest user on 05/11/2009

Kingdom Animalia

Method 'By Rectangle'

Extent 115°45' 25" E, 115°48' 05" E, 32°14' 20" S, 32°17' 05" S

Name ID	Species Name	Naturalised	Conservation Code	Endemic To Query Area
1.	24260 <i>Acanthiza apicalis</i> (Broad-tailed Thornbill (Inland Thornbill))			
2.	24262 <i>Acanthiza inornata</i> (Western Thornbill)			
3.	25535 <i>Accipiter cirrocephalus</i> (Collared Sparrowhawk)			
4.	25536 <i>Accipiter fasciatus</i> (Brown Goshawk)			
5.	24561 <i>Anthochaera carunculata</i> (Red Wattlebird)			
6.	25670 <i>Anthus australis</i> (Australian Pipit)			
7.	25538 <i>Aquila morphnoides</i> (Little Eagle)			
8.	25715 <i>Cacatua roseicapilla</i> (Galah)			
9.	24980 <i>Christinus marmoratus</i> (Marbled Gecko)			
10.	24431 <i>Chrysococcyx basalis</i> (Horsfield's Bronze Cuckoo)			
11.	25675 <i>Colluricincla harmonica</i> (Grey Shrike-thrush)			
12.	25568 <i>Coracina novaehollandiae</i> (Black-faced Cuckoo-shrike)			
13.	25592 <i>Corvus coronoides</i> (Australian Raven)			
14.	25595 <i>Cracticus tibicen</i> (Australian Magpie)			
15.	25596 <i>Cracticus torquatus</i> (Grey Butcherbird)			
16.	25399 <i>Crinia glauerti</i> (Clicking Frog)			
17.	25400 <i>Crinia insignifera</i> (Squelching Froglet)			
18.	25027 <i>Ctenotus australis</i>			
19.	25039 <i>Ctenotus fallens</i>			
20.	30901 <i>Dacelo novaeguineae</i> (Laughing Kookaburra)	Y		
21.	30902 <i>Dacelo novaeguineae</i> subsp. <i>novaeguineae</i>	Y		
22.	25673 <i>Daphoenositta chrysoptera</i> (Varied Sittella)			
23.	25766 <i>Delma fraseri</i>			
24.	25540 <i>Elanus caeruleus</i> (Black-shouldered Kite)			
25.	25622 <i>Falco cenchroides</i> (Australian Kestrel)			
26.	25623 <i>Falco longipennis</i> (Australian Hobby)			
27.	25530 <i>Gerygone fusca</i> (Western Gerygone)			
28.	24443 <i>Grallina cyanoleuca</i> (Magpie-lark)			
29.	24295 <i>Haliastur sphenurus</i> (Whistling Kite)			
30.	25410 <i>Heleioporus eyrei</i> (Moaning Frog)			
31.	25119 <i>Hemiergis quadrilineata</i>			
32.	24491 <i>Hirundo neoxena</i> (Welcome Swallow)			
33.	25629 <i>Hirundo nigricans</i> (Tree Martin)			
34.	24153 <i>Isodon obesulus</i> subsp. <i>fusciventer</i> (Southern Brown Bandicoot, Quenda)		P5	
35.	25133 <i>Lerista elegans</i>			
36.	25005 <i>Lialis burtonis</i>			
37.	24581 <i>Lichenostomus virescens</i> (Singing Honeyeater)			
38.	25661 <i>Lichmera indistincta</i> (Brown Honeyeater)			
39.	25378 <i>Litoria adelaidensis</i> (Slender Tree Frog)			
40.	25388 <i>Litoria moorei</i> (Motorbike Frog)			
41.	25654 <i>Malurus splendens</i> (Splendid Fairy-wren)			
42.	25184 <i>Menetia greyii</i>			
43.	25185 <i>Menetia maini</i>			
44.	25186 <i>Menetia surda</i> subsp. <i>cresswelli</i>			
45.	25187 <i>Menetia surda</i> subsp. <i>surda</i>			
46.	24598 <i>Merops ornatus</i> (Rainbow Bee-eater)			
47.	25188 <i>Morethia adelaidensis</i>			
48.	25189 <i>Morethia boulengeri</i>			
49.	25190 <i>Morethia butleri</i>			
50.	25191 <i>Morethia lineocellata</i>			
51.	25192 <i>Morethia obscura</i>			
52.	25193 <i>Morethia ruficauda</i> subsp. <i>exquisita</i>			
53.	25194 <i>Morethia ruficauda</i> subsp. <i>ruficauda</i>			
54.	25195 <i>Morethia storri</i>			
55.	24223 <i>Mus musculus</i> (House Mouse)	Y		
56.	25249 <i>Neelaps calonotos</i> (Black-striped Snake)		P3	
57.	25197 <i>Notoscincus ornatus</i> subsp. <i>ornatus</i>			

Name ID	Species Name	Naturalised	Conservation Code	Endemic To Query Area
58.	25198 <i>Notoscincus ornatus</i> subsp. <i>wotjulum</i>			
59.	25680 <i>Pachycephala rufiventris</i> (Rufous Whistler)			
60.	25682 <i>Pardalotus striatus</i> (Striated Pardalote)			
61.	24630 <i>Pardalotus striatus</i> subsp. <i>westraliensis</i>			
62.	25695 <i>Petroica multicolor</i> (Scarlet Robin)			
63.	24409 <i>Phaps chalcoptera</i> (Common Bronzewing)			
64.	24596 <i>Phylidonyris novaehollandiae</i> (New Holland Honeyeater)			
65.	24747 <i>Platycercus spurius</i> (Red-capped Parrot)			
66.	25721 <i>Platycercus zonarius</i> (Australian Ringneck (Ring-necked Parrot))			
67.	24750 <i>Platycercus zonarius</i> subsp. <i>semitorquatus</i> (Twenty-eight Parrot)			
68.	25007 <i>Pletholax gracilis</i> subsp. <i>gracilis</i>			
69.	25703 <i>Podargus strigoides</i> (Tawny Frogmouth)			
70.	24679 <i>Podargus strigoides</i> subsp. <i>brachypterus</i>			
71.	24907 <i>Pogona minor</i> subsp. <i>minor</i>			
72.	24908 <i>Pogona minor</i> subsp. <i>mitchelli</i>			
73.	24909 <i>Pogona nullarbor</i> (Nullabor Bearded Dragon)			
74.	25199 <i>Proablepharus reginae</i>			
75.	25200 <i>Proablepharus tenuis</i>			
76.	25201 <i>Pseudemoia baudini</i>			
77.	25259 <i>Pseudonaja affinis</i> subsp. <i>affinis</i> (Dugite)			
78.	25008 <i>Pygopus lepidopodus</i> (Common Scaly Foot)			
79.	25009 <i>Pygopus nigriceps</i>			
80.	24911 <i>Rankinia adelaidensis</i> subsp. <i>adelaidensis</i> (Western Heath Dragon)			Y
81.	24910 <i>Rankinia adelaidensis</i> subsp. <i>chapmani</i> (Western Heath Dragon)			Y
82.	24245 <i>Rattus rattus</i> (Black Rat)	Y		
83.	25614 <i>Rhipidura leucophrys</i> (Willie Wagtail)			
84.	25534 <i>Sericornis frontalis</i> (White-browed Scrubwren)			
85.	30948 <i>Smicromis brevirostris</i> (Weebill)			
86.	25590 <i>Streptopelia senegalensis</i> (Laughing Turtle-Dove)	Y		
87.	24942 <i>Strophurus spinigerus</i> subsp. <i>spinigerus</i>			
88.	25202 <i>Tiliqua multifasciata</i> (Central Blue-tongue)			
89.	25203 <i>Tiliqua occipitalis</i> (Western Bluetongue)			
90.	25204 <i>Tiliqua rugosa</i> subsp. <i>aspera</i>			
91.	25206 <i>Tiliqua rugosa</i> subsp. <i>palarra</i>			
92.	25207 <i>Tiliqua rugosa</i> subsp. <i>rugosa</i>			
93.	25762 <i>Tyto alba</i> (Barn Owl)			
94.	25227 <i>Varanus tristis</i> subsp. <i>tristis</i> (Racehorse Monitor)			

Conservation Codes

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



Table 6 Listing of Potentially Occurring Significant, Rare and Priority Fauna Species within 10 km of the Study Area, with Information Source

Genus	Species	Common Name	Listing under Wildlife Conservation Act 1950 or DEC Priority List	Listing under EPBC Act	NatureMap Search/DEC records	EPBC Protected Matters Search Tool
Birds						
<i>Calyptorhynchus</i>	<i>banksii naso</i>	Forest Red-tailed Black Cockatoo	Schedule 1	Vulnerable		+
<i>Calyptorhynchus</i>	<i>baudinii</i>	Baudin's Black Cockatoo	Schedule 1	Vulnerable		+
<i>Calyptorhynchus</i>	<i>latirostris</i>	Carnaby's Black-Cockatoo	Schedule 1	Endangered		+
<i>Haliaeetus</i>	<i>leucogaster</i>	White-bellied Sea-Eagle		Migratory		+
<i>Merops</i>	<i>ornatus</i>	Rainbow Bee-eater		Migratory		+
<i>Ardea</i>	<i>alba</i>	Great Egret, White Egret		Migratory		+
<i>Ardea</i>	<i>ibis</i>	Cattle Egret		Migratory		+
<i>Apus</i>	<i>pacificus</i>	Fork-tailed Swift		Migratory		+
Reptiles						
<i>Neelaps</i>	<i>calonotos</i>	Black-striped Snake	Priority 3		+	
Mammals						
<i>Dasyurus</i>	<i>geoffroii</i>	Chuditch, Western Quoll	Schedule 1	Vulnerable		+
<i>Isoodon</i>	<i>obesulus</i> subsp. <i>fusciventer</i>	Southern Brown Bandicoot, Quenda	Priority 5		+	
<i>Phascogale</i>	<i>calura</i>	Red-tailed Phascogale	Schedule 1	Endangered		+



Genus	Species	Common Name	Listing under Wildlife Conservation Act 1950 or DEC Priority List	Listing under EPBC Act	NatureMap Search/DEC records	EPBC Protected Matters Search Tool
<i>Setonix</i>	<i>brachyurus</i>	Quokka	Schedule 1	Vulnerable		+
Insects						
<i>Synemon</i>	<i>gratiosa</i>	Graceful Sun Moth	Schedule 1	Endangered		+



Table 7 Fauna species observed during the field survey

Family	Species	Common Name	Status
Birds			
Petroicidae	<i>Petroica multicolor</i>	Scarlet Robin	
Psittacidae	<i>Cacatua roseicapilla</i>	Galah	
Accipitridae	<i>Haliastur sphenurus</i>	Whistling Kite	
Meliphagidae	<i>Anthochaera carunculata</i>	Red Wattlebird	
Campephagidae	<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike	
Columbidae	<i>Streptopelia senegalensis</i>	Laughing Turtle-Dove	
Corvidae	<i>Corvus coronoides</i>	Australian Raven	
Cracticidae	<i>Cracticus tibicen</i>	Australian Magpie	
Cracticidae	<i>Cracticus torquatus</i>	Grey Butcherbird	
Dicruridae	<i>Rhipidura leucophrys</i>	Willie Wagtail	
Falconidae	<i>Falco cenchroides</i>	Australian Kestrel	Mi, Ma
Halcyonidae	<i>Dacelo novaeguineae</i>	Laughing Kookaburra	x
Hirundinidae	<i>Hirundo neoxena</i>	Welcome Swallow	
Meliphagidae	<i>Lichenostomus virescens</i>	Singing Honeyeater	
Meliphagidae	<i>Lichmera indistincta</i>	Brown Honeyeater	
Meliphagidae	<i>Phylidonyris novaehollandiae</i>	New Holland Honeyeater	
Meropidae	<i>Merops ornatus</i>	Rainbow Bee-eater	Mi, Ma
Pelecanidae	<i>Pelecanus conspicillatus</i>	Pelican	Ma
Reptiles			
Agamidae	<i>Pogona minor minor</i>	Dwarf Bearded Dragon	
Elapidae	<i>Notechis scutatus</i>	Tiger Snake	
Elapidae	<i>Pseudonaja affinis affinis</i>	Dugite	
Scincidae	<i>Tiliqua rugosa rugosa</i>	Bobtail	
Varanidae	<i>Varanus gouldii gouldii</i>	Gould's Goanna	
Mammals			
Canidae	<i>Vulpes vulpes</i>	Red Fox	x
Felidae	<i>Felis catus</i>	Feral cat	x
Leporidae	<i>Oryctolagus cuniculus</i>	Rabbit	x



x Introduced
Mi Migratory
Ma Marine



Appendix D
Plates – Vegetation Types



Plate 1: W, east along Office Road.



Plate 2: V1 and W, east along Office Road



Plate 3: V2 and W, end of Office Road towards Mandurah Road.



Plate 4: V3 and C, east across from Mandurah Road and Office Road.



Plate 5: W and C, south along the railway, parallel to Mandurah Road



Plate 6: V3, W and C, south of Dixon Road, east of the railway



Plate 7: V4, W and C, south of Dixon Road, east of the railway



Plate 8: V5, W and C, south of Dixon Road, east of the railway



Plate 9: V3, W and C, south of Dixon Road, east of the railway.



Plate 10: V6 and C, south of Dixon Road, west of the railway.



Plate 11: V3 and C, south of Dixon Road, west of the railway.



Plate 12: V2 and C, west of the railway towards Millar Road.



Plate 13: W and C, south towards Millar Road.



Plate 14: V1, South of Millar Road.



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