REVISED ENVIRONMENTAL OFFSET PROPOSAL

Bunbury Port Access Project Stage 2

October 2015

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TRIM Document Number	B15#38617
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Report Compilation and Review	Name and Position	Document Revision	Date
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Author:	N McCarthy Project Environment Manager	Rev 0	06/02/15
Author:	N McCarthy Project Environment Manager	Rev 1	20/05/15
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1. Background

Main Roads completed construction of the Bunbury Access Project Stage 2 (the Project) as shown at Figure 1 in early 2013.

In October 2011 Main Roads submitted an Environmental Offset Plan (EOP) (GHD 2011b) to the Department of Sustainability, Environment, Water, Population and Communities (now Department of the Environment (DotE)) for the Project and this was subsequently conditionally approved in November 2012.

The approved EOP included land that Main Roads was in negotiations with the property owners / managers for purchase. Negotiations for several of these properties were unable to be realised, theses being:

- Lot 3 Moore Road, Davenport
- Lot 15 South Western Highway Linkage to Preston River
- Preston River Foreshore (Part of Lot 11, Lot 5814 and reserve 31 866)

Main Roads has also purchased Lot 301 Boyanup Picton Road, Davenport as a strategic offset for future stages of the Bunbury Outer Ring Road. Given the delays in securing the previously nominated offset properties it is now proposed to include a portion of Lot 301 as an alternative offset.

This revised EOP has been prepared for approval by DotE and WA Department of Environment Regulation (DER) as required for Project clearing approval.

The original EOP was approved prior to the implementation of:

- The Commonwealth Environment Protection and Biodiversity Conservation Act 1999, Environmental Offsets Policy (2012)
- Adoption of the Commonwealth Environmental Offset Calculator
- Adoption of the WA Environmental Offsets Policy (2011)

The 2011 EOP and was based on advice provided by DotE in respect to offset requirements as detailed in Section 3. This revised EOP complies with the offset requirements at the time of Project clearing and the original offset proposal being approved.

Project clearing has been re-assessed based on that required for the construction of the Project and this revised EOP is based on the reduced clearing impact.

2. Environmental Approvals

State Environmental Approval

The Project was referred to the WA Environmental Protection Authority (EPA) in late 2010 under Section 38 of the *Environmental Protection Act 1986* (EP Act). In February 2011 the EPA subsequently determined that the Project did not require formal environmental assessment. Consequently project clearing was conducted under Main Roads Statewide Purpose Clearing Permit CPS 818/5 (CPS 818).

An assessment of the Project clearing against the Ten Clearing Principles concluded clearing was:

- at variance with principles (b) and (f), and
- may be at variance with principle (e)

As such an environmental offset was required, as prescribed under the conditions of CPS 818. The Department of Environment and Conservation (now Department of Environment Regulation (DER)) gave conditional approval for Project clearing to proceed with the resolution of the environmental offset to occur at a later date (see correspondence at Appendix A).

Commonwealth Environmental Approval

The Project was determined by DotE to be 'Controlled Action" assessed through Preliminary Information (EPBC 2010/5768) under the provisions of the *Environment Protection and Biodiversity Conservation Act 1999* as a result of impacts on threatened species:

- Western Ringtail Possum
- Carnaby's Cockatoo, and
- Baudin's cockatoo

Conditional approval (Appendix B) of the Project prescribed a number of conditions including the requirement for an environmental offset (Condition 5) to address impacts on the above threatened species.

3. Scope

This revised EOP has been prepared to document the environmental offsets required to address:

- Part V of Main Roads Purpose Clearing Permit 818
- Conditions prescribed by the Minister for the Environment in approving the Greater Bunbury Region Scheme (Statement No. 000697) (Appendix C), and
- Advice from, and conditions prescribed by DotE approval of the Project (EPBC 2010/5768) (Condition 5).

As noted above, the revised EOP complies with the requirement for environmental offsets that were in place at the time of the original EOP being approved in 2011 and the clearing conducted in 2012.

Commonwealth Environmental Requirements

Conditions were prescribed by DotE in giving the Project conditional environmental approval as detailed at Appendix A to address issues such as:

- Defining the protection and habitat clearing limits for Western Ringtail Possum and Black Cockatoo species
- The requirements to provide funding for research for Western Ringtail Possum and Carnaby's Black Cockatoo
- The preparation and implementation of an Offset Management Plan
- The preparation and implementation of a Western Ringtail Possum Management Plan
- Audit, monitoring and reporting requirements

Correspondence from DotE to Main Roads (Appendix D) noted that due to potential impacts on listed threatened species and communities ie Western Ring-tailed Possum, Carnaby's Cockatoo and Baudin's Cockatoo Main Roads was required to provide suitable environmental protection and enhancement offsets. The advice noted that:

"Outcomes on other projects with impacts on these fauna species have been successfully achieved where:

1. For every hectare of Black Cockatoo foraging habitat cleared, 4 hectares are created through the successful establishment of new plantings of foraging species and/or infill planting of degraded habitat: or

2. For every hectare of foraging habitat cleared, 6 hectares of existing unprotected or 'at risk' habitat is protected in perpetuity, or

3. A combination of new plantings and/or infill-planting and/or protection of existing habitat in perpetuity produces similar overall results to those above.

4. 1:1 offset for Western Ringtail Possum habitat has previously been accepted for projects clearing less than 20% of the remnant habitat patch."

West Australian Environmental Requirements (CPS 818)

Project clearing was conducted under Main Roads CPS 818. An assessment of the Project clearing impacts against the Ten Clearing principles by DER (see Appendix B) identified that clearing was at:

- variance with Principles b) and f), and
- may be at variance with Principle (e).

These principles are defined as:

(b) Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia.

(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.

(f) Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland.

As per the conditions of CPS 818/5 Main Roads is required to implement an environmental offset. This revised EOP complies with the offset requirements of CPS 818/5, which was current at the time.

West Australian Planning Requirements

Conditional approval for the implementation of the Greater Bunbury Region Scheme, which includes the Project, issued by the WA Minister for the Environment (Statement No. 000697) (Appendix C) included a condition that required the "Preparation of an offset strategy prior to construction of the Port Access Road and Bunbury Outer Ring Road.'

The condition details that;

> "With respect to the Bunbury Outer Ring Road, the strategy shall include rehabilitation of the strip of land adjacent to the road in the vicinity of Lot 15 North Boyanup Road (South Western Highway) …."

The purchase of this strip of land has not been possible and negotiations with the landowner are unlikely to be successful in the near future. The acquisition of this strip of land is currently the focus of legal action between the landowner and Main Roads. The land has been set aside through an approved sub-

division and it is proposed that this condition will be met in future stages of the Bunbury Outer Ring Road.

4. Project Environmental Impacts

The environmental impact as detailed in the project EIA (GHD, 2011) predicted the total Project clearing was expected to be 16.8 ha based on the Concept Design. This formed the basis of the EOP (GHD, 2011b).

The environmental impacts documented in the EIA that require an environmental offset are the following:

- Western Ringtail Possum habitat
- Carnaby's Cockatoo and Baudin's Cockatoo habitat
- Moore Road wetland
- River crossings - Preston River and Ferguson River
- Regionally significant and underrepresented vegetation Complexes – Southern River, Guildford and Swan

This revised EOP is based on the actual project clearing area as defined by:

- Clearing area survey provided by the construction contractor
- Post-construction site assessment
- % vegetation cover within the clearing area (shapefiles), and
- A review of pre-construction and post construction aerial photography.

The actual clearing area has been determined to be 10.7 ha and is as shown at Figure 2. Based on the revised clearing area environmental impacts requiring offset are detailed in Table 1 below.

Table 1 Project Predicted and Actual Clearing Impacts

Environmental Impact	**Expected Impact 2011**	**Actual Impact**	**Difference in Impact**
Total clearing area	16.7 ha	10.6 ha	6.1 ha less
Clearing of *Corymbia calophylla / Agonis flexuosa* woodland Clearing of *Eucalyptus rudis* woodland	13.7 ha 1.5 ha	6.4 ha 1.0 ha	7.3 ha less 0.5 ha less
Loss of Western Ringtail Possum habitat	16.1 ha	10.0 ha	6.1 ha less
Loss of Carnaby's Cockatoo and Baudin's Cockatoo habitat	16.7 ha	10.5 ha	6.2 ha less
Moore Road wetland fringe	No impact	No impact	No change
Clearing impact on Preston River crossing	1.5 ha	1.0 ha	0.5 ha less
Clearing impact on Ferguson River crossing	0.3 ha	0.2 ha	0.1 ha less
Clearing impact on regionally significant and underrepresented vegetation Complexes			

Environmental Impact	Expected Impact 2011	Actual Impact	Difference in Impact
• Southern River	14.8 ha	6.7 ha	8.1 ha less
• Guildford	0.7 ha	2.6 ha	1.9 ha greater
• Swan	1.2 ha	1.3 ha	0.1 ha greater

Impact Mitigation and Enhancement

Throughout the development and construction of the Project, Main Roads has minimised the impacts of the project in line with:

- the impact mitigation and enhancement of best practise requirements of DotE (Commonwealth of Australia, 2011)
- CPS 818 offset principles – "Offsets are implemented only once all avenues to avoid, minimise, rectify or reduce environmental impacts have been exhausted.'

Table 2 summarises impact mitigation measures that have been implemented and details the residual impacts requiring an environmental offset.

Table 2 Bunbury Port Access Project (Stage 2) Summary of Impact Mitigation Measures and Residual Impacts

Item	Environmental Asset	Legislative Protection	Impact Mitigation				Residual Impact Requiring Offset	Proposed Offset	
			Avoid	Minimise	Rectify	Reduce		Direct	Contributing (Enhancing)
1	Western Ringtail possum. Loss of habitat (*Corymbia calophylla* / *Agonis flexuosa* open woodland comprising Southern River and Guildford Vegetation Complexes)	EPBC Act listed species (Section 18 and 18A) Wildlife Conservation Act 1950, Schedule 1 species Clearing principle (b)	A number of alignment options were considered for PAR alignment of the project. The option selected reduced possum habitat clearing by 4.8 ha from the alignment option with the greatest impact.	Clearing was the minimum necessary for the safe construction and operation of the Project. Note that clearing impact was less than predicted. Fencing was aligned to minimise habitat loss where practicable.	Revegetation with suitable habitat species	A possum rope bridge was installed to link habitat areas	Yes	Yes	Yes
2	Carnaby's Cockatoo foraging habitat - *Corymbia calophylla* / *Agonis flexuosa* open woodland	EPBC Act listed species (Section 18 and 18A) *Wildlife Conservation Act 1950,* Schedule 1 species Clearing principle (b)	A number of alignment options were considered for PAR alignment of the project. The option selected reduced habitat clearing by 4.4 ha from the alignment option with the greatest impact.	Clearing was the minimum necessary for the safe construction and operation of the Project. Note that clearing impact was less than predicted. Fencing was aligned to avoid habitat loss where practicable.	Revegetation of portions of the project site with suitable foraging species	No other options to further reduce the residual impact	Yes	Yes	Yes
3	Moore Road wetland buffer - EPP Lake and Environmental Sensitive Area	*Environmental Protection (Swan Coastal Plain Lakes) Policy, 1992* *Environmental Protection (Clearing of Native Vegetation) Regulations, 2004.* Clearing Principle (f)	Not possible to avoid entirely the wetland buffer. The EPP mapped area and wetland vegetation is 15 m and 35 m beyond the clearing footprint respectively.	Clearing of fringing vegetation was the minimum necessary for the safe construction and operation of the Project. Road drainage has been constructed so that there is no discharge of off road run off to the wetland.	The roadworks batter within the wetland fringe has been revegetated with indigenous native species	No other options to further reduce the residual impact	Yes	Yes	No
4	Preston River - Conservation category wetland, Environmentally Sensitive Area and Swan vegetation complex Ferguson River – Multiple use wetland and Swan vegetation complex	*Environmental Protection (Clearing of Native Vegetation) Regulations, 2004* Clearing Principle f Clearing Principle (f)	Not possible to avoid entirely this watercourse due to road crossing. Bridge abutments setback to maintain fauna linkage along the river bank. The bridge design avoids long term disturbance of the primary watercourse.	Clearing was minimised to minimum necessary for the safe construction and operation of the Project. Fencing was aligned to minimise impact on riparian vegetation. Road drainage was designed and constructed so that there is no discharge of off road run off to the wetland.	Revegetation of road reserve at crossing with native species. Drainage designed and constructed so that there is no direct discharge of road run-off to the watercourse.	No other options to further reduce the residual impact	Yes	Yes	No
5	Regionally significant vegetation - Southern River Complex	Clearing principle (e)	The selected PAR alignment option reduced clearing of this complex by 7.8 ha There were no further options to reduce the impact on this complex as bridge crossings are required at the Ferguson and Preston Rivers.	Clearing was minimised to minimum necessary for the safe construction and operation of the Project. Note that clearing impact was less than predicted.	Revegetation of project site.	No other options to further reduce the residual impact	Ye	Yes	No
6	Regionally significant vegetation – Swan Complex– Preston and Ferguson River crossings	Clearing principle (e)	The selected PAR alignment option reduced habitat clearing by 0.8 ha There were no further options to reduce the impact on this vegetation complex.	Clearing was minimised to minimum necessary for the safe construction and operation of the Project. Note that clearing impact was marginally greater than predicted.	Revegetation of the road reservation at bridge crossings is in progress	No other options to further reduce the residual impact	Yes	Yes	No
7	Regionally significant vegetation – Guildford Complex	Clearing principle (e)	There were no options to reduce the impact on this complex.	Clearing was minimised to minimum necessary for the safe construction and operation of the Project. Note that clearing impact was 1.9 ha greater than predicted.	No options to rectify the impacts	No other options to further reduce the residual impact	Yes		No

5. Environmental Offsets

The original and this revised EOP address the residual environmental impacts detailed in Table 1 through a combination of direct and contributing offsets as described below.

Direct Offset - Land Purchases and Rehabilitation

Main Roads has completed or confirmed land purchases comprising:

- Lot 111 (formerly Lot 102) Moore Road
- Part Lot 301 (formerly Lot 5) Boyanup Picton Road
- Portion of Lot 520 adjacent to the Ferguson River

The above properties, or portions of, provide the direct offsets for Project clearing.

Offset land will be rezoned to Regional Open Space and incorporated into the conservation estate through the GBRS planning process, congruent with the recommendations of EPA Bulletin 1282 (EPA, 2008b).

Other Compensatory Measures / Contributing Offsets

Main Roads has also provided the following contributing offsets:

- Carnaby's Cockatoo research funding to the Department of Environment and Conservation (DEC) ($300 000). This is congruent with EPBC Act approval Condition 4.
- Western Ringtail Possum research funding to the University of WA ($700 000) as required under EPBC Act approval Condition 6, and to monitor the efficacy of the possum rope bridge constructed as part of the Project.

6. Residual Impacts Requiring Offset

The residual impacts of Project clearing are briefly discussed below.

Fauna Habitat Impacts (Item 1 and 2, Table 2)

The direct loss of fauna habitat, particularly for Western Ringtail Possum, Carnaby's and Baudin's Cockatoo was considered to be a significant impact of the Project.

The alignment selection process considered a number of potential routes for the PAR Stage 2 alignment to link the existing PAR Stage 1 with the BORR Stage 1. The alignment that was selected reduced habitat impact for both Western Ringtail Possum and White-tailed Black Cockatoo species, while actual construction clearing reduced the impact further.

Table 3 Direct Habitat Loss for Conservation Significant Fauna Species

Species	Worst Case Alignment Option Potential Habitat Loss (ha)	Potential Habitat Loss on Selected Alignment	Actual Construction Clearing Habitat Loss (ha)
Western Ringtail Possum	19.1	14.3	10.0
Black Cockatoo	17.6	13.2	10.6

The loss of fauna habitat listed as Schedule 1 under the WA *Wildlife Conservation Act 1950* is at variance with Clearing Principle (b).

Moore Road Wetland Buffer Impact (Item 3, Table 2)

The Moore Road Wetland occurs south of the proposed earthworks footprint approximately 300 m west of the Boyanup Picton Road intersection. The wetland is protected under the *Environmental Protection (Swan Coastal Plain Lakes) Policy 1992* and defined as an Environmentally Sensitive Area (ESA) under the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*. The wetland vegetation is 35 m from the earthworks footprint while the edge mapped EPP Lake boundary is 15 m from the footprint.

The wetland has been grazed for a number of years and comprises remnant paperbarks over a weed/pasture understorey and was assessed as having a vegetation condition rating of Good. The Project embankment traverses the wetland buffer, impacts the immediate wetland fringe and passes within 35 m of the wetland vegetation at it closest point. The road drainage was constructed so that there is no direct discharge of road run-off to the wetland.

Impacts on the wetland could not be avoided and consequently an environmental offset to address the residual impact is required.

The impact of the Project clearing on the wetland fringe is at variance with Clearing Principle (f).

Preston River Impact (Item 4, Table 2)

The Preston River is a Conservation Category Wetland and also recognised as an ESA. The river foreshore and its surrounds have been grazed for many years and essentially comprise an overstorey of native Jarrah (*Eucalyptus marginata*), Flooded Gum (*E. rudis*) and Red Gum (*Corymbia calophylla*) with a weed / pasture understorey. The vegetation condition at the Project crossing is considered to be Degraded.

The watercourse was impacted by the construction of two bridges at the highway crossing with 1.0 ha of vegetation cleared.

The impact of the river crossing is at variance with Clearing Principle (f).

Ferguson River Impact (Item 4, Table 2)

The Ferguson River is a Multiple Use wetland. The river foreshore has been previously altered by major drainage and excavation works. The PAR crossing site comprised a remnant overstorey and, regrowth *E. rudis* over a weed infested understorey. Clearing for the construction of the Ferguson River crossing was 0.2 ha.

The impact on the river crossing is at variance with Clearing Principle (f).

Regionally Significant Vegetation Impact (Items 5, 6 and 7, Table 2)

Regional vegetation has been mapped by Heddle, *et al.* (1980) at a scale of 1:250,000 based on major geomorphic units on the Swan Coastal Plain. The Project traverses three vegetation complexes defined by Heddle as listed in Table 4:

The Project will result in the clearing of a portion of the three vegetation complexes as mapped Heddle *et al.* (1980) and as assessed by the Local Biodiversity Program (2013). According to the Local Biodiversity Program, the remaining pre-European vegetation extent of these vegetation types is as shown in Table 4.

The Commonwealth of Australia has stated National Targets and Objectives for Biodiversity Conservation, which recognised that the retention of 30%, or more, of the pre-clearing extent of each ecological community was necessary if Australia's biological diversity and was to be protected (Environment Australia, 2001). This is congruent with the targets set in the Environmental Protection Authority (EPA) Position Statement on the 'Environmental protection of native vegetation in Western Australia: clearing of native vegetation, with particular reference to the agricultural area' (EPA, 2000). The EPA has set a target of 15% of pre-European extent for each ecological community to be protected in a comprehensive, adequate and representative reserve system (EPA, 2006).

Although the site vegetation has been degraded though past land use it was considered to be of regional significance. Clearing Principle (e) also recognises the significance of these remnant vegetation complexes and that the Project clearing may be considered to be at variance. Project clearing impact was as detailed in Table 5.

Table 4 Assessment of PAR Stage 2 Clearing Impact on Regional Vegetation Complexes from Swan Coastal Plain (Local Biodiversity Program, 2013)

Vegetation Complex	Pre-European Extent (ha)	2013 Extent (ha)	% Remaining (of Pre-European Extent)	Project Clearing (ha)	Project Clearing as % Remaining (of remaining Pre-European Extent)
Swan	16 651.60	2304.86	13.84	1.3	0.06
Guildford	92 281.43	5412.79	5.87	2.6	0.05
Southern River Complex	57 171.55	11254.99	19.7	6.7	0.06

As shown in Table 4, the Project clearing as a proportion of the current extent of the vegetation complexes was very small, but it was considered to be at variance with Clearing Principles (e) and (f).

7. Environmental Offsets

Offset Rationale

Main Roads proposes to address the requirements of both the Commonwealth and West Australian offset requirements through the protection and enhancement of key environmental values detailed in Section 2.1 through both direct and other compensatory measures.

Direct Offsets

Direct offsets are environmentally beneficial activities undertaken to counterbalance an adverse environmental impact or harm, with the goal of achieving a ‘net environmental benefit’.

The direct offset land areas are shown at Figure 3, while a summary of the residual impacts on key environmental values and the proposed offset are detailed in Table 5. Each of the environment values of the proposed offset sites are summarised below.

Other Compensatory Measures

The other compensatory measures that form part of EOP have been developed congruent with DotE advice and EPBC Act conditions as used in preparing the 2011 EOP.

Direct Offsets – Land Purchases

Main Roads has purchased land for direct offsets. These three properties and their environmental values are detailed below.

Lot 111 (formerly Lot 102) Moore Road

Main Roads has secured the purchase of Lot 111 Moore Road which is traversed by the Project. The area of Lot 111 to be incorporated into the environmental offset comprises existing native vegetation (26.7 ha) and revegetation areas (13.2 ha) that will provide habitat values for Black Cockatoo and Western Ringtail Possum. The remnant vegetation and revegetation areas of Lot 111 are as shown at Figure 4.

Environmental Values

Lot 111 was identified by the EPA (2008), being part of Investigation Area 11 as comprising regionally significant vegetation as detailed at Appendix E. The lot forms part of Recommendation Area B which the EPA (2008) recommended be reserved as Regional Open Space.

A site survey conducted in October 2010 identified six main vegetation types within the lot. The vegetation types are outlined below.

- Low lying wetland area, heavily vegetated with a good combination of trees, understory and ground cover.
- Low lying wetland - mostly populated with Melaleuca species and has a degraded understory consisting of pasture and sedges.
- Open area of pasture.
- Dense Banksia woodland with a good understory and ground cover.
- Jarrah, Marri, *Banksia ilicifolia* and Melaleuca woodland, the understory in this area is dense in some parts and degraded in others.
- Agonis, Jarrah, Marri and *Banksia ilicifolia* woodland with a degraded understory.

The vegetation condition within Lot 111 varies from excellent condition to degraded as shown at Appendix F.

A number of different fauna habitats are present within the lot, including:

- Seasonal wetland; and
- Banksia/Agonis/Jarrah woodland;

The habitat present varies from degraded to excellent and the majority has the potential to regenerate. A dense overstorey of mature trees with breeding hollows provides both breeding and feeding habitat for significant species.

Environmental Offset Values

Lot 111 provides the following environmental attributes to offset the residual impact of the Project:

- Provides 26.7 ha of potential Black Cockatoo foraging habitat
- Provides 26.7 ha of known Western Ringtail Possum habitat
- Secures 26.7 ha of Southern River vegetation complex
- Secures a 1.8 ha EPP wetland, ESA and multiple use wetland (UFI 1395)
- Provides 13.2 ha to be revegetated with species suitable for Black Cockatoo and WRP and inclusion into the future Ocean to Preston Regional Park
- Secures 26.7 ha of the regionally significant vegetation identified by the EPA (2008b) (Investigation Area 11)

Portion of Part Lot 301 (formerly Lot 5) Boyanup Picton Road, Davenport

Main Roads has a contract of sale with the owners of Lot 301 for the purchase of 112 ha of the property which is as shown at Figure 3.

Environmental Values

The remnant vegetation identified by the EPA (2008b) as being part of Investigation Areas 10, 14 and 21 comprising regionally significant vegetation as detailed at Appendix E. The Lot forms part of Recommendation Areas B which the EPA (2008) recommended be reserved as Regional Open Space under the GBRS and managed for conservation purposes.

Main Roads has managed the preparation of an Environmental Values Assessment of Lot 301 (GHD, 2014) and in summary identified that the site vegetation has the following environmental values:

- Contains two ESAs with one associated with a 1.8 ha EPP Lake wetland
- Contains a number of vegetation types including:
    - Jarrah-Banksia-Peppermint Woodland
    - fringing ‘Marri Woodland’
    - dampland vegetation recorded as ‘Closed Heath of Astartea’
    - wetland vegetation with grass and daisy species in the understorey with scattered Melaleuca and Flooded Gum (Eucalyptus rudis) trees in the overstorey (10.81 ha)
- Supports Guildford and Southern River Vegetation Complexes
- Supports habitat suitable for / and or populations of Carnaby’s Black Cockatoo, Forest Red-tailed Black Cockatoo, Baudin’s Black Cockatoo, Western Ringtail Possum, Quenda/Southern Brown Bandicoot, Rainbow Bee-eater and Southern Brush-tailed Phascogale

A copy of the Environmental Values Assessment is included at Appendix G.

Environmental Offset

Main Roads proposes to provide a 14.8 ha portion of Lot 301 as part of the environmental offset for the Project. The remainder of the property will be used as a strategic environmental offset for future stages of the BORR.

The proposed offset will provide the following environmental values:

- Securing 14.8 ha of potential cockatoo habitat
- Securing 14.8 ha of WRP habitat
- Securing 9.3 ha of Guildford Vegetation Complex
- Securing 5.4 ha of Southern River Vegetation Complex
- Securing part of regionally significant vegetation identified by the EPA (2008b) as Recommendation Area B

Purchase of Portion of Lot 520 at the Ferguson River Foreshore

Main Roads has purchased a severed portion of Lot 5 which abuts the Ferguson River as shown at Figure 3.

Environmental Values

The remnant vegetation identified by the EPA (2008b) as being part of Investigation Area 8 comprising regionally significant vegetation as detailed at Appendix E. The Lot forms part of Recommendation Area C which the EPA (2008) recommended be reserved as Regional Open Space under the GBRS and managed for conservation purposes.

Environmental Offset

The outcome of this purchase will be:

- Securing 4.0 ha of potential cockatoo habitat
- Securing 4.0 ha of Swan Vegetation Complex
- Securing part of regionally significant vegetation identified by the EPA (2008b) as Recommendation Area C
- Secure a vegetated buffer to approximately 400m section of the Ferguson River

Other Compensatory Measures

Main Roads has enhanced the proposed direct offsets with other compensatory measures as detailed below.

Carnaby's Cockatoo Research Funding

Main Roads discussed opportunities for providing cockatoo research funding with Dr Peter Mawson Principal Research Scientist with the Department of Environment and Conservation (now Department of Parks and Wildlife). As a result of these discussions Department of Parks and Wildlife (DPaW) submitted a research proposal to Main Roads in August 2010 which addressed a number of research priorities for Carnaby's Cockatoo.

The "Research Proposal to Support the Conservation of Carnaby's Cockatoo (*Calyptorhynchus latirostris*) on the Swan Coastal Plain" included the following priorities:

- research into critical foraging and breeding habitat
- a covenanting program for foraging and breeding habitat on private land
- assistance with purchase of land on or near to the Swan Coastal Plain

- funding for the revegetation of pine plantations with native species following pine harvesting

Main Roads has provided funding of $300 000 to DPaW to assist in funding this research.

The provision of the research funding is in line with EPBC Act approval Condition 4.

Western Ringtail Possum

Main Roads has provided funding of $700 000 as a contribution to the University of Western Australia (UWA) for the monitoring of possum rope bridge overpass usage in Busselton, and to monitor the efficacy and usage of the possum rope bridge overpass built as part of the Project.

Table 5 Summary of Residual Impacts and Offsets

Item	Environmental Impact	Residual Impact	Total Offset Area			Total Land Offset	Research Funding
			Lot 111 Moore Road	Part Lot 301 Boyanup Picton Road	Ferguson River Lot 520		
1	WRP habitat	10.0	26.7 ha of remnant vegetation and 13.2 ha of revegetation	14.8 ha of remnant vegetation		41.5 ha vegetated land 13.2 ha of revegetation	$700 000
2	Black Cockatoo habitat	10.5	26.7 ha of remnant vegetation and 13.2 ha of revegetation	14.8 ha of remnant vegetation	4.0 ha remnant vegetation	45.5 ha vegetated land 13.2 ha of revegetation	$250 000
3	Moore Rd Wetland (EPP and ESA)	No direct impact	1.8 ha EPP			1.8 ha EPP wetland	
4	Preston River (CCW and ESA)	1.0 ha				N/A	
5	Ferguson River	0.2 ha			4.0 ha remnant vegetation	4.0 ha vegetated land	
6	Guildford Complex	0.7 ha		9.3 ha		9.3 ha	
7	Southern River Complex	6.7 ha	27.9 ha	5.4 ha		37.3 ha	
8	Swan Complex	1.3 ha			4.0 ha remnant vegetation	4.0 ha	
9	Other environmental outcomes		Secure 42.6 ha of land recommended for conservation by the EPA	Secure 16.1 ha of land recommended for conservation by the EPA	Secure 4.0 ha of land recommended for conservation by the EPA	Secure 62.7 ha of land recommended for conservation by the EPA	

8. Suitability of Environmental Offset

Commonwealth Offset Requirements

The following table summarises the proposed offset to address Project impacts on Western Ringtail Possum, Carnaby's Cockatoo and Baudin's Cockatoo. These offset measures are considered against the EPBC Act approval Conditions and the DotE advice.

Table 6 Conformance with Protected Species Offset, Mitigation and Enhancement Measures

Item	Offset / Mitigation Measure	Main Roads proposed Offset / Action
DotE Advice and Approval Conditions		
1	Provide a 1:1 offset for Western Ringtail Possum habitat. EPBC Act approval Conditions 3, 5 and 6	1. Purchase and securing 41.5 ha of existing WRP habitat (offsets clearing of 41.5 ha of WRP habitat) 2. Installation of the possum rope overpass and research funding to monitor its use 3. Provision of $700 000 research funding **The proposed offset meets DotE advice and EPBC Act approval Conditions 3, 5 and 6.**
2	Provide an offset for Carnaby's and Baudin's Cockatoo comprising: ◗ 4 to 1 for establishing new habitat and ◗ 6 ha to 1 ha for existing habitat. EPBC Act approval Conditions 4, 5 and 6.	1. Purchase of land providing 45.5 ha of habitat (offsets the clearing of 7.6 ha of habitat) 2. Create by revegetation 13.2 ha of habitat (offsets the clearing of 3.3 ha of habitat) 3. Provision of $300 000 research funding **The proposed offset meets DotE advice and EPBC Act approval Conditions 4, 5 and 6.**
Significant Impact guidelines for the vulnerable western ringtail possum (*Pseudocheirus occidentalis*) in the southern Swan Coastal Plain, Western Australia (Australian Government 2009).		
3	Retain and improve remnant habitat patches including corridors	1. Purchase 41.5 ha of land for inclusion into the conservation estate. 2. Provide 13.2 ha of revegetation including plant species suitable for Western Ringtail Possum.
4	Retain Peppermint trees	Clearing for road construction was minimised.
5	Use landscape plantings as a means of creating or connectivity	*Agonis flexuosa* (Peppermint) is being utilised in the revegetation planting mix.

Main Roads believes that the proposed offset complies with the advice, management measures and enhancements requested by DotE through the combination of direct and contributing offsets.

State Offset Requirements

Compliance with the offset principles detailed in CPS 818 and variances with the Ten Clearing Principles is demonstrated in the following Table.

Table 7 Compliance with Environmental Protection Bulletin No. 1 (EPA, 2008)

	Clearing Principle	Main Roads Offset Compliance
a	Direct offsets should directly counterbalance the loss of native vegetation	The direct offsets counterbalance the loss of native vegetation.
b	Contributing offsets should complement and enhance the direct offset	The contributing offsets (possum rope overpass and $700 000 research funding) address fauna species considered as part of direct offset
c	Offsets are implemented only once all avenues to avoid, minimise, rectify or reduce environmental impacts have been exhausted	All opportunities to avoid, minimise, rectify and reduce impacts have been realised
d	The environmental values, habitat, species, ecological community, physical area, ecosystem, landscape, and hydrology of the offset should be the same as, or better than, that of the area of native vegetation being offset	The proposed offsets will result in a net environmental benefit and assist in the development of the proposed regional park.
e	A ratio greater than 1:1 should be applied to the size of the area of native vegetation that is offset to compensate for the risk that the offset may fail	Overall the proposed offsets have a ratio greater than 1:1 for residual impacts as shown at Table 5.
f	Offsets must entail a robust and consistent assessment process	The assessment of environmental impacts and offset values has been conducted consistently by qualified and experienced environmental practitioners. The proposed offsets are congruent with EPA recommendations for the Preston Industrial Park (2008b).
g	In determining an appropriate offset, consideration should be given to ecosystem function, rarity and type of ecological community, vegetation condition, habitat quality and area of native vegetation cleared	The proposed offset areas are either adjacent to of in close proximity to the impact area. The offsets address the Project clearing impact, regionally significant vegetation complexes, wetlands and protected fauna species. The proposed offsets are consistent with the recommendations of the EPA (2008b) and the Preston River to Ocean Regional Park.
h	The offset should either result in no net loss of native vegetation, or lead to a net gain in native vegetation and improve the condition of the natural environment	The offsets will lead to a net gain in overall vegetation and wetlands secured within the conservation estate. Habitat values of the land purchases and

	Clearing Principle	Main Roads Offset Compliance
		revegetation works, plus proposed research funding will provide an net benefit and enhancement of knowledge about Western Ringtail Possum, Carnaby's and Baudin's Cockatoo.
i	Offsets must satisfy all statutory requirements	The proposed offset complies with the statutory requirements of CPS 818 and Condition 5 of Ministerial Approval 0697.
j	Offsets must be clearly defined, documented and audited	The proposed offset is clearly defined and provides the opportunity for monitoring and auditing.
k	Offsets must ensure a long-term (10-30 year) benefit	The offsets will ensure a long term benefit to conservation significant fauna species, wetlands and proposed regional park.
l	An environmental specialist must be involved in the design, assessment and monitoring of offsets	The revegetation works will be conducted by an experienced landscape practitioner. Site vegetation monitoring will be conducted by an appropriately experienced ecologist to determine compliance with the completion criteria

Main Roads believes that the proposed environmental offsets for the project are congruent and compliant with the relevant offset principles and CPS 818/5.

9. Implementation Plan

The proposed offsets have been the subject of on-going discussions with officers from the DPaW Bunbury office as part of consideration of a greater offset project by Main Roads.

The following section details how Main Roads has implemented the EOP.

Purchase of Offset Properties

Main Roads has purchased the offset land required to provide the offset land detailed in this EOP, namely

- Lot 111 Moore Road (purchased)
- Lot 520 severed portion for Ferguson River foreshore (purchased)
- Part Lot 301 Boyanup Picton Road (contract of sale signed with landowner)

Security of Offset Tenure

The land and vegetation included in the EOP will be protected for long term conservation purposes in the following manner.

Ownership

Privately owned freehold land has been purchased by Main Roads in the name of the Commissioner of Main Roads. The land will subsequently be transferred to the State of WA (Department of Regional

Development and Lands), who will arrange for those areas to be reserved as a Crown reserve with, a management order issued to a responsible agency, which is expected to be DPaW.

The ongoing tenure of the land will be as defined in the Preston River to Ocean Regional Parks Implementation Plan Proposal (WA Planning Commission, 2011).

Zoning

It is proposed that Regional Open Space Reservations will be placed over the identified land under the provisions of the Greater Bunbury Region Scheme. Rezoning proposals will require the approval of local government and the Western Australian Planning Commission, and will provide statutory protection over the conservation values of the land.

Management

Main Roads will manage the land until such time that revegetation completion criteria have been achieved and the land ownership has been transferred to the State of WA. The management of the land will then be undertaken by the designated agency and immediately managed as if it were already a conservation reserve.

Main Roads is in the process of finalising a Management Plan for the on-going management of the offset properties. The Preston South Conservation Area Management Plan has been prepared in consultation with DPaW Bunbury.

Preston River to Ocean Regional Park

The WA Planning Commission (2011) notes, that the proposal to develop a regional park system for Greater Bunbury has been a vision for many years. The proposed Preston River to Ocean Regional Park (PRORP) will create a 893 ha regional park providing a continuous reserve on the southern flank of the City of Bunbury extending west from the Preston River to Manea Park, College Grove, the Shearwater Tuart Forest through The Maidens bushland on the coast.

The PRORP land is to be reserved as regional open space in the Greater Bunbury Region Scheme (GBRS), and may be expanded to include additional adjacent land in the future through amendments to the scheme.

In respect to Lot 520, part Lot 301 and Lot 111 in the longer term, the land is to be included into the PRORP. Inclusion into a Regional Park managed by DPaW will provide a conservation management framework for the land and other adjoining conservation areas to provide broad direction for the protection and enhancement of the conservation values of the lands included in the Park.

Management of Degraded Offset Land

Main Roads has prepared and implemented an Offset Revegetation Plan to direct the proposed management and rehabilitation measures for the offset sites. The objectives of the revegetation plan are:

- To revegetate the offset sites with local plant species including those that are suitable habitat for Western Ringtail Possum and White-tailed Black Cockatoo
- To form habitat and habitat linkages between existing conserved native vegetation
- To manage access to the offset properties through the installation of fencing

The implemented rehabilitation methodology, species, completion criteria, monitoring and management measures are detailed at Appendix H. Once the completion criteria have been achieved Main Roads will hand over management of Lot 111 to DPaW.

In the interim Main Roads is in the process of finalising a management plan which details management actions to be implemented prior to the offset land being incorporated into the PRORP.

10. Reporting

Main Roads will report on the implementation of the EOP as required under the following approval requirements.

Commonwealth Approval Conditions

Congruent with EPBC Act approval Condition 8 Main Roads will report annually for 10 years from September 7, 2011, within three months of every 12 month anniversary of the commencement of construction on compliance with each of the conditions of the approval, including implementation of management plans, including this EOP.

The compliance report will be published on Main Roads website and documentary evidence providing proof of the date of publication and non-compliance with any Condition of the approval will be provided to DotE at the same time that the compliance report is published.

Department of Environment Regulation

Main Roads will report in writing to DER compliance with this EOP on achievement of the revegetation completion criteria.

1. References

Commonwealth of Australia (1999). *Environmental Protection and Biodiversity Conservation Act 1999*, Canberra.

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Commonwealth of Australia (2009). *Significant Impact guidelines for the vulnerable western ringtail possum (Pseudocheirus occidentalis) in the southern Swan Coastal Plain, Western Australia*. Department of the Environment, Water, Heritage and the Arts. EPBC policy statement 3.10. Canberra, ACT.

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Heddle E M, Loneragan O W & 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.

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Western Australian Planning Commission (2011). *Preston River to Ocean Regional Park, Establishment Plan Proposal Final Report*. Western Australian Planning Commission. Perth, WA.

Figure 1
Locality Plan
Bunbury Port Access Stage 2

DESCRIPTION:
Figure 1
Locality Plan
Bunbury Port Access Stage 2

LEGEND

KEY MAP

AUTHOR: DOMAIN01\c3721
DATE: 29-October-2015
CREATED BY INTEGRATED MAPPING SYSTEM
GEOCENTRIC DATUM OF AUSTRALIA

0 2 4 km

mainroads WESTERN AUSTRALIA

Figure 2a
Bunbury Port Access Stage 2
Clearing Area

DESCRIPTION:
Figure 2a
Bunbury Port Access Stage 2
Clearing Area

LEGEND

PAR Clearing 2014

KEY MAP

AUTHOR: DOMAIN01\c3721
DATE: 29-October-2015
CREATED BY INTEGRATED MAPPING SYSTEM
GEOCENTRIC DATUM OF AUSTRALIA

0 0.4 0.8 km

mainroads WESTERN AUSTRALIA

Figure 2b
Bunbury Port Access Stage 2
Clearing Area

DESCRIPTION:
Figure 2b
Bunbury Port Access Stage 2
Clearing Area

LEGEND

PAR Clearing 2014

KEY MAP

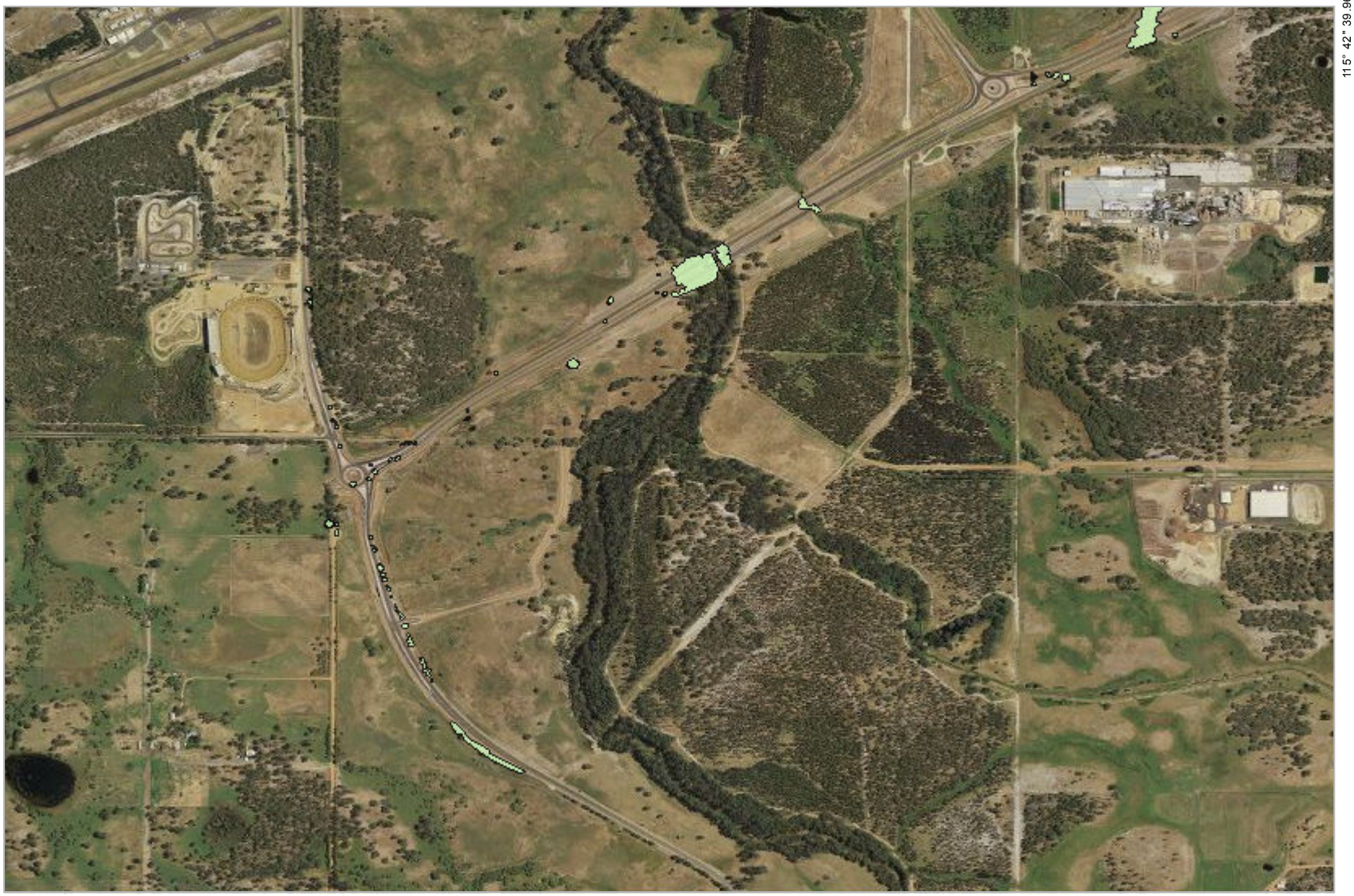
AUTHOR: DOMAIN01\c3721
DATE: 29-October-2015
CREATED BY INTEGRATED MAPPING SYSTEM
GEOCENTRIC DATUM OF AUSTRALIA

0 0.4 0.8 km

mainroads WESTERN AUSTRALIA

Figure 2c
Bunbury Port Access Stage 2
Clearing Area

DESCRIPTION:
Figure 2c
Bunbury Port Access Stage 2
Clearing Area



LEGEND

PAR Clearing 2014

KEY MAP

AUTHOR: DOMAIN01\c3721
DATE: 29-October-2015
CREATED BY INTEGRATED MAPPING SYSTEM
GEOCENTRIC DATUM OF AUSTRALIA

0 0.4 0.8 km

mainroads WESTERN AUSTRALIA

Figure 3
Bunbury Port Access Stage 2
Offset Areas

DESCRIPTION:
Figure 3
Bunbury Port Access Stage 2
Offset Areas

LEGEND

- PAR_ Lot_301_Offset
- PAR_Lot_520_Offset
- PAR_Lot_102_Offset

KEY MAP

AUTHOR: DOMAIN01\c3721
DATE: 29-October-2015
CREATED BY INTEGRATED MAPPING SYSTEM
GEOCENTRIC DATUM OF AUSTRALIA

0 0.8 1.6 km

mainroads WESTERN AUSTRALIA

Figure 2
Bunbury Port Access Stage 2
Lot 111 Offset Site

DESCRIPTION:
Figure 2
Bunbury Port Access Stage 2
Lot 111 Offset Site

LEGEND

- PAR_Lot_102_Offset
- Cadastre

KEY MAP

AUTHOR: DOMAIN01\c3721
DATE: 29-October-2015
CREATED BY INTEGRATED MAPPING SYSTEM
GEOCENTRIC DATUM OF AUSTRALIA

0 0.2 0.4 km

mainroads WESTERN AUSTRALIA

Appendix A

Department of Environment and Conservation Clearing Assessment Letter

Government of **Western Australia**
Department of **Environment and Conservation**

Your ref:
Our ref: 61/26518/110710
Enquiries: CPS 818/5 DEC4894/14
Phone: Jane Clarkson
Fax: 9219 8744
Email: 9219 8701
nvp@dec.wa.gov.au

File 05/2466
Document No. Bin#17193
Resp. Officer PMD Zoetelief

Mr Gerry Zoetelief
Main Roads Western Australia
PO Box 5010
BUNBURY WA 6271

Dear Mr Zoetelief

CPS 818/5 – SUBMISSION – BUNBURY PORT ACCESS STAGE 2 PROJECT

Thank you for your letter dated 18 May 2011, inviting the Department of Environment and Conservation's (DEC) Native Vegetation Conservation Branch to provide comment on Main Roads Western Australia's (MRWA) proposed Bunbury Port Access Stage 2 Project, in the City of Bunbury. I understand that the area of impact will involve the clearing of up to 16.8 hectares of native vegetation.

Submissions are invited in accordance with condition 8 of clearing permit CPS 818/5 for any clearing that 'may be at variance', 'is at variance' or 'is seriously at variance' with the clearing principles contained within Schedule 5 of the EP Act.

The 16.8 hectares of native vegetation proposed to be cleared has been assessed against the clearing principles contained in Schedule 5 of the *Environmental Protection Act 1986* (EP Act), taking into account information you have provided and information the Department of Environment and Conservation (DEC) has obtained through consultation.

In relation to clearing principle (b), you advise that the proposal 'may be at variance', however I consider the principle 'is at variance' as the vegetation under application is considered to be part of an ecological linkage and approximately 14.2 hectares of potential Western Ringtail Possum (*Pseudocheirus occidentalis*) habitat (of which 5.5 hectares is confirmed) and approximately 13.2 hectares of black cockatoo foraging habitat (of which 3.5 hectares is confirmed) will be impacted. The Western Ringtail Possum and Carnaby's black cockatoo are listed as Vulnerable under the *Environment Protection and Biodiversity Conservation Act 1999.*

In relation to clearing principle (e), you advise that the proposal 'may be at variance'. I agree with this level of variance due to the low vegetation complexes (Swan, Guildford and Southern River) remaining (less than 20%) and the location of the proposed clearing being within a highly cleared landscape (approximately 10% remaining native vegetation within a 10km radius).

In relation to clearing principle (f), you advise that the proposal 'may be at variance', however I consider the principle 'is at variance' as vegetation growing in association with watercourses and wetlands, including the Preston River (a Conservation Category Wetland) and an Environmental Protection Policy wetland located south of the corner of Moore Road and the Boyanup Picton Road will be impacted. Furthermore, the majority of the proposed clearing falls within a multiple use wetland.

Considering the above, the proposed clearing is at variance to principles (b) and (f), may be at variance to principle (e) and is not likely to be at variance to the remaining principles.

In accordance with conditions 5(a)(ii) and 9(c) and Part V of clearing permit CPS 818/5, MRWA is required to submit for approval an offset proposal as the clearing 'is at variance' to principles (b) and (f) and 'may be at variance' to principle (e). Please note that an offset proposal must be approved by DEC's Chief Executive Officer (CEO) prior to clearing and prior to implementing the offset.

Please ensure that to the greatest extent possible DEC managed lands are avoided, and where not possible the clearing should be minimised.

Thank you for providing the location of potential sites to undertake revegetation to offset the proposed clearing for the works. Please note that the natural range of species used in rehabilitation must include the areas proposed to be cleared. *Boronia alata* is not endemic to the area and should not be a part of the final revegetation plan.

If you have any queries regarding the matters raised above, please contact A/ Senior Environmental Officer Jane Clarkson at DEC's Native Vegetation Conservation Branch on (08) 9219 8744.

Yours sincerely

Matt Warnock
A/ MANAGER
NATIVE VEGETATION CONSERVATION BRANCH

Officer delegated under Section 20
of the Environmental Protection Act 1986

11 August 2011

cc: *Mr Murray Limb, Manager, Environment Branch, Main Roads Western Australia, PO Box 6202, East Perth 6892*

Appendix B

EPBC Act Approval Instrument (2010/5768)

Australian Government

Department of Sustainability, Environment, Water, Population and Communities

Approval

Bunbury Port Access Project - Stage 2, WA (EPBC 2010/5768)

This decision is made under sections 130(1) and 133 of the *Environment Protection and Biodiversity Conservation Act 1999*.

Proposed action

person to whom the approval is granted	Main Roads Western Australia
proponent's ABN	50 860 676 021
proposed action	To construct new roads linking Stage 1 of the Bunbury Port Access Road to the South Western Highway and the improvement and modification to several existing roads [See EPBC Act referral 2010/5768].

Approval decision

Controlling Provision	Decision
Listed threatened species and communities (sections 18 & 18A)	

conditions of approval

This approval is subject to the conditions specified below.

expiry date of approval

This approval has effect until 31 December 2041.

Decision-maker

name and position	Barbara Jones Assistant Secretary Environment Assessment Branch
signature	
date of decision	7 SEPTEMBER 2011

Conditions attached to the approval

1. Within 30 days after the **commencement** of the action, the person taking the action must advise the **Department** in writing of the actual date of **commencement**.

2. The person taking the action must maintain accurate records substantiating all activities associated with or relevant to the conditions of approval, including measures taken to implement the management plans, and make them available upon request to the **Department**. Such records may be subject to audit by the **Department** or an independent auditor in accordance with section 458 of the EPBC Act, or used to verify compliance with the conditions of approval. Summaries of audits will be posted on the **Department**'s website. The results of audits may also be publicised through the general media.

3. To protect habitat for the Western Ringtail Possum (*Pseudocheirus occidentalis*),Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*), Baudin's Black Cockatoo (*Calyptorhynchus baudinii*) and the Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*), no more than 13.7 ha of *Corymbia calophylla / Agonis flexuosa* woodland and 1.5 ha of *Eucalyptus rudis* woodland may be **cleared** unless approved in writing by the **Minister**.

4. In order to protect Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*), within 6 months of the date of this approval, the person taking the action must provide documentary evidence to the **Department** that $300 000 has been provided to the **DEC** to undertake research on Carnaby's Black Cockatoo on the swan coastal plain. Within 3 months of the date of this approval, the person taking the action must provide the **Department** with a project outline for this research that includes detail on:
   - the purpose of the research;
   - who will undertake the research;
   - a timeline indicating when the components of the research will be undertaken; and
   - how the research findings will be published.

5. The person taking the action must prepare and submit an *Offset Management Plan* (the plan) to the **Department** for the **Minister**'s approval, to mitigate and offset the impacts on **listed threatened species**.

   The person taking the action must not **clear** any **on-site habitat** for **listed threatened species** unless the **Minister** has approved the plan.

   The plan must include:
   - details of the offset properties, how they will be managed and protected in perpetuity; and
   - how revegetation of habitat for **listed threatened species** will be undertaken.

   If the **Minister** approves the plan then the approved plan must be implemented.

6. In order to protect the Western Ringtail Possum (*Pseudocheirus occidentalis*), within 6 months of the date of this approval, the person taking the action must provide documentary evidence to the **Department** that $250 000 has been provided to a **recognised research organisation** for research and monitoring of the efficacy of rope bridges for the Western Ringtail Possum. The person taking the action must publish the results of the research on the internet within 6 months of the completion of the research, and the research must be published on the internet for at least 2 years.

7. In order to protect the Western Ringtail Possum the person taking the action must prepare and submit a *Western Ringtail Possum Management Plan* (the plan) to the **Department** for the **Minister**'s approval, to mitigate and offset the impacts on the Western Ringtail Possum.

   The person taking the action must not **clear** any **on-site habitat** for the Western Ringtail Possum unless the **Minister** has approved the plan.

   The plan must include mitigation measures to reduce the impact of fragmentation and road mortality, and include details of:

- how fauna crossings and rope bridges will be constructed;
- how research and monitoring on the above measures will be undertaken;
- who will undertake the research and monitoring;
- how the results of research will be published; and
- how monitoring results can be used to improve the mitigation measures to increase their efficacy.

If the **Minister** approves the plan then the approved plan must be implemented.

8. For ten years from the date of this approval, within three months of every 12 month anniversary of the **commencement** of the action, the person taking the action must publish a report on their website addressing compliance with each of the conditions of this approval, including implementation of any management plans as specified in the conditions. Documentary evidence providing proof of the date of publication and non-compliance with any of the conditions of this approval must be provided to the **Department** at the same time as the compliance report is published.

9. If the person taking the action wishes to carry out any activity otherwise than in accordance with the management plan(s) as specified in the conditions, the person taking the action must submit to the **Department** for the **Minister**'s written approval a revised version of that management plan. The varied activity shall not commence until the **Minister** has approved the varied management plan in writing. The **Minister** will not approve a varied management plan unless the revised management plan would result in an equivalent or improved environmental outcome over time. If the **Minister** approves the revised management plan, that management plan must be implemented in place of the management plan originally approved.

10. If the **Minister** believes that it is necessary or convenient for the better protection of **listed threatened species** and communities to do so, the **Minister** may request that the person taking the action make specified revisions to the management plan/s specified in the conditions and submit the revised management plan/s for the **Minister**'s written approval. The person taking the action must comply with any such request. The revised approved management plan/s must be implemented. Unless the **Minister** has approved the revised management plan/s, then the person taking the action must continue to implement the management plan/s originally approved, as specified in the conditions.

11. Unless otherwise agreed to in writing by the **Minister**, the person taking the action must publish all management plan(s) referred to in these conditions of approval on their website. Each management plan must be published on the website within 1 month of being approved, and must remain on the website for ten years after they are published.

Definitions

Clear / Clearing: The cutting down, felling, thinning, logging, removing, killing, destroying, poisoning, ringbarking, uprooting or burning of native vegetation.

Commencement: The initiation of any **clearing** or **construction**.

Construction: Includes any preparatory works required to be undertaken including the erection of any onsite temporary structures and the use of heavy duty equipment for the purpose of breaking the ground for buildings or infrastructure.

DEC: the Western Australian Department of Environment and Conservation.

Department: The Australian Government Department administering the *Environment Protection and Biodiversity Conservation Act 1999*.

Listed threatened species: In this case are:

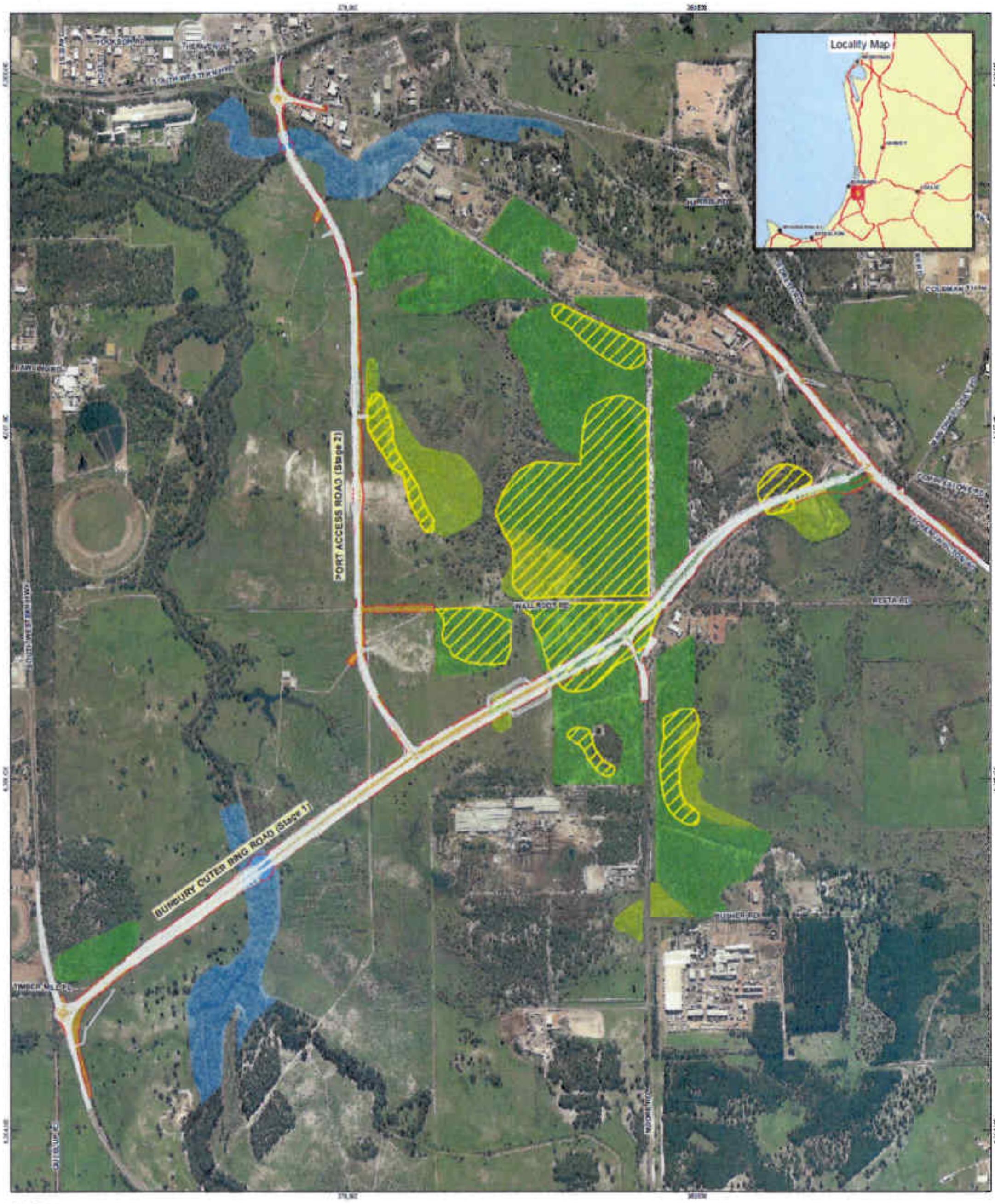
- Western Ringtail Possum (*Pseudocheirus occidentalis*);
- Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*);
- Baudin's Black Cockatoo (*Calyptorhynchus baudinii*); and
- Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*).

Minister: The Minister administering the *Environment Protection and Biodiversity Conservation Act 1999* and includes a delegate of the Minister.

On-site Habitat: For the Western Ringtail Possum is the area marked with yellow striping in Attachment A. For Carnaby's Black Cockatoo, Baudin's Black Cockatoo, and the Forest Red-tailed Black Cockatoo is the area marked in dark green and light blue in Attachment B.

Recognised research organisation: an Australian university (based from a Western Australian campus), or other organisation that conducts scientific ecological research (such as the **DEC**).

Attachment A



LEGEND

Bunbury Port Access Project Stage 2

- 3m Road Extents Buffer
- Known Western Ringtail Possum Habitat

Vegetation Type

- *Corymbia calophylla/ Agonis flexuosa* open woodland
- *Eucalyptus rudis* woodland
- *Melaleuca rhaphiophylla* wetland
- Paddock/Cleared

1:15,000 (at A3)

0 75 150 300 450 600 750

Metres

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

CLIENTS | PEOPLE | PERFORMANCE

Main Roads WA
Bunbury Port Access Project Stage 2

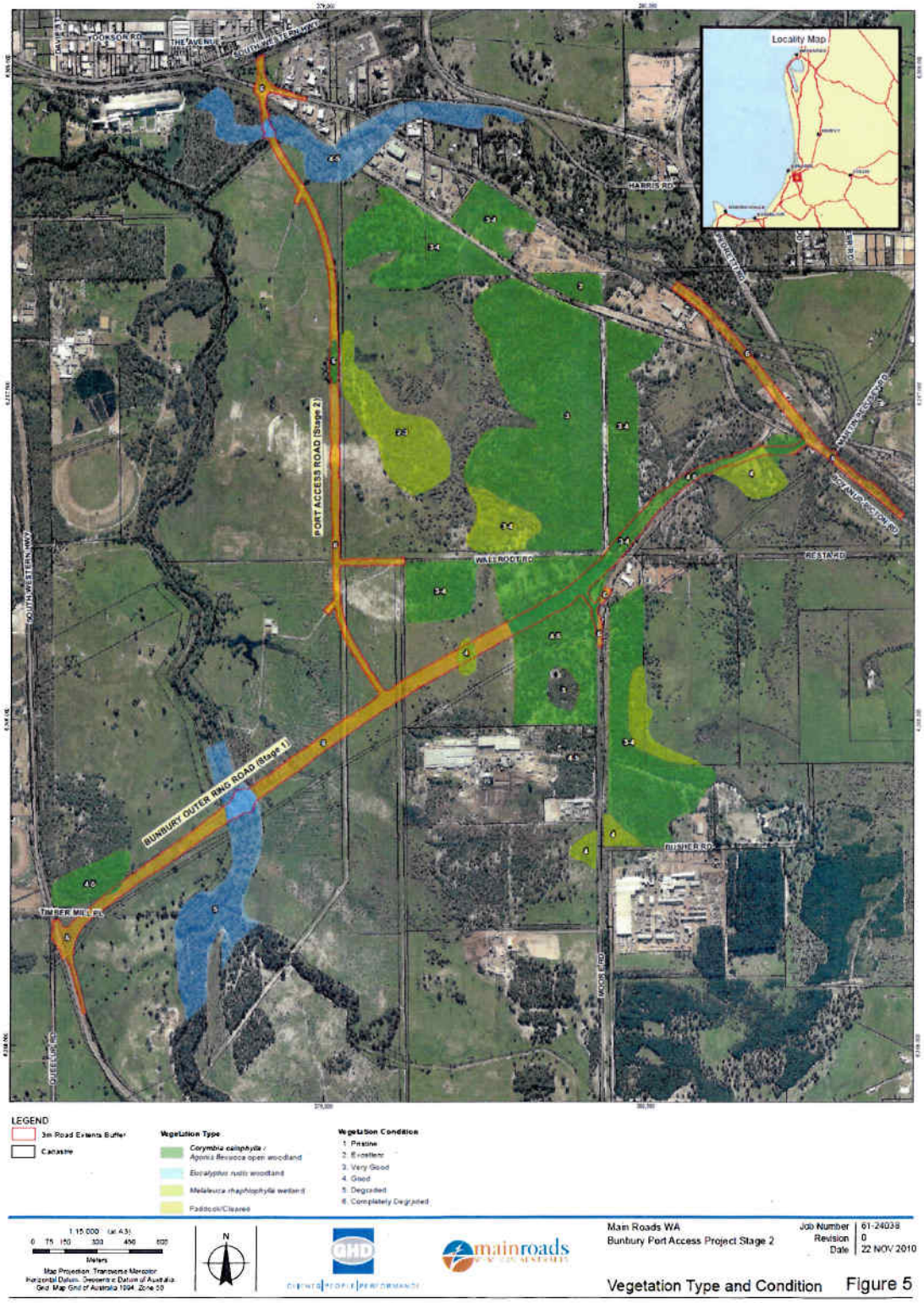
Known Possum
Habitat and Impact

Job Number	61-24038
Revision	0
Date	22 NOV 2010

Figure 7a

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

Attachment B



Appendix C

Ministerial Statement 0697

GOVERNMENT OF WESTERN AUSTRALIA

Statement No.

000697

MINISTER FOR THE ENVIRONMENT; SCIENCE

STATEMENT THAT A SCHEME MAY BE IMPLEMENTED (PURSUANT TO THE PROVISIONS OF DIVISION 3 OF PART IV OF THE ENVIRONMENTAL PROTECTION ACT 1986)

GREATER BUNBURY REGION SCHEME

Scheme Purpose: To guide and regulate the use and development of land and to make provisions for regional infrastructure and regional open space within the Greater Bunbury Region.

Responsible Authority: Western Australian Planning Commission

Responsible Authority Address: 469 Wellington Street, PERTH WA 6000

Assessment Number: 1048

Report of the Environmental Protection Authority: Bulletin 1108

Subject to the following conditions, there is no known environmental reason why the Greater Bunbury Region Scheme to which the above report of the Environmental Protection Authority relates should not be implemented:

1 Additional Land to be Reserved

1-1 All or portions of the following sites shall be reserved for conservation, in accordance with the requirements set out in Attachment 1 of the Minister for the Environment's "Statement that a Scheme may be Implemented" No. 000697 published on (date):

1) Reserve 35061 Paris Road, Australind - Decommissioned Wastewater Treatment Plant
2) Reserve 31012 Harewoods Road, Dalyellup
3) Foreshore adjoining Port Installations Reserve
4) Twin Rivers - Pt Lot 211 Barnes Avenue, Australind
5) College Grove - Lot 1000 Bussell Highway
6) Pt Loc 632 Parade Road, Glen Padden
7) Reserve 670 North Boyanup Road, Davenport
8) Picton Waters – Environmental Protection Policy Lake on portion of Lots 40-44 Jeffery Road, Picton
9) Pt Lot 1 North Boyanup Road, Davenport
10) Lot 317 Harewoods Road, Dalyellup
11) Lot 1, Dalyellup Boulevard, Dalyellup

Published on

31 OCT 2005

29th FLOOR, ALLENDALE SQUARE, 77 ST. GEORGE'S TERRACE, PERTH 6000
TELEPHONE: (08) 9220 5050 FACSIMILE: (08) 9221 4665
E-MAIL: judy-edwards@dpc.wa.gov.au
WEBSITE: www.ministers.wa.gov.au/edwards

2 Realignment of Primary Regional Roads Reserves

2-1 Portions of the following Primary Regional Roads Reserves shall be realigned, in accordance with the requirements set out in Attachment 1 of the Minister for the Environment's "Statement that a Scheme may be Implemented" No. 000697 published on (date):

1) Port Access Road
2) Bunbury Outer Ring Road

CONDITIONS TO BE INCORPORATED INTO THE SCHEME BY INSERTION OF PROVISIONS IN SCHEME TEXT

3 Management Plans

3-1 The following Environmental Management Plans may be required in accordance with the specifications set out in Attachment 1 in the Minister for the Environment's "Statement that a Scheme may be Implemented" No. 000697 published on (insert date), and shall be subsequently implemented in accordance with the provisions of the Management Plans, to the satisfaction of the Western Australian Planning Commission:

1) Environmental Management Plans for schemes, subdivisions and developments which impact on Regional Open Space in the scheme, Crown conservation or nature reserves, a National Park or bushland, waterways, wetlands or other land that may be part of an ecological linkage;
2) Environmental Management Plans for industrial development within the Kemerton Industrial Area and Special Control Area No. 2;
3) Drainage, Nutrient and Water Management Plans in areas where the Average Maximum Groundwater Level is less than 1.2 metres below the natural ground surface or where any proposed off-site drainage could lead to degradation of wetlands or waterways; and
4) Acid Sulfate Soil Management Plans where the presence of acid sulphate soils is confirmed or there is likely to be a significant risk of disturbing acid sulphate soils.

4 Biological Survey

4-1 As part of a scheme amendment or application to subdivide or develop land which has the potential to impact on regionally significant native remnant vegetation or native fauna, the Western Australian Planning Commission or local government, as the case requires, may require a biological survey, including a search for Declared Rare Flora and Fauna, Priority Flora, Threatened Flora Communities and Threatened Fauna, to be undertaken.

The biological survey shall be undertaken to the satisfaction of the Western Australian Planning Commission or local government, as the case requires, having due regard for advice from relevant government agencies, and shall be taken into account when considering the rezoning and subsequent subdivision and development applications.

5 **Provision of Environmental Offsets**

5-1 Prior to construction of the Port Access Road and Bunbury Outer Ring Road, an environmental offset strategy shall be prepared to mitigate unavoidable impacts on wetlands and native vegetation associated with the Port Access Road and Bunbury Outer Ring Road to the satisfaction of the Western Australian Planning Commission on advice of the Environmental Protection Authority. With respect to the Port Access Road, the strategy shall include a foreshore management plan for the Ferguson River in the vicinity of the road. With respect to the Bunbury Outer Ring Road, the strategy shall include rehabilitation of the strip of land adjacent to the road in the vicinity of Lot 15 North Boyanup Road (South Western Highway) and design of the intersection with the Australind Bypass to minimize impacts on environmental values of the area.

Dr Judy Edwards MLA
MINISTER FOR THE ENVIRONMENT; SCIENCE

31 OCT 2005

STATEMENT THAT A SCHEME MAY BE IMPLEMENTED – GREATER BUNBURY REGION SCHEME

SPECIFICATIONS FOR ENVIRONMENTAL MANAGEMENT PLANS, ADDITIONAL LAND TO BE RESERVED AND REALIGNMENT OF PRIMARY REGIONAL ROAD RESERVES

1 Environmental Management Plans for Schemes, Subdivisions and Developments

1-1 Prior to amending local town planning schemes, or finally approving subdivisions or developments (whichever is sooner), the Western Australian Planning Commission or local government, as the case requires, may require an Environmental Management Plan to be prepared and implemented to achieve the objective of managing the potential impacts of the proposed subdivision or development on the following:

1) land which is reserved as Regional Open Space in the Scheme;

2) a Crown conservation or nature reserve;

3) a National Park; or

4) bushland, waterway, wetland or land that may be part of an ecological linkage.

The Environmental Management Plan shall include:

i) a description of existing environmental values, and the identification of the environmental outcome to be achieved through the implementation of the Plan;

ii) clear delineation of boundaries of significant areas to be protected;

iii) fire management;

iv) drainage and nutrient management;

v) management of access and rehabilitation;

vi) vegetation and/or wetland mitigation strategies;

vii) a program for implementation;

viii) allocation of responsibilities and identification of timing and duration of implementation;

ix) provision for routine monitoring of environmental values; and

x) provision of details of contingency plans in the event that the monitoring surveys indicate that the development is having or has had an adverse impact upon environmental values.

1-2 Environmental Management Plans required by condition 1-1 shall be prepared to the satisfaction of the Western Australian Planning Commission or local government, as the case requires, having due regard for advice from relevant government agencies and shall be implemented in accordance with a program defined in the Environmental Management Plan.

2 Environmental Management Plans for Industrial Development within the Kemerton Industrial Area and Special Control Area No. 2

2-1 Prior to approving subdivision or development within the Kemerton Industrial Area and the Special Control Area No. 2, the Western Australian Planning Commission or local government, as the case requires, may require an Environmental Management Plan to be prepared and implemented to achieve the objective of managing the potential impacts of the proposed development.

The Environmental Management Plan shall include:

1) a description of existing environmental values (including vegetation, fauna and wetlands) and the identification of the environmental outcome to be achieved through the implementation of this Plan;
2) management of potential impacts on visual amenity;
3) clear delineation of significant areas to be protected;
4) a program for implementation;
5) allocation of responsibilities and identification of timing and duration of implementation;
6) provision for routine monitoring of environmental values; and
7) provision of details of contingency plans in the event that the monitoring surveys indicate that the subdivision or development is having or has had an adverse impact upon environmental values.

2-2 An Environmental Management Plan required by condition 2-1 shall be prepared to the satisfaction of the Western Australian Planning Commission or local government, as the case requires, having due regard for advice from relevant government agencies and shall be implemented in accordance with a program defined in the Environmental Management Plan.

3 Drainage, Nutrient and Water Management Plans

3-1 Prior to amending local town planning schemes, or finally approving subdivision or developments (including those for intensive horticulture), whichever is sooner, in areas where the Average Maximum Groundwater Level is less than 1.2 metres below the natural ground surface, or where any proposed off-site drainage could lead to degradation of wetlands or waterways, the Western Australian Planning Commission or local government, as the case requires, may require a Drainage, Nutrient and Water Management Plan to be prepared and implemented.

3-2 A Drainage, Nutrient and Water Management Plan, if required, shall ensure that there is no net increase in nitrogen export to the Leschenault Estuary as a result of development within the Greater Bunbury Region.

3-3 The Drainage, Nutrient and Water Management Plan shall be prepared to the satisfaction of the Western Australian Planning Commission or local government, as the case requires, having due regard for advice from relevant government agencies, and shall be implemented in accordance with a program defined in the Drainage, Nutrient and Water Management Plan.

4 Acid Sulfate Soil Management Plans

4-1 Prior to amending local town planning schemes, or finally approving subdivisions or development, the Western Australian Planning Commission or local government, as the case requires, may require a Preliminary Acid Sulfate Soils Assessment to be prepared where there is likely to be a significant risk of disturbing acid sulfate soils.

4-2 Where the presence of acid sulfate soils is confirmed, an Acid Sulphate Soil Management Plan shall be prepared to the satisfaction of the Western Australian Planning Commission or local government, as the case requires, having due regard for advice from relevant government agencies and implemented in accordance with a program defined in the Acid Sulphate Soil Management Plan.

5 Additional Land to be Reserved

5-1 Reserve 35061 Paris Road, Australind - Decommissioned Wastewater Treatment Plant

Land shall be reserved for conservation purposes to protect the integrity, function and environmental value of the bushland on the northern and western portions of Reserve 35061 Paris Road, Australind, to the requirements of the Western Australian Planning Commission on advice of the Environmental Protection Authority, and shall only be used for conservation and complementary purposes.

5-2 Reserve 31012 Harewoods Road, Dalyellup

Land shall be reserved for conservation purposes to protect the integrity, function and environmental value of the bushland on the northern portion of Reserve 31012 Harewoods Road, Dalyellup to the requirements of the Western Australian Planning Commission on advice of the Environmental Protection Authority and shall only be used for conservation, landscape and recreational purposes.

5-3 Foreshore adjoining Port Installations Reserve

Land shall be reserved for conservation purposes to protect the integrity, function and environmental value of the foreshore adjacent to the Port Installations Reserve to the requirements of the Western Australian Planning Commission on advice of the

Environmental Protection Authority and shall only be used for conservation and complementary purposes.

5-4 **Twin Rivers - Pt Lot 211 Barnes Avenue, Australind**

A portion of Pt Lot 211 Barnes Avenue as detailed in the Minister for the Environment's determination of appeals relating to the Environmental Protection Authority's report and recommendations on the Scheme, dated 30 November 2004, shall be reserved for conservation purposes to protect the integrity, function and environmental values of the land to the requirements of the Western Australian Planning Commission on advice of the Environmental Protection Authority, and shall only be used for conservation and complementary purposes.

5-5 **Picton Waters – Environmental Protection Policy Lake on Portion of Lots 40-44 Jeffery Road, Picton**

Land shall be reserved for conservation purposes to protect the integrity, function and environmental value of the wetland on Lots 40-44 Jeffery Road, Picton, to the requirements of the Western Australian Planning Commission on advice of the Environmental Protection Authority, and shall only be used for conservation and complementary purposes. The land requirements shall include an appropriate buffer to protect the core wetland.

5-6 **College Grove – Lot 1000 Bussell Highway**

A portion of Lot 1000, Bussell Highway, as detailed in the Minister for the Environment's determination of appeals relating to the Environmental Protection Authority's report and recommendations on the Scheme, dated 30 November 2004, shall be reserved for conservation purposes to protect the integrity, function and environmental values of the land to the requirements of the Western Australian Planning Commission on advice of the Environmental Protection Authority, and shall only be used for conservation and complementary purposes.

5-7 **Pt Loc 632 Parade Road, Glen Padden**

Land shall be reserved for conservation purposes to protect the integrity, function and environmental value of the bushland on Pt Loc 632 Parade Road, Glen Padden, to the requirements of the Western Australian Planning Commission on advice of the Environmental Protection Authority, and shall only be used for conservation and complementary purposes.

5-8 **Reserve 670 North Boyanup Road, Davenport**

Land shall be reserved for conservation purposes to protect the integrity, function and environmental value of the bushland on Reserve 670 North Boyanup Road, Davenport to the requirements of the Western Australian Planning Commission on advice of the Environmental Protection Authority, and shall only be used for conservation and complementary purposes.

5-9 **Pt Lot 1 North Boyanup Road, Davenport**

Land shall be reserved for conservation purposes to provide an appropriate buffer to the Preston River on Pt Lot 1, North Boyanup Road, Davenport to the requirements of the Western Australian Planning Commission on advice of the Environmental Protection Authority, and shall only be used for conservation and complementary purposes.

5-10 **Lot 317 Harewoods Road, Dalyellup**

Lot 317 Harewoods Road, Dalyellup shall be reserved for conservation purposes to protect the integrity, function and environmental value of the bushland on the land to the requirements of the Western Australian Planning Commission on advice of the Environmental Protection Authority, and shall only be used for conservation and complementary purposes.

5-11 **Lot 1 Dalyellup Boulevard, Dalyellup**

Lot 1 Dalyellup Boulevard, Dalyellup shall be reserved for conservation purposes to protect the integrity, function and environmental values of the land to the requirements of the Western Australian Planning Commission on advice of the Environmental Protection Authority and shall only be used for conservation and complementary purposes.

6 Realignment of Primary Regional Roads Reserves

6-1 Port Access Road

The Port Access Road Primary Regional Roads Reserve shall be realigned in accordance with the Minister for the Environment's determination of appeals relating to the Environmental Protection Authority's report and recommendations on the Scheme, dated 30 November 2004.

6-2 Bunbury Outer Ring Road

The Bunbury Outer Ring Road Primary Regional Roads Reserve shall be realigned in accordance with the Minister for the Environment's determination of appeals relating to the Environmental Protection Authority's report and recommendations on the Scheme, dated 30 November 2004.

Appendix D

DSEWPaC Advice re Environmental Offsets

MCCARTHY Neil (PEM)

From: Neil.McCarthy@ghd.com
Sent: Tuesday, 6 July 2010 1:42 PM
To: ZOETELIEF Gerry (DSWO/A); ZOETELIEF Gerry (DSWO/A); PALANDRI Lou (PM)
Subject: DEWHA Advice re Impacts on Cockatoos

Hi Gerry and Lou

As discussed separately with each of you, please find below advice in two separate e-mails received from DEWHA re impacts of project clearing on the protected black cockatoo species.

This is provided for your information and discussion as required.

Cheers

Neil

----- Forwarded by Danika L Taylor/Perth/GHD/AU on 24/05/2010 09:39 AM -----

From: **"Smith, Kate" <Kate.Smith@environment.gov.au>** on **01/03/2010 09:21:42 AM**

Repository: 612148011 Boral Gidgegannup Scoping Document

To: Danika.Taylor@ghd.com.au
cc: "Wilkinson, Lachlan" <Lachlan.Wilkinson@environment.gov.au>
Subject: Gigdegannup Quarry Project [SEC=UNCLASSIFIED]

Hi Danika

Please see below information that our 'WA Section' sends out to proponents regarding potential impacts on Black Cockatoos. I will be providing comments separately for the draft PER. Just as a heads, DEWHA would be looking for offset ratios of 4:1 or greater for projects that particularly impact the Black Cockatoos in their breeding areas.

FYI…

To assist you in providing the department with adequate referral information, below is some guidance on frequently asked questions about referrals and examples of mitigation strategies that have been used by proposals, impacting on Black Cockatoo habitat, that have been approved under the EPBC Act.

When should I talk to the department about projects affecting Black Cockatoo habitat?

Below is some general guidance on the significant impact thresholds and mitigation strategies that have been used by proposals impacting on Black Cockatoo habitat, that have been approved under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The EPBC Act protects matters of National Environmental Significance (NES), which are threatened species and ecological communities, listed migratory species, national and world heritage sites, the Commonwealth marine environment, the Great Barrier Reef Marine Park and Ramsar listed wetlands of international importance. Any action that is likely to have a significant impact on a matter of NES needs to be referred to the Department.

We encourage proponents to consult with us prior to a formal referral under the EPBC Act. This allows the Department to provide guidance on preparing a referral that fully explains the likely impacts on matters of NES and how these will be mitigated. The level of impact on matters of NES determines if further assessment is required, and informs the package of mitigation and offset measures that may be required. Pre-referral discussions aim to assist project proponents to be flexible in project design and reduce their level of impact, thereby shortening assessment timeframes, and reducing the need for mitigation and offset measures.

The following is a list of significant impact thresholds that would be applicable across the range of the Carnaby's black cockatoo, the Baudin's black cockatoo and the Forest Red-tailed black cockatoo in Western Australia.

Significant impact thresholds

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

- Any clearing of breeding habitat in woodland stands of 0.5 ha or more that contains 3 or more breeding trees of suitable size (i.e. a DBH greater than 500 mm);
- Any clearing of known breeding trees of suitable size (i.e. a DBH greater than 500 mm);
- Clearing of more than 1 ha of foraging habitat;
- Creation of a new gap of more than 4 kilometers between patches of black cockatoo habitat;
- Clearing of a known roosting site (including individual trees used for roosting);
- Shooting of birds or taking of eggs or chicks from the wild;
- Introduction of invasive species such as honey bees that creates competition for hollows;
- Spreading of known plant diseases such as Phytophthora; or
- Altering hydrology or fire regimes so that black cockatoo habitat of more than 1 ha would become degraded or destroyed.

What outcomes is the department looking for?

Each project is assessed on a case by case basis. However, the Minister expects projects that involve black cockatoo habitat to achieve similar standards to previous approved projects. As a guide, the following are some ratios which are indicative of the outcomes recent projects affecting black cockatoo habitat have achieved through a combination of mitigation strategies.

4:1 or higher has been achieved for the creation of foraging habitat - ie for every hectare of cleared habitat, 4ha were created through new plantings of foraging species. The department seeks to create new foraging

habitat because we understand that there is not enough foraging habitat to support current black cockatoo populations

6:1 or higher has been achieved for protection of foraging habitat – protecting existing habitat that is under threat can also assist black cockatoos, but this needs to be a higher ratio than creating new habitat because this measure does not add new habitat to existing resources.

6:1 or higher has also been achieved for the protection of breeding habitat – the department prefers protecting existing breeding habitat because of the time it takes for new breeding habitat (seedlings) to become viable (more than 230 years). Given this length of time, the ratio for creating new breeding habitat needs to be higher (above 10:1).

Examples of recent projects that have met the minimum expected outcomes include the Peet and Satterley's residential developments at Alkimos. As each project is unique, I am happy to work with you to develop a suitable suite of onsite, near site and offset options to present to the Minister.

Regards

Kate Smith | **Assessment Officer**
Department of the Environment, Water, Heritage and the Arts | GPO Box 787 CANBERRA, ACT 2601
02 6274 1393 (p) | 02 6274 1789 (f) | kate.smith@environment.gov.au

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SEPARATE E-MAIL RESPONSE FROM DEWHA

Jeremy Bower/Perth/GHD/AU

26/11/2009 08:46 AM

To: Bryce D Skarratt/Perth/GHD/AU@GHD, Raymond Steedman/Perth/GHD/AU@GHD

cc: Danika L Taylor/Perth/GHD/AU@GHD, Lisa Last/Perth/GHD/AU@GHD, Bonnie C Galbraith/Perth/GHD/AU@GHD, Casey Skalski/Perth/GHD/AU@GHD, Andre Kemp/Perth/GHD/AU@GHD, Fionnuala M Hannon/Bunbury/GHD/AU@GHD, Neil McCarthy/Bunbury/GHD/AU@GHD, Anna Napier/Perth/GHD/AU@GHD, Glen Gaikhorst/Perth/GHD/AU@GHD, Erin D'raine/Perth/GHD/AU@GHD, Andrew Nagle/Geraldton/GHD/AU@GHD, David Horn/Perth/GHD/AU

Subject: Fw: Reference for hollow bearing trees [SEC=UNCLASSIFIED]

Repository: 610103010 "Perth Environmental Office Marketing"

I asked the question on science behind DEWHA position on Black Cockie breeding habitat, see response below, be warned.

Regards

Jeremy Bower
Manager - Environment

GHD **Accomplish More Together**
T: 61 8 6222 8751 M: 0438 974 431 V: 618751 | E: jeremy.bower@ghd.com
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Water | Energy & Resources | Environment | Property & Buildings | Transportation

----- Forwarded by Jeremy Bower/Perth/GHD/AU on 26/11/2009 08:41 AM -----

"Lal-Parks, Yogi" <Yogi.Lal-Parks@environment.gov.au>

26/11/2009 07:29 AM

To jeremy.bower@ghd.com

cc "Mitchell, David" <David.Mitchell@dec.wa.gov.au>, "Weavers, Andrew" <Andrew.Weavers@environment.gov.au>, "DeFay, Kara" <Kara.DeFay@environment.gov.au>

Subject Reference for hollow bearing trees [SEC=UNCLASSIFIED]

Hi Jeremy,

David Mitchell from the WA DEC copied me into an email last week which seems to relate to questions on the science behind breeding habitat and guidance the Department provided to Landcorp as well as other proponents and presumably the standards we apply relating to breeding habitat for referrals under the EPBC Act. .

We have utilised the findings of the work by Rose which WA DEC has previously summarised and provided to us to gain an understanding of an appropriate diameter at breast height (dbh) for breeding trees. The Rose study points towards 500mm dbh as being a suitable size for a significant impact threshold that includes a 50 year buffer prior to the tree developing hollows of a suitable size. This was then coupled with the advice from WA DEC on behalf of the Black cockatoo recovery team about the importance of protecting woodland stands for breeding.

The thresholds and related explanation below hopefully addresses any concerns you may have about the need to protect entire woodland patches, build in an appropriate buffer for trees that are near to breeding size (for 'potential' breeding habitat) and not just focus on available hollows. Focusing on only protecting existing hollows and not potential breeding habitat would, over time, result in very detrimental impacts on black cockatoos as once the existing hollows no longer are viable, lack of current protection of potential breeding habitat would mean that there would be decreased availability of breeding trees in the future. Another important point to note is that we are of the view that trees that are known to support breeding should also be protected, even if they do not fit within the definition of breeding habitat of known resources . These projects must also be referred.

Our current significant impact thresholds relating to breeding habitat, which we are communicating to proponents, are:

- Any clearing of breeding habitat in woodland stands of 0.5 ha or more that contains 3 or more breeding trees of greater than 500 mm dbh (this is the definition of 'breeding habitat'); and
- Any clearing of known breeding trees

Our significant impact thresholds then, are based on the best available science and appropriate judgements to fill the gaps that are not covered by available science. We have also discussed the possibility of further research to cover other suitable species of trees to further quantify what an appropriate dbh for inclusion in significant impact thresholds might be.

In terms of outcomes sought, while we do not have a published policy as yet to provide proponents, we provide them with the following ratios as an indication of the outcomes recent projects have achieved through a combination of mitigation strategies. Also, it is worth noting that we tend to look at offsite offsets as just one option in a range of measures taken by proponents to reduce environmental impacts rather than a “quick fix” to compensate clearing.
Some examples include:

- minimising of clearance and retention of key habitat through amendments in project design;
- creation of new habitat on site or in the local area and strengthening of on-site or local degraded habitat; and
- offsets which involves acquisition of existing habitat for conservation into perpetuity.

The ratios that have been achieved to date are:

4:1 or higher has been achieved for the creation of foraging habitat - ie for every hectare of cleared habitat, 4ha were created through new plantings of foraging species.

6:1 has been achieved for protection of foraging habitat – the Department has accepted this because there needs to be an increase in the amount of foraging habitat for the Black Cockatoo species to assist with their persistence and recovery.

6:1 has also been achieved for the protection of breeding habitat – important because of the time it takes for new breeding habitat (seedlings) to become viable. This is the same reason that the ratio for creating new breeding habitat is generally viewed by the Department as needing to be higher (around 10:1).

The Minister expects projects that involve Black Cockatoo habitat to achieve these standards.

I hope this clears up any uncertainties that you may have in relation to the Department's position on breeding habitat. Please feel free to contact me should you wish to discuss further.

Cheers - Yogi

Yogi Lal-Parks

Assistant Director

Western Australia / South Australia Section

Environmental Assessment Branch

ph: (02) 6275 9395

fax: (02) 6274 1620

From: Mitchell, David [mailto:David.Mitchell@dec.wa.gov.au]
Sent: Wednesday, 18 November 2009 1:33 PM
To: 'jeremy.bower@ghd.com'
Cc: Lal-Parks, Yogi
Subject: References for hollow-bearing trees

Jeremy,

apologies for the delay in getting back to you.

I don't believe I have a copy of the guidance that DEWHA are using and therefore cannot make any comment on the discussion within it. I will chase that up separately for my own future reference.

I have attached a couple of references that I have digital copies of, and a list of references below for you to follow

up. This wouldn't be the full extent, but you should be able to find others.

Also members of the Carnaby's black cockatoo Recovery Team had a series of discussions and meetings with DEWHA staff when they were preparing the DEWHA guidance. I would imagine the guidance would be based on published references as well as those discussions and observations of field researchers and workers with Carnaby's black cockatoo.

It is important to ensure that woodlands provide a long term (100+ years) sustainable supply of suitable nest hollows. In achieving this it is necessary to consider the whole stand of trees and the range, density and distribution of tree sizes, not just existing hollows or one cohort of trees. Also need to factor in rates of hollow formation, tree recruitment and senescence and collapse of trees and of hollows.

This is to avoid a scenarios where focus is just on existing nesting hollows and ignores the long term.

It is impossible to predict and select which individual trees will develop hollows suitable for Carnaby's, but with consideration of whole stands there should be some confidence that a number (or proportion) of hollows should be present in the whole stand of trees at a given future time.

I hope this helps a bit,

Cheers

David Mitchell
Regional Leader Nature Conservation
Swan Region
Department of Environment and Conservation

Ph: 9423 2913
Fax: 9423 2901

Appendix E

Extract from Bulletin 1282

Advice on areas of conservation significance in the Preston Industrial Park

Advice of the Environmental Protection Authority to the Minister for the Environment under Section 16(e) of the *Environmental Protection Act 1986*

Environmental Protection Authority
Perth, Western Australia
Bulletin 1282
March 2008

Strategic Advice Timelines

Date	Progress stages
25 Oct 2007	**Request for advice from Minister for the Environment**
25 Mar 2008	**EPA section 16(e) advice released**

Report Released:
25 March 2008
There is no appeal period on s16(e) advice.

ISBN. 0 7307 6882 1
ISSN. 1030 – 0120

Executive Summary

This report provides the Environmental Protection Authority's (EPA's) advice to the Minister for the Environment under section 16(e) of the *Environmental Protection Act 1986* on the areas of conservation significance within the area identified by the Western Australian Planning Commission (WAPC) for the future development of the Preston Industrial Park. The Preston Industrial Park is approximately 2950 hectares (ha) in area, and is situated approximately 4 kilometres (km) east of the Bunbury Central Business District, within the municipalities of the City of Bunbury and the Shire of Dardanup.

The Preston Industrial Park has been identified as an industrial area in strategic planning documents, most recently in *Industry 2030-Greater Bunbury Industrial Land and Port Access Planning* (WAPC 2000) which contains an *Interim Strategy Plan* for the area pending the completion of further technical investigations.

The Department for Planning and Infrastructure (DPI), on behalf of the WAPC is currently undertaking a review of the *Industry 2030* – Preston Industrial Park *Interim Strategy Plan* with a view to developing a Structure Plan for the area to guide and facilitate appropriate land use zoning and development.

A formal request was made by the Minister for the Environment requesting strategic advice from the EPA on the areas of native vegetation to be retained in the Preston Industrial Park Area, and if required, other environmental matters to be addressed in subsequent planning stages.

In preparing its advice the EPA has taken into account the *Preston Industrial Park – Environmental Study* (Connell Wagner and Ecoscape 2007) commissioned by the DPI in addition to, other biological studies in the area, advice of the Department of Environment and Conservation, site visits and investigations.

The Preston Industrial Park Area has been divided in 25 Investigation Areas. Investigation Areas were delineated by considering the draft remnant vegetation mapping from Swan Bioplan and areas defined in Connell Wagner and Ecoscape 2007, to include all natural areas with bushland of 'Good' or better condition on the Keighery condition scale (Government of Western Australia 2000).

In considering the areas of native vegetation to be retained within the Preston Industrial Park, the EPA has applied the *Strategy to Identify Regionally Significant Natural Areas* as outlined in Guidance Statement No.10 (EPA 2006a) and Bulletin 1108 Greater Bunbury Region Scheme (EPA 2003a). This has included the consideration of:

1. Native Vegetation and Flora;
2. Native Fauna;
3. Wetlands and Waterways (Preston and Ferguson Rivers); and
4. Ecological Linkage.

A natural area assessment sheet has been completed for each Investigation Area to assess them against the EPA's criteria for regional significance.

The EPA has used these assessments to formulate strategic recommendations which provide for the protection of priority areas of regional conservation significance. Further to this the EPA has made recommendations for a series of natural areas in the Preston Industrial Park for the purpose of enhancing and restoring ecological linkage.

The recommendations are divided into several categories. The categories acknowledge subsequent planning approvals processes that apply to the future development of the Preston Industrial Park which can provide for conservation and management. The categories are:

Conservation
The EPA recommends that regionally significant natural areas of highest conservation value are retained as Regional Open Space as a future amendment to the Greater Bunbury Region Scheme and appropriately managed for conservation purposes.

Subdivision/Rezoning Protection
The EPA recommends that regionally significant areas of high conservation value that due to their size, shape, location or isolation can be adequately protected and retained as part of any future rezoning, subdivision or development whichever comes first.

Linkage – Enhancement or Restoration
The EPA recommends that the enhancement and restoration areas as identified in strategic locations between the Conservation and Subdivision/Rezoning Protection Areas be restored and/or enhanced to contribute to regionally significant ecological linkage. Opportunities should be explored through future rezoning, subdivision or development , including the implementation of other developments where offsets may be required, or conservation initiatives targeting the restoration and/or enhancement of these areas.

The EPA has also identified environmental matters which will require further consideration during subsequent statutory planning processes (i.e. structure planning, town planning schemes, subdivision and development proposals) so the environment will be adequately protected. These include:

1. Wetland Buffers;
2. Air Quality;
3. Noise;
4. Water Quality and Quantity;
5. Flood Way Mapping;
6. Acid Sulfate Soils;
7. Solid and Liquid Waste Disposal;
8. Risk;
9. The requirement for construction materials; and
10. Development Priority.

The EPA will also use the advice provided in this report when assessing subsequent statutory planning instruments such as town planning schemes and development proposals.

With respect to future development for the PIP, the EPA expects that a development footprint that complies with the advice in this report is not likely to require formal assessment of native vegetation and flora, native fauna, wetlands, waterways or ecological linkage in the foreseeable future. However, the EPA retains the ability under the *Environmental Protection Act 1986* to assess any amendments or proposals that may have a significant impact on the environment.

Finally the EPA commends the WAPC and DPI on its strategic and proactive approach to the consideration of environmental matters in its overall planning for the Preston Industrial Park.

Summary of recommendations

The EPA's recommendations are based on the future land use of the area for industrial land use purposes. The EPA's recommendations are in recognition of the environmental values of the area and it is the EPA's expectation that areas with significant environmental values will be retained as part of future planning for the Preston Industrial Park.

The EPA recommends that:

1. **All remnant vegetation within the Preston Industrial Park is considered to be regionally significant and should be retained.**

2. **The vegetation in its entirety within Recommendation Areas A,B,C, D and E (Figure 6) be reserved as Regional Open Space in a future amendment to the GBRS and appropriately managed.**

3. **That vegetation in its entirety within Recommendation Areas F,G, H, I, J, and K (Figure 6) be retained and protected as part of any future rezoning, subdivision or development, whichever comes first.**

4. **Connectivity be enhanced in Recommendation Areas L, M, N, P and U (Figure 6) and restored in Areas Q, R & S (Figure 6) given the fragmented distribution of the remaining natural areas in the study area and the negative impact this has on long term viability in a changing climate.**

5. **Appropriate buffers for wetlands be determined based on the values of the wetlands and proposed land uses, and protected and appropriately managed as part of any future rezoning, subdivision or development, whichever comes first.**

6. **That the Minister note the Advice Provided in Section 10 on environmental matters that will require further consideration as part of future planning processes.**

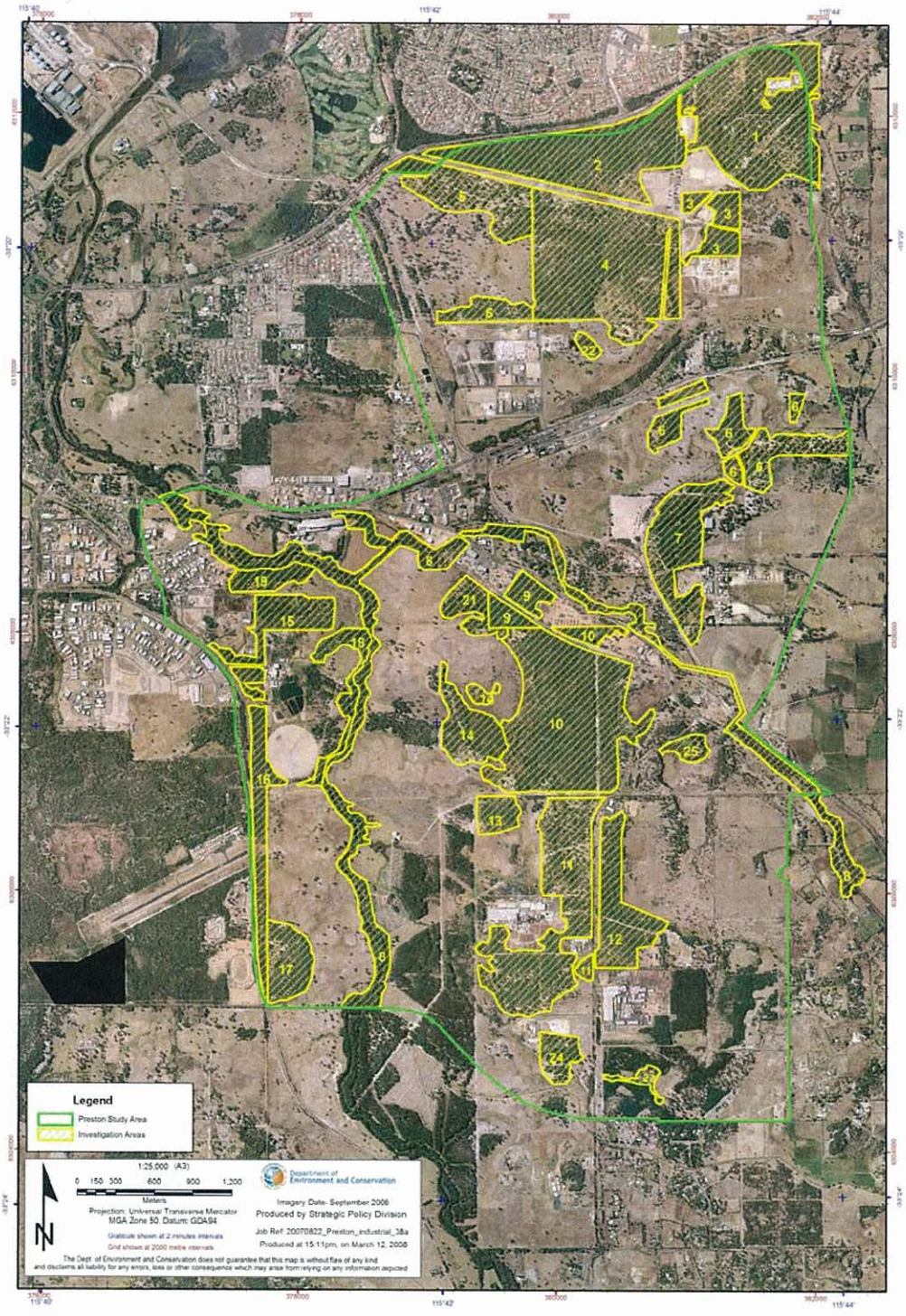

Figure 5. Investigation Areas

8.1 Investigation Areas

As mentioned above the study area has been divided into 25 Investigation Areas (Figure 5). Table 5 below indicates which criteria for regional significance each of the Investigation Areas meet. Please note there is no Investigation Area 20 as this area was determined to be a plantation.

Table 5: Criteria met for regional significance for each Investigation Area

Investigation Area	Representation of communities	Diversity	Rarity	Maintenance of Processes	Scientific or Evolutionary	Wetland Protection	Number of Criteria Met
1	X	X	X	X		X	5
2	X	X	X	X		X	5
3		X	X	X		X	4
4		X	X	X		X	4
5			X				1
6	X		X	X			3
7	X		X	X		X	4
8	X		X	X		X	4
9		X	X	X		X	4
10		X	X	X		X	4
11		X	X	X		X	4
12		X	X	X			3
13			NK*	X			1
14			X	X			2
15			X	X		X	3
16			X	X		X	3
17			X	X		X	3
18			NK*	X		X	2
19			NK*	X		X	2
21			X	X			2
22			NK*				1?
23			X				1
24			X	X			2
25	X	X	X	X		X	5

X = Critera Met

*NK = Not Known, may meet this criteria but not verified because site specific information not available.

Almost all areas meet the criterion for Maintaining Ecological Processes and Natural Systems as they form part of the four regional ecological linkages previously recognised by the EPA within the PIP (EPA 2003a). The EPA (2003a) stated that naturally vegetated areas in the area of the linkages will be priorities for retention and protection, particularly if larger and relatively intact.

In undertaking the studies for the PIP no information was collected in order to apply the criterion for scientific or evolutionary importance. Therefore it should not be inferred that any particular area does not meet this criterion.

8.1.1 Investigation Area 1

Description
Investigation Area 1 is located on Lots 2 on diagram 78828 Picton East, Lot 84 on plan 29208 Picton East and Lot 40 on plan 232800 Taverner Road Picton East at the north west corner of the area known as the Northern Precinct of the PIP (Figure 5). The remnant vegetation covers an area of approximately 88ha. The land is currently zoned Rural and Primary Regional Roads under the GBRS and General Farming under the Shire of Dardanup Town Planning Scheme No. 3.

This area is marginally impacted by the alignment of the Bunbury Outer Ring Road. The position of this road was assessed in the GBRS (Bulletin 1108) and the final alignment subsequently determined by the Minister for the Environment through the appeals process. Ministerial Statement No. 697 provides conditions relating to this road, including the provision of an environmental offset strategy to mitigate unavoidable impacts on wetlands and native vegetation associated with the road.

The EPA's assessment of the GBRS "deferred" the environmental factors of remnant vegetation and wetlands for all rural zoned land under the GBRS to allow for a more detailed assessment at later stages of the planning process.

Assessment
The natural attributes of Investigation Area 1 are described in detail in Sheet 1 (Appendix 6). Investigation Area 1 is considered to be a regionally significant natural area meeting 5 criteria. The natural attributes of Investigation Area 1 that contribute to meeting the criteria are listed below.

- Representation of Ecological Communities;
  - Representative area of natural vegetation in predominately Very Good condition of the Southern River Vegetation complex.

- Diversity;
  - A highly diverse area with respect to diversity of landforms, wetland and upland vegetation units, habitat and fauna.

- Rarity;
  - Location for 4 Priority and 1 poorly reserved Flora.
  - Location for 3 threatened bird species (Baudin's, Carnaby's and Red-tailed Black Cockatoo), 1 threatened mammal species (Western Ringtail Possum), 1

More recently the EPA considered the subdivision of Lot 3 on diagram 50159 (Harris Road), Picton East under Section 38 of the EP Act.

Assessment
The natural attributes of Investigation Area 7 are described in detail in Sheet 7 (Appendix 6). Investigation Area 7 is considered to be a regionally significant natural area meeting 4 criteria. The natural attributes of Investigation Area 7 that contribute to meeting the criteria are listed below.

- Representation of Ecological Communities;
  - Representative area of natural vegetation in Good to Very Good condition of the Guildford vegetation complex.

- Rarity;
  - Location for 3 Priority and 5 poorly reserved Flora
  - Location for 2 threatened bird species (Baudin's and Red-tailed Black Cockatoo), 1 threatened mammal species (Western Ringtail Possum), and at least 3 bird species listed as conservation significant on the Swan Coastal Plain.

- Maintaining Ecological Processes or Natural Systems;
  - Part of a regional ecological linkage: McLarty/Kemerton/Twin Rivers/Preston River/Gwindinnup (north-south ecological linkage).

- General Criteria for the Protection of Wetland, Streamline, and Estuarine Fringing Vegetation and Coastal Vegetation;
  - The area contains 1 EPP Lake and 2 likely Conservation Category wetlands.

The EPA acknowledges that previous decisions made under Section 48A, and subsequently S38, have impacted upon its ability to protect natural areas of regional significance within this Investigation Area. Accordingly the EPA has taken this into consideration in making its recommendations.

Summary
It is the EPA's opinion that:

a) Investigation Area 7 is a regionally significant natural area of high value which should be retained within the future planning for the PIP area.
b) Investigation Area 7 should be retained as Regional Open Space as a future amendment to the GBRS and appropriately managed.

Accordingly Investigation Area 7 is included in Recommendation Area E as shown in Figure 6.

8.1.8 Investigation Area 8

Description
Investigation Area 8 is located on various lots along both the Preston and Ferguson Rivers within the area known as the Southern Precinct of the Preston Industrial Park (Figure 5). The Remnant covers an area of approximately 105ha. The land is currently zoned Regional Open Space under the GBRS and Parks and Recreation

under the City of Bunbury Town Planning Scheme No.7, and Recreation and General Farming under the Shire of Dardanup Town Planning Scheme No. 3.

Assessment
The natural attributes of Investigation Area 8 are described in detail in Sheet 8 (Appendix 6). Investigation Area 8 is considered to be a regionally significant natural area meeting 4 criteria. The natural attributes of Investigation Area 8 that contribute to meeting the criteria are listed below.

- Representation of Ecological Communities;
  - Representative area of natural vegetation in predominately Good to Degraded condition of the Southern River, Swan and Guildford Vegetation Complexes.

- Rarity;
  - Location for 1 Priority and 4 poorly reserved flora.
  - Location for 1 threatened bird species (Baudin's Black Cockatoo), 1 threatened mammal species (Western Ringtail Possum), and at least 4 bird species that are of regional conservation significance.

- Maintaining Ecological Processes or Natural Systems;
  - Part of 3 regional ecological linkages: Ferguson River, Preston River and McLarty/Kemerton/Twin Rivers/Preston River/Gwindinnup (north-south ecological linkage).

- General Criteria for the Protection of Wetland, Streamline, and Estuarine Fringing Vegetation and Coastal Vegetation;
  - The area contains both the Preston and Ferguson Rivers.
  - The area contains Conservation Category wetlands.

Summary
It is the EPA's opinion that:

a) Investigation Area 8 is a regionally significant natural area of high value which should be retained within the future planning for the Preston Industrial Park area.
b) Investigation Area 8 should be retained as Regional Open Space, as a future amendment to the GBRS where not previously reserved, and appropriately managed.

Accordingly Investigation Area 8 is included in Area C as shown in Figure 6.

8.1.9 Investigation Area 9

Description
Investigation Area 9 is located on Lot 5545 on plan 21705, Crown Reserve 40552, South Western Highway, Picton within the area known as the Southern Precinct of the Preston Industrial Park (Figure 5). The Remnant covers an area of approximately 13ha. The land is currently zoned Rural, Primary Regional Roads, Railways and Industrial under the GBRS and Industry, Rural, Primary Distributor Road and Railway under the City of Bunbury Town Planning Scheme No. 7.

8.1.10 Investigation Area 10

Description
Investigation Area 10 is located on Lot 5, on plan 7878, Boyanup-Picton Road Picton East and Lot 520 on plan 301384, Picton East within the area known as the Southern Precinct of the Preston Industrial Park (Figure 5). The Remnant covers an area of approximately 111ha. The land is currently zoned Rural, Industrial, Railways and Primary Regional Roads under the GBRS and General Farming, General Industry and Public Utilities under the Shire of Dardanup Town Planning Scheme No. 3.

This Investigation Area is intersected by the alignment of the Bunbury Outer Ring Road and Port Access Road. The alignment of these roads was assessed in the GBRS (Bulletin 1108) and the alignment subsequently determined by the Minister for the Environment through the appeals process. Ministerial Statement No. 697 provides conditions relating to these roads including the provision of an environmental offset strategy to mitigate unavoidable impacts on wetlands and native vegetation associated with the road.

The EPA's assessment of the GBRS "deferred" the environmental factors of remnant vegetation and wetlands for all rural zoned land under the GBRS, and remnant vegetation, wetland, watercourses, fauna and noise for the Port Access Road and Bunbury Outer Ring Road, to allow for a more detailed assessment at later stages of the planning process.

The EPA is also currently undertaking an Environmental Review of an amendment for the proposed rezoning of the subject land from General Farming to Development Zone under the Shire of Dardanup Town Planning Scheme No. 3.

Assessment
The natural attributes of Investigation Area 10 are described in detail in Sheet 10 (Appendix 6). Investigation Area 10 is considered to be a regionally significant natural area meeting 4 criteria. The natural attributes of Investigation Area 10 that contribute to meeting the criteria are listed below.

- Diversity;
  - A highly diverse area with respect to diversity of landforms, wetland and upland vegetation units, habitat and fauna.

- Rarity;
  - Guildford vegetation complex
  - Location for 1 Priority and 9 poorly reserved Flora
  - Location for 2 threatened bird species (Red-tailed Black and Carnaby's Black Cockatoo), 1 threatened mammal species (Western Ringtail Possum), and at least 11 bird species listed as conservation significant on the Swan Coastal Plain.

- Maintaining Ecological Processes or Natural Systems;
  - Part of a regional ecological linkage: McLarty/Kemerton/Twin Rivers/Preston River/Gwindinnup (north-south ecological linkage).

- General Criteria for the Protection of Wetland, Streamline, and Estuarine Fringing Vegetation and Coastal Vegetation;
  - The area contains a Conservation Category wetland

Summary
It is the EPA's opinion that:

a) Investigation Area 10 is a regionally significant natural area of high value which should be retained within the future planning for the Preston Industrial Park area.
b) Investigation Area 10 should be retained as Regional Open Space as a future amendment to the GBRS and appropriately managed.

Accordingly Investigation Area 10 is included in Area B as shown in Figure 6.

8.1.11 Investigation Area 11

Description
Investigation Area 11 is located on Lots 1, 2 and 3 on diagram 46933, Moore Road Dardanup West within the area known as the Southern Precinct of the Preston Industrial Park (Figure 5). The Remnant covers an area of approximately 75ha. The land is currently zoned Rural, Industrial and Primary Regional Roads under the GBRS and General Farming, General Industry and Important Regional Roads under the Shire of Dardanup Town Planning Scheme No. 3.

This Investigation Area is intersected by the alignment of the Bunbury Outer Ring Road and Port Access Road. The alignment of these roads was assessed in the GBRS (Bulletin 1108) and the alignment subsequently determined by the Minister for the Environment through the appeals process. Ministerial Statement No. 697 provides conditions relating to these roads including the provision of an environmental offset strategy to mitigate unavoidable impacts on wetlands and native vegetation associated with the road.

The EPA's assessment of the GBRS "deferred" the environmental factors of remnant vegetation and wetlands for all rural zoned land under the GBRS, and remnant vegetation, wetland, watercourses, fauna and noise for the Port Access Road and Bunbury Outer Ring Road, to allow for a more detailed assessment at later stages of the planning process.

Assessment
The natural attributes of Investigation Area 11 are described in detail in Sheet 11 (Appendix 6). Investigation Area 11 is considered to be a regionally significant natural area meeting 4 criteria. The natural attributes of Investigation Area 11 that contribute to meeting the criteria are listed below.

- Diversity;
  - A highly diverse area with respect to diversity of landforms, wetland and upland vegetation units, habitat and fauna.

- Rarity;

- Location for 1 Priority and 5 poorly reserved Flora.
- Location for 3 threatened bird species (Baudin's, Carnaby's and Red-tailed Black Cockatoo), 1 threatened mammal species (Western Ringtail Possum), and at least 9 bird species listed as conservation significant on the Swan Coastal Plain.

- Maintaining Ecological Processes or Natural Systems;
  - Part of a regional ecological linkage: McLarty/Kemerton/Twin Rivers/Preston River/Gwindinnup (north-south ecological linkage).

- General Criteria for the Protection of Wetland, Streamline, and Estuarine Fringing Vegetation and Coastal Vegetation;
  - The area contains an EPP Lake.

The EPA acknowledges that a portion of the Investigation Area is currently zoned industrial under the GBRS, consistent with the Town Planning Scheme. The EPA does not consider that the recommendations in this report prevent the continued Industrial land use at this locality.

Summary
It is the EPA's opinion that:

a) Investigation Area 11 is a regionally significant natural area of high value which should be retained within the future planning for the Preston Industrial Park area.
b) Investigation Area 11 should be retained as Regional Open Space as a future amendment to the GBRS and appropriately managed.

Accordingly Investigation Area 11 is included in Area B as shown in Figure 6.

8.1.12 Investigation Area 12

Description

Investigation Area 12 is located on Lots 4 on diagram 46933 Dardanup West, Lot 10 on diagram 82158, Busher Road, Dardanup West and Lot 609 on plan 246174, Resta Rd Dardanup West within the area known as the Southern Precinct of the Preston Industrial Park (Figure 5). The Remnant covers an area of approximately 31ha. The land is currently zoned Industrial under the GBRS and General Farming and General Industry, under the Shire of Dardanup Town Planning Scheme No. 3.

Assessment
The natural attributes of Investigation Area 12 are described in detail in Sheet 12 (Appendix 6). Investigation Area 12 is considered to be a regionally significant natural area meeting 3 criteria. The natural attributes of Investigation Area 12 that contribute to meeting the criteria are listed below.

- Diversity;
  - A highly diverse area with respect to diversity of landforms, wetland and upland vegetation units and habitat.

- Rarity;
  - Location for 1 poorly reserved Flora.
  - Location for 3 threatened bird species (Baudin's, Carnaby's and Red-tailed Black Cockatoo), and at least 3 bird species listed as conservation significant on the Swan Coastal Plain.

- Maintaining Ecological Processes or Natural Systems;
  - Part of a regional ecological linkage: McLarty/Kemerton/Twin Rivers/Preston River/Gwindinnup (north-south ecological linkage)

The EPA acknowledges that this Investigation Area is currently zoned industrial under the GBRS. The EPA's opinion on this area has been reached because the EPA has reassessed the regional natural values of the site using the criteria to identify regionally significant areas and has found that the site has higher values than previously indicated.

Summary
It is the EPA's opinion that:

a) Investigation Area 12 is a regionally significant natural area of high value which should be retained within the future planning for the Preston Industrial Park area.
b) Investigation Area 12 should be retained as Regional Open Space as a future amendment to the GBRS and appropriately managed.

Accordingly Investigation Area 12 is included in Area B as shown in Figure 6.

8.1.13 Investigation Area 13

Description
Investigation Area 13 is located on Lot 1 on diagram 46933 Dardanup West within the area known as the Southern Precinct of the Preston Industrial Park (Figure 5). The Remnant covers an area of approximately 9ha. The land is currently zoned Rural under the GBRS and General Farming under the Shire of Dardanup Town Planning Scheme No. 3.

The EPA's assessment of the GBRS "deferred" the environmental factors of remnant vegetation and wetlands for all rural zoned land under the GBRS to allow for a more detailed assessment at later stages of the planning process.

Assessment
The natural attributes of Investigation Area 13 are described in detail in Sheet 13 (Appendix 6). Investigation Area 13 is considered to be a regionally significant natural area meeting 1 criterion and likely to meet a second. The natural attributes of Investigation Area 13 that contribute to meeting the criteria are listed below.

- Rarity (Not Known, insufficient information);
  - Location for at least 3 bird species listed as conservation significant on the Swan Coastal Plain.
  - Likely habitat for 3 threatened bird species (Baudin's, Carnaby's and Red-tailed Black Cockatoo)

- Maintaining Ecological Processes or Natural Systems;
  - Part of a regional ecological linkage: McLarty/Kemerton/Twin Rivers/Preston River/Gwindinnup (north-south ecological linkage)

Summary
It is the EPA's opinion that:

a) Investigation Area 13 is a regionally significant natural area of high value which should be retained within the future planning for the Preston Industrial Park area.
b) Investigation Area 13 should be retained as Regional Open Space as a future amendment to the GBRS and appropriately managed.

Accordingly Investigation Area 13 is included in Area B as shown in Figure 6.

8.1.14 Investigation Area 14

Description
Investigation Area 14 is located on Lot 5 on plan 7878, Boyanup-Picton Road Picton East within the area known as the Southern Precinct of the Preston Industrial Park (Figure 5). The Remnant covers an area of approximately 23ha. The land is currently zoned Rural under the GBRS, and General Farming under the Shire of Dardanup Town Planning Scheme No. 3.

The EPA is currently undertaking an Environmental Review of an amendment for the proposed rezoning of the subject land from General Farming to Development Zone under the Shire of Dardanup Town Planning Scheme No. 3.

The EPA's assessment of the GBRS "deferred" the environmental factors of remnant vegetation and wetlands for all rural zoned land under the GBRS to allow for a more detailed assessment at later stages of the planning process.

Assessment
The natural attributes of Investigation Area 14 are described in detail in Sheet 14 (Appendix 6). Investigation Area 14 is considered to be a regionally significant natural area meeting 2 criteria. The natural attributes of Investigation Area 14 that contribute to meeting the criteria are listed below.

- Rarity;
  - Location for Declared Rare Flora *Diuris drummondii*
  - Location for 1 threatened mammal species (Western Ringtail Possum), and at least 5 bird species listed as conservation significant on the Swan Coastal Plain.

- Maintaining Ecological Processes or Natural Systems;
  - Part of a regional ecological linkage: McLarty/Kemerton/Twin Rivers/Preston River/Gwindinnup (north-south ecological linkage).

Summary
It is the EPA's opinion that:

a) Investigation Area 15 is a regionally significant natural area of high value which should be retained within the future planning for the Preston Industrial Park area.
b) Investigation Area 15 should be retained as Regional Open Space as a future amendment to the GBRS and appropriately managed.

Accordingly Investigation Area 15 is included in Area D as shown in Figure 6.

8.1.16 Investigation Area 16

Description
Investigation Area 16 is located on Lots 1050 on plan 33291, Crown Reserve 670 South Western Highway Davenport, Lot 549 on plan 213069 South Western Highway, Lot 5 on diagram 50137 South West Highway Davenport and Lots 14 and 15 on plan 64665 South West Highway Davenport within the area known as the Southern Precinct of the Preston Industrial Park (Figure 5). The Remnant covers an area of approximately 28ha. The land is currently zoned Regional Open Space, Public Purpose, Rural, Primary Regional Roads and Industrial under the GBRS and Industry, Special Use 17 and 18, Parks and Recreation, Rural Public Purposes, Primary Distributor Road and Development Zone-Industrial under the City of Bunbury Town Planning Scheme No. 7.

The EPA's assessment of the GBRS considered the zoning of Lot 15 on plan 64665 South Western Highway (North Boyanup Road) Davenport and the reservation of part Lot 5 on diagram 50137 South West Highway (North Boyanup Road) Davenport and Crown Reserve 670 South Western Highway (North Boyanup Road).

In considering Lot 15, the EPA recommended that the vegetation in the southern corner should be protected through the future planning process. The EPA's assessment of the GBRS "deferred" the environmental factors of remnant vegetation and fauna for Lot 15 North Boyanup Road, Davenport under the GBRS to allow for a more detailed assessment at later stages of the planning process

Part Lot 5 and the southern portion of Reserve 670 was reserved in the GBRS, however at this time the EPA considered that there may be some scope for development in the northern portion. Accordingly the EPA's assessment of the GBRS "deferred" the environmental factors of remnant vegetation fauna and ecological linkage for Reserve 670 North Boyanup Road, Davenport under the GBRS to allow for a more detailed assessment at later stages of the planning process.

Assessment
The natural attributes of Investigation Area 16 are described in detail in Sheet 16 (Appendix 6). Investigation Area 16 is considered to be a regionally significant natural area meeting 3 criteria. The natural attributes of Investigation Area 16 that contribute to meeting the criteria are listed below.

- Rarity;
  - Location for 5 poorly reserved Flora.
  - Location for 1 threatened bird species (Baudin's Black Cockatoo), and at least 7 bird species listed as conservation significant on the Swan Coastal Plain.

- Maintaining Ecological Processes or Natural Systems;
  - Part of a regional ecological linkage: Maidens/Preston River (east-west ecological linkage).

- General Criteria for the Protection of Wetland, Streamline, and Estuarine Fringing Vegetation and Coastal Vegetation;
  - The area contains 2 Conservation Category wetlands.

The EPA's opinion on this area has been reached because the EPA has reassessed the regional natural values of the site using the criteria to identify regionally significant areas and has found that the site has higher values than previously indicated. The EPA acknowledges that the Investigation Area is within larger lots that are currently zoned industrial under the GBRS, consistent with the TPS. The EPA considers that adequate protection of the values of this site can be provided through conservation and management as part of future planning proposals. The EPA does considers that land outside of the Investigation Area within these lots can be developed for the intended industrial purpose.

Summary
It is the EPA's opinion that:

a) Investigation Area 16 is a regionally significant natural area of high value which should be retained within the future planning for the Preston Industrial Park area.
b) Investigation Area 16 should be retained as Regional Open Space as a future amendment to the GBRS and appropriately managed.

Accordingly Investigation Area 16 is included in Area D as shown in Figure 6.

8.1.17 Investigation Area 17

Description

Investigation Area 17 is located on Lot 15 on plan 64665 South Western Highway Davenport within the area known as the Southern Precinct of the Preston Industrial Park (Figure 5). The Remnant covers an area of approximately 18ha. The land is currently zoned Primary Regional Roads and Industrial under the GBRS and Primary Distributor Road and Development Zone-Industrial under the City of Bunbury Town Planning Scheme No. 7.

The EPA's assessment of the GBRS considered the zoning of Lot 15 on plan 64665 South Western Highway (North Boyanup Road) Davenport. The EPA recommended that the vegetation consistent with Investigation Area 17 was regionally significant and should be protected through the future planning process.

This area is marginally impacted by the alignment of the Bunbury Outer Ring Road. The alignment of this road was assessed in the GBRS (Bulletin 1108) and the alignment subsequently determined by the Minister for the Environment through the appeals process. Ministerial Statement No. 697 provides conditions relating to this

road including the provision of an environmental offset strategy to mitigate unavoidable impacts on wetlands and native vegetation associated with the road.

The EPA's assessment of the GBRS "deferred" the environmental factors of remnant vegetation and fauna for Lot 15 North Boyanup Road, Davenport and remnant vegetation, wetland, watercourses, fauna and noise for the Port Access Road, to allow for a more detailed assessment at later stages of the planning process.

Assessment
The natural attributes of Investigation Area 17 are described in detail in Sheet 17 (Appendix 6). Investigation Area 17 is considered to be a regionally significant natural area meeting 3 criteria. The natural attributes of Investigation Area 17 that contribute to meeting the criteria are listed below.

- Rarity;
  - Location for 1 poorly reserved Flora.
  - Location for 2 threatened species (Baudin's Black Cockatoo and Western Ringtail Possum), and at least 2 bird species listed as conservation significant on the Swan Coastal Plain.

- Maintaining Ecological Processes or Natural Systems;
  - Part of a regional ecological linkage: Maidens/Preston River (east-west ecological linkage).

- General Criteria for the Protection of Wetland, Streamline, and Estuarine Fringing Vegetation and Coastal Vegetation;
  - The area contains a Conservation Category wetland.

The EPA's opinion on this area has been reached because the EPA has reassessed the regional natural values of the site using the criteria to identify regionally significant areas and has found that the site has higher values than previously indicated. The EPA acknowledges that the Investigation Area is within a larger lot that is currently zoned industrial under the GBRS, consistent with the TPS. The EPA considers that adequate protection of the values of this site can be provided through conservation and management as part of future planning proposals. The EPA considers that land outside of the Investigation Area within these lots can be developed for the intended industrial purpose.

Summary
It is the EPA's opinion that:

a) Investigation Area 17 is a regionally significant natural area of high value which should be retained within the future planning for the Preston Industrial Park area.
b) Investigation Area 17 should be retained as Regional Open Space as a future amendment to the GBRS and appropriately managed.

Accordingly Investigation Area 17 is included in Area D as shown in Figure 6.

- Rarity;
  - Location for 2 threatened bird species (Carnaby's and Red-tailed Black Cockatoo), and at least 1 bird species listed as conservation significant on the Swan Coastal Plain.

- Maintaining Ecological Processes or Natural Systems;
  - Important bird breeding habitat.

- General Criteria for the Protection of Wetland, Streamline, and Estuarine Fringing Vegetation and Coastal Vegetation;
  - The area contains an EPP lake.

Summary
It is the EPA's opinion that:

a) Investigation Area 25 is a regionally significant natural area of high value which should be retained within the future planning for the Preston Industrial Park area.
b) Investigation Area 25 should be retained and protected as part of any future rezoning, subdivision or development, whichever comes first.

Accordingly Investigation Area 25 is included in Area I as shown in Figure 6.

9. Recommendation Areas

Based on these assessments the EPA considers that all Investigation Areas are regionally significant natural areas that should be retained in the future planning for the PIP. This is consistent with the EPA's policy in the GBRS that the general protection of remnant native vegetation on the Swan Coastal Plain should be achieved through the preferential location of developments in cleared areas (EPA 2003a).

The EPA has used these assessments to formulate strategic recommendations for protection of priority areas of regional conservation significance. Further to this the EPA has made recommendations for a series of natural areas in the PIP, for the purpose of enhancing and restoring ecological linkage. This is consistent with the EPA's policy statement in the GBRS that there be proactive planning for the restoration of ecological communities and landscape rehabilitation between and around selected sequences of the small remaining remnants on the eastern side of the Swan Coastal Plain in the Greater Bunbury Region (EPA 2003a).

The EPA's recommendations are discussed below and are divided into several categories. The categories acknowledge subsequent planning approvals processes that apply to the future development of the Preston Industrial Park which can provide for conservation and management. It should be noted that where Investigation Areas are described, the Lot numbers affected are not repeated below. The reader is referred to Section 8 above that details lot numbers which form Investigation Areas.

Conservation Areas
The EPA has identified areas that are considered to be the regionally significant natural areas of highest conservation value and should be retained as Regional Open

Space as a future amendment to the Greater Bunbury Region Scheme and appropriately managed for conservation purposes.

Conservation Areas A, B, C, D and E have been identified in this category (Figure 6).

Subdivision/Rezoning Protection
The EPA has also identified areas that are considered to be regionally significant natural areas of high conservation value which should be retained within the future planning for the Preston Industrial Park. Due to the size, shape, location or isolation of these areas the EPA considers that adequate protection of the values can be provided through conservation and management as part of future planning proposals. These areas should be retained and protected as part of any future rezoning, subdivision or development, whichever comes first.

Subdivision/Rezoning Protection Areas F, G, H, I, J and K have been identified in this category (Figure 6).

Linkage – Enhancement or Restoration
The EPA has identified areas for enhancement or restoration in strategic locations between the Conservation and Subdivision/Rezoning Protection areas that contribute to regionally significant ecological linkage. These are natural areas that were not of a condition suitable to be included in an Investigation Area.

Opportunities should be explored through future rezoning, subdivision or development , including the implementation of other developments where offsets may be required, or conservation initiatives targeting the restoration and/or enhancement of these areas.

Identification of such areas allows for:
- Enhancement where some natural values remain, or
- Restoration where little or no natural values remain.

Linkage Enhancement Areas are identified as L, M, N, P and U (Figure 6).

Linkage Restoration Areas are identified as Q, R & S (Figure 6).

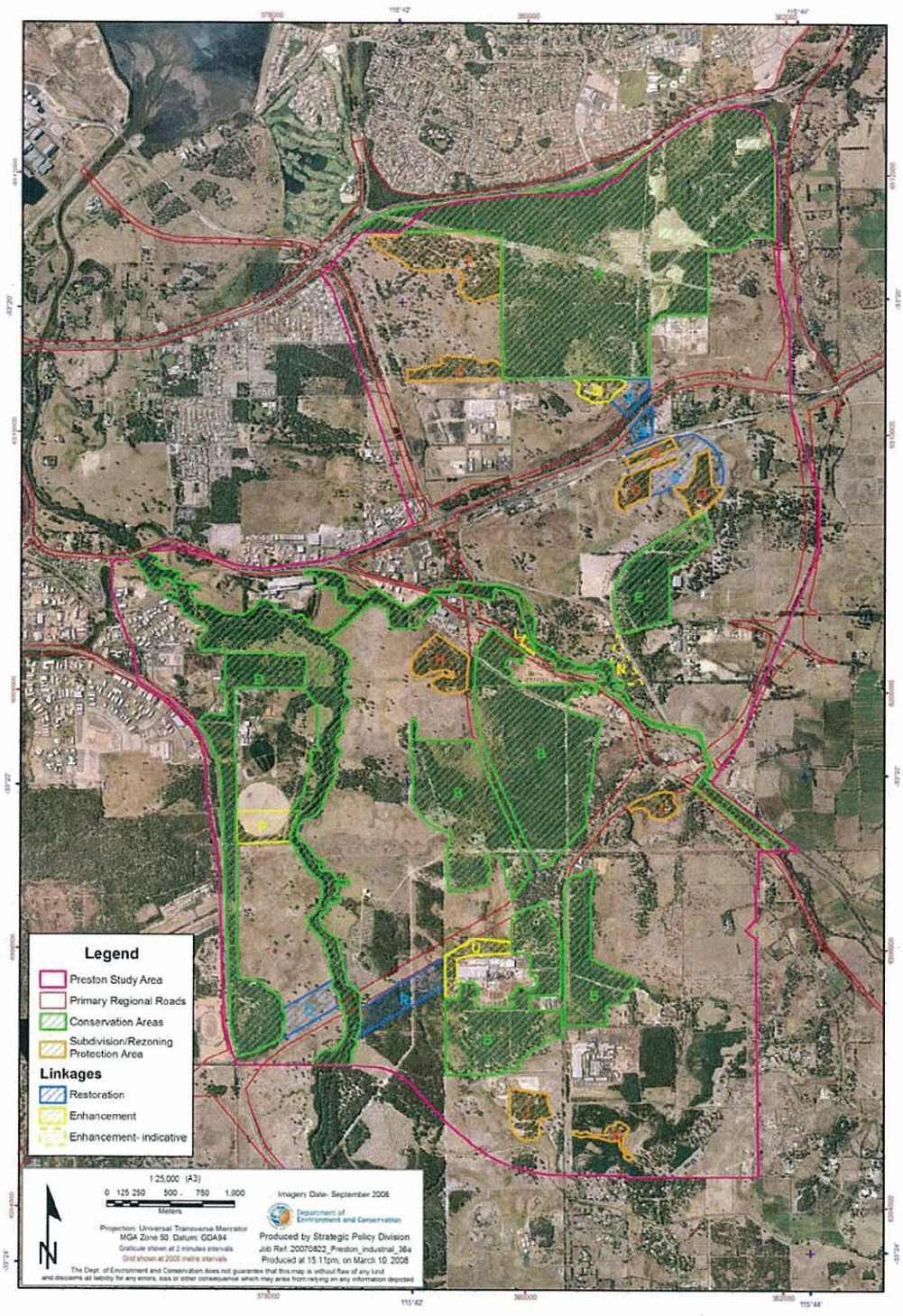

Figure 6. Recommendation Areas

9.1 Conservation Areas

These 5 areas represent the highest conservation values in the PIP, as they each meet at least 4 criteria for regional significance (Table 6). The EPA recommends that these 5 areas be retained as Regional Open Space as a future amendment to the Greater Bunbury Region Scheme and appropriately managed for conservation purposes.

Table 6: Criteria met for regional significance for proposed conservation areas

Conservation Area	Representation of communities	Diversity	Rarity	Maintenance of Processes and Systems	Scientific or Evolutionary	Wetland Protection	Total Criteria met for Regional Significance
A	X	X	X	X		X	5
B		X	X	X		X	4
C	X		X	X		X	4
D		X	X	X		X	4
E	X		X	X		X	4

9.1.1 Recommendation Area A

Recommendation Area A covers an area of approximately 314ha and includes Investigation Areas 1, 2, 3 and 4. The majority of the land is currently zoned Rural with a small part Industrial and Primary Regional Roads under the GBRS, General Farming under the Shire of Dardanup Town Planning Scheme No. 3, and Industry under the City of Bunbury Town Planning Scheme No. 7.

Area A meets the highest number of criteria for regional conservation significance of all the sites, includes areas in best condition, is the largest and most consolidated and is therefore the highest priority conservation area in the PIP.

9.1.2 Recommendation Area B

Recommendation Area B covers an area of approximately 269ha and includes Investigation Areas 9, 10, 11, 12, 13 and 14. The majority of the land is currently zoned Rural with a part zoned Industrial and Railways under the GBRS. At the local scale, it includes land zoned General Farming, General Industry and Public Utilities under the Shire of Dardanup Town Planning Scheme No. 3 and Rural, Industry and Railway under the City of Bunbury Town Planning Scheme No. 7.

Area B meets 4 criteria for regional conservation significance, and includes the second largest population in the state of the threatened flora *Diuris drummondii* (Tall Donkey Orchid) (DEC unpublished data).

9.1.3 Recommendation Area C

Recommendation Area C covers an area of approximately 133ha and includes Investigation Area 8, 18 and 19. The majority of the land is already zoned under the GBRS as Regional Open Space with a portion zoned Industrial and Railways. At the local scale, it includes land zoned Parks and Recreation, Special Use 18 and Railway under the City of Bunbury Town Planning Scheme No. 7 and General Farming and Public Utilities under the Shire of Dardanup Town Planning Scheme No. 3.

Area C meets 4 criteria for regional conservation significance, and is particularly significant for regional ecological linkage, providing linkage from north and west of the PIP through to the Darling and Whicher Scarps. Therefore this area connects major landforms in the Greater Bunbury Region, the coastal and estuarine areas of the portion of the Swan Coastal Plain to the Darling and Blackwood Plateaus.

This recommendation includes areas that are Completely Degraded and do not meet the criteria for regional conservation significance, but because they are within areas of high conservation significance they are not deemed to be suitable for development. Development of these areas is likely to indirectly impact on the significant environmental values that surround them. Such areas are recommended for reservation to Regional Open Space to be used for conservation and complementary purposes.

9.1.4 Recommendation Area D

Recommendation Area D covers an area of approximately 61ha and includes Investigation Areas 15, 16 and 17. The land is zoned Regional Open Space, Rural, Industrial and Public Purpose-Airport under the GBRS and Parks and Recreation, Rural, Development Zone-Industrial, Industry, Public Purposes (Local Government) and Special Use 17 and 18 under the City of Bunbury Town Planning Scheme No. 7.

Area D meets 4 criteria for regional conservation significance, and provides an important part of the Maidens/Preston ecological linkage.

9.1.5 Recommendation Area E

Recommendation Area E covers an area of approximately 32ha and includes the majority of Investigation Area 7. The land is zoned Rural and Industrial under the GBRS and Rural and Restricted Uses (R2 Dry Industry) under the Shire of Dardanup Town Planning Scheme No. 3.

Area E meets 4 criteria for regional conservation significance, and includes the best representation of the Guildford complex in the PIP.

The southern portion of Investigation Area 7 is not included in this recommendation in recognition of previous decisions.

9.1.3 Recommendation Area C

Recommendation Area C covers an area of approximately 133ha and includes Investigation Area 8, 18 and 19. The majority of the land is already zoned under the GBRS as Regional Open Space with a portion zoned Industrial and Railways. At the local scale, it includes land zoned Parks and Recreation, Special Use 18 and Railway under the City of Bunbury Town Planning Scheme No. 7 and General Farming and Public Utilities under the Shire of Dardanup Town Planning Scheme No. 3.

Area C meets 4 criteria for regional conservation significance, and is particularly significant for regional ecological linkage, providing linkage from north and west of the PIP through to the Darling and Whicher Scarps. Therefore this area connects major landforms in the Greater Bunbury Region, the coastal and estuarine areas of the portion of the Swan Coastal Plain to the Darling and Blackwood Plateaus.

This recommendation includes areas that are Completely Degraded and do not meet the criteria for regional conservation significance, but because they are within areas of high conservation significance they are not deemed to be suitable for development. Development of these areas is likely to indirectly impact on the significant environmental values that surround them. Such areas are recommended for reservation to Regional Open Space to be used for conservation and complementary purposes.

9.1.4 Recommendation Area D

Recommendation Area D covers an area of approximately 61ha and includes Investigation Areas 15, 16 and 17. The land is zoned Regional Open Space, Rural, Industrial and Public Purpose-Airport under the GBRS and Parks and Recreation, Rural, Development Zone-Industrial, Industry, Public Purposes (Local Government) and Special Use 17 and 18 under the City of Bunbury Town Planning Scheme No. 7.

Area D meets 4 criteria for regional conservation significance, and provides an important part of the Maidens/Preston ecological linkage.

9.1.5 Recommendation Area E

Recommendation Area E covers an area of approximately 32ha and includes the majority of Investigation Area 7. The land is zoned Rural and Industrial under the GBRS and Rural and Restricted Uses (R2 Dry Industry) under the Shire of Dardanup Town Planning Scheme No. 3.

Area E meets 4 criteria for regional conservation significance, and includes the best representation of the Guildford complex in the PIP.

The southern portion of Investigation Area 7 is not included in this recommendation in recognition of previous decisions.

9.2 Subdivision/Rezoning Protection Areas

These 6 areas include areas of regional conservation significance for which the EPA considers that adequate protection of the values can be provided through conservation and management as part of future planning proposals. These areas should be retained, as they each meet at least 1 criterion for regional significance (Table 7), and protected as part of any future rezoning, subdivision or development, whichever comes first.

Table 7: Criteria met for regional significance for proposed subdivision protection areas

Conservation Area	Representation of communities	Diversity	Rarity	Maintenance of Processes and Systems	Scientific or Evolutionary	Wetland Protection	Total Criteria met for Regional Significance
F			x				1
G	x		x	x			3
H			x	x			2
I	x	x	x	x		x	5
J			x	x			2
K			x				1

9.2.1 Recommendation Area F

Recommendation Area F covers an area of approximately 43ha and includes Investigation Area 5. The land is currently zoned Industrial under the GBRS and Industry under the City of Bunbury Town Planning Scheme No. 7.

Area F is generally in Good to Degraded condition but contains areas of habitat for 2 threatened bird species (Red-tailed Black Cockatoo and Baudin's Black Cockatoo). The regionally significant values of this area can be adequately protected through conservation and management as part of future planning proposals.

9.2.2 Recommendation Area G

Recommendation Area G covers an area of approximately 18ha and includes Investigation Area 6. The land is currently zoned Industrial under the GBRS and Restricted Uses (R2 Dry Industry) under the Shire of Dardanup Town Planning Scheme No. 3.

Area G meets 3 criteria for regional conservation significance. Area G contains vegetation of the Guildford complex, provides habitat for 1 threatened bird species (Red-tailed Black Cockatoo) and forms a critical part of the ecological linkage between the northern and southern precincts of the PIP. However it is fragmented and in generally Degraded condition. The EPA considers that the regionally significant

values of this area can be adequately protected through conservation and management as part of future planning proposals.

9.2.3 Recommendation Area H

Recommendation Area H covers an area of approximately 13ha and includes Investigation Area 21. The land is currently zoned Rural under the GBRS and Rural under the City of Bunbury Town Planning Scheme No. 7.

Area H meets 1 criterion for regional conservation significance, supporting populations of 1 threatened mammal species (Western Ringtail Possum). However Area H is small and isolated and the EPA considers that the regionally significant values of this area can be adequately protected through conservation and management as part of future planning proposals.

9.2.4 Recommendation Area I

Recommendation Area I covers an area of approximately 5ha and includes Investigation Area 25. The land is currently zoned Rural under the GBRS and General Farming under the Shire of Dardanup Town Planning Scheme No. 3.

Area I meets 5 criteria for regional conservation significance, however due to the small size and isolation of Area I, the EPA considers that the regionally significant values of this area can be adequately protected through conservation and management as part of future planning proposals.

9.2.5 Recommendation Area J

Recommendation Area J covers an area of approximately 10ha and includes Investigation Area 24. The land is currently zoned Rural under the GBRS and General Farming under the Shire of Dardanup Town Planning Scheme No. 3.

Area J meets 2 criteria for regional conservation significance, supporting populations of 1 threatened bird species (Baudin's Black Cockatoo) and 1 threatened mammal species (Western Ringtail Possum), and contributing to ecological linkage. However Area J is small and isolated and the EPA considers that the regionally significant values of this area can be adequately protected through conservation and management as part of future planning proposals.

9.2.6 Recommendation Area K

Recommendation Area K covers an area of approximately 3ha and includes Investigation Area 23. The land is currently zoned Rural under the GBRS and Rural under the Shire of Dardanup Town Planning Scheme No. 3.

Area K meets 1 criterion for regional conservation significance and was observed to support a significant population of 1 threatened mammal species (Western Ringtail Possum), however due to the small size and isolation of Area K, the EPA considers that the regionally significant values of this area can be adequately protected through conservation and management as part of future planning proposals.

9.3 Linkage Enhancement Areas

The EPA has recommended areas in strategic locations for enhancement and restoration given the fragmented distribution of the remaining natural areas in the study area and the negative impact this has on long term viability in a changing climate. Where these areas have not been previously discussed in Section 8 the Lot numbers are identified below.

9.3.1 Recommendation Area L

Recommendation Area L is located on Lot 10 on diagram 60475, South Western Highway Picton on the Ferguson River Foreshore, within the area known as the Southern Precinct of the PIP (Figure 6). The recommendation covers an area of approximately 0.7ha. The land is currently zoned Rural under the GBRS and Parks and Recreation under the City of Bunbury Town Planning Scheme No. 7.

The EPA previously recommended this area for retention as ROS in its assessment of the GBRS in order to consolidate the size and shape of the Ferguson River Foreshore and provide linkage to the nearby Crown Reserve 5545. The EPA acknowledges that through the appeals process that it was determined by the Minister that the EPA's recommendation not be adopted. However, the ecological linkage values remain and require some level of protection.

The EPA makes its current recommendation on the basis that development of the area for industrial purposes will be incompatible with residential land use. Therefore during the rezoning process there is an opportunity to protect the ecological linkage and it is recommended that this land be acquired at this time and appropriately reserved or protected through planning approvals processes.

9.3.2 Recommendation Area M

Recommendation Area M is located on Lot 2010 on diagram 43721 Picton East, within the area known as the Northern Precinct of the Preston Industrial Park (Figure 6). The recommendation covers an area of approximately 5ha and includes part Investigation Area 4. The land is currently zoned Rural under the GBRS and General Farming under the Shire of Dardanup Town Planning Scheme No. 3.

This area is located directly adjacent to Conservation Area A and contains a Resource Enhancment wetland. This area contributes to the ecological linkage between core conservation areas (Conservation Areas A and E). While vegetation condition of this area is Degraded, management actions (such as weed control and enhancement plantings with native flora) would further enhance the ecological linkage values of this area.

9.3.3 Recommendation Area N

Recommendation Area N is located on Lot 37 on plan 128640 Harris Road Picton East on the Ferguson River Foreshore, within the area known as the Northern Precinct of the Preston Industrial Park (Figure 6). The recommendation covers an area of approximately 4ha. The land is currently zoned Industrial under the GBRS and

General Farming and Public Utilities under the Shire of Dardanup Town Planning Scheme No. 3.

There is a need to maintain and enhance the ecological linkage between the Ferguson River (Conservation Area C) and Conservation Area E. The boundary of this recommendation is indicative only and subject to review based on detailed investigation of the site.

9.3.4 Recommendation Area P

Recommendation Area P is located on Lots 5 on diagram 50137 South West Highway Davenport and Lot 1 on diagram 10260 (North Boyanup Road) Davenport within the area known as the Southern Precinct of the PIP (Figure 6). The Recommendation Area covers an area of approximately 11ha. The land is currently zoned Regional Open Space under the GBRS and Special Use 18 under the City of Bunbury Town Planning Scheme No. 7.

Recommendation Area P was identified for retention of Regional Open space under the GBRS. This area was considered through the appeals process and it was determined by the Minister that the area be retained for Regional Open Space as it is a key component of the Ocean to Preston River Park and is the only area of land providing direct linkage to the Preston River. In addition Ministerial Statement No.697 required that Pt Lot 1 North Boyanup Road be reserved for conservation purposes to provide an appropriate buffer to the Preston River and shall only be used for conservation and complementary purposes.

An assessment of aerial photography indicates that the vegetation within this area has been impacted leaving only a small corridor of vegetation along its southern boundary. The EPA therefore recommends that the area be revegetated to restore this linkage.

9.3.5 Recommendation Area U

Recommendation Area U is located on Lots 1 and 2 on diagram 46933 Moore Road Dardanup West within the area known as the Southern Precinct of the PIP (Figure 6). The recommendation covers an area of approximately 8ha. The land is currently zoned Rural and Industry under the GBRS and General Farming and General Industry under the Shire of Dardanup Town Planning Scheme No. 3.

The vegetation within Recommendation Area U contributes to linkage between Conservation Area B and the Preston River (Conservation Area C). Actions to manage this area for conservation purposes (such as weed control and enhancement plantings with native flora) would enhance the natural values of this area and further strengthen the regional ecological linkage.

9.4 Linkage Restoration Areas

9.4.1 Recommendation Area Q

Recommendation Area Q is located on Lot 15 on plan 64665 South West Highway Davenport within the area known as the Southern Precinct of the PIP (Figure 6). The recommendation covers an area of approximately 9ha. The land is currently zoned Industrial under the GBRS and Development Zone-Industrial under the City of Bunbury Town Planning Scheme No. 7.

This recommendation aims to restore linkage between the Ocean to Preston River Regional Park and the Preston River. This linkage area will require rehabilitation to restore the ecological linkage values of this area.

The alignment of Bunbury Outer Ring road was assessed in the GBRS (Bulletin 1108) and the alignment subsequently determined by the Minister for the Environment through the appeals process. Ministerial Statement No. 697 provides conditions relating to this road including the provision of an environmental offset strategy to mitigate unavoidable impacts on wetlands and native vegetation associated with the road. The EPA notes that the Ministerial Condition specifically relates to the rehabilitation of the strip of land adjacent to the road in the vicinity of Lot 15 North Boyanup Road (South Western Highway). The proposed Restoration Area Q may provide a suitable option to fulfil this requirement.

9.4.2 Recommendation Area R

Recommendation Area R is located on Lot 7 on Plan 10116 Davenport within the area known as the Southern Precinct of the PIP (Figure 6). The recommendation covers an area of approximately 14ha. The land is currently zoned Rural under the GBRS and Rural under the City of Bunbury Town Planning Scheme No. 7.

This recommendation aims to restore linkage between Conservation Area B and the Preston River (Conservation Area C). To overcome significant deficiencies in the ecological linkage between these high priority conservation areas, an area for restoration is required. This should be located in a strategic position that preferably traverses the shortest distance between Areas B and C to minimise the area required. The location of Recommendation Area R abuts the Bunbury Outer Ring Road and provides a management boundary. This linkage area will require rehabilitation.

9.4.3 Recommendation Area S

Recommendation Area S is located on Lot 105 on diagram 96, Picton East, Lot 2010 on diagram 43721 Picton East and Lot 1 on diagram 22496, South Western Highway, Picton East within the area known as the Northern Precinct of the PIP (Figure 6). The recommendation covers an area of approximately 24 ha. The land is currently zoned Rural, and Industry under the GBRS and General Farming and Restricted Uses (R2 Dry Industry) under the Shire of Dardanup Town Planning Scheme No. 3.

Recommendation Area S aims to consolidate Recommendation G and restore linkage between Conservation Area's A and E. The area is in Completely Degraded

11. Recommendations

The EPA recommends that:

1. **All remnant vegetation within the Preston Industrial Park is considered to be regionally significant and should be retained.**

2. **The vegetation in its entirety within Recommendation Areas A,B,C, D and E (Figure 6) be reserved as Regional Open Space in a future amendment to the GBRS and appropriately managed.**

3. **That vegetation in its entirety within Recommendation Areas F,G, H, I, J, and K (Figure 6) be retained and protected as part of any future rezoning, subdivision or development, whichever comes first.**

4. **Connectivity be enhanced in Recommendation Areas L, M, N, P and U (Figure 6) and restored in Areas Q, R & S (Figure 6) given the fragmented distribution of the remaining natural areas in the study area and the negative impact this has on long term viability in a changing climate.**

7. **Appropriate buffers for wetlands be determined based on the values of the wetlands and proposed land uses, and protected and appropriately managed as part of any future rezoning, subdivision or development, whichever comes first.**

8. **That the Minister note the Advice Provided in Section 10 on environmental matters that will require further consideration as part of future planning processes.**

Appendix F

Lot 111 Vegetation Assessment

379,500 380,000 380,500

6,307,000

WALLRODT RD

Lot 1

61.78ha
Excluding PAR

MOORE RD

6,306,500

6,306,000

6,305,500

379,500 380,000 380,500

LEGEND

- Port Access Road
- Study Area (minus area of Port Access Road)
- Port Access Road (in Study Area)
- Cadastre (Nov 2011)

Vegetation Type

- Low lying wetland
- Low lying *melaleuca* populated wetland over pasture and sedges
- Pasture
- Banksia Woodland
- Jarrah, Marri, *B.ilisifola* and *melaleuca* woodland
- *Agonis*, Jarrah, Marri, *B.ilisifola* and *melaleuca* woodland

1:5,000 (at A3)

0 25 50 100 150 200 250

Metres

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

N

mainroads WESTERN AUSTRALIA

GHD CLIENTS|PEOPLE|PERFORMANCE

Main Roads WA - ETS
Environmental Values Assessment
Lot 1 Wallrodt Road, Dardanup West

Job Number	61-26239
Revision	C
Date	07 FEB 2011

Lot 1 Vegetation Type

Appendix D

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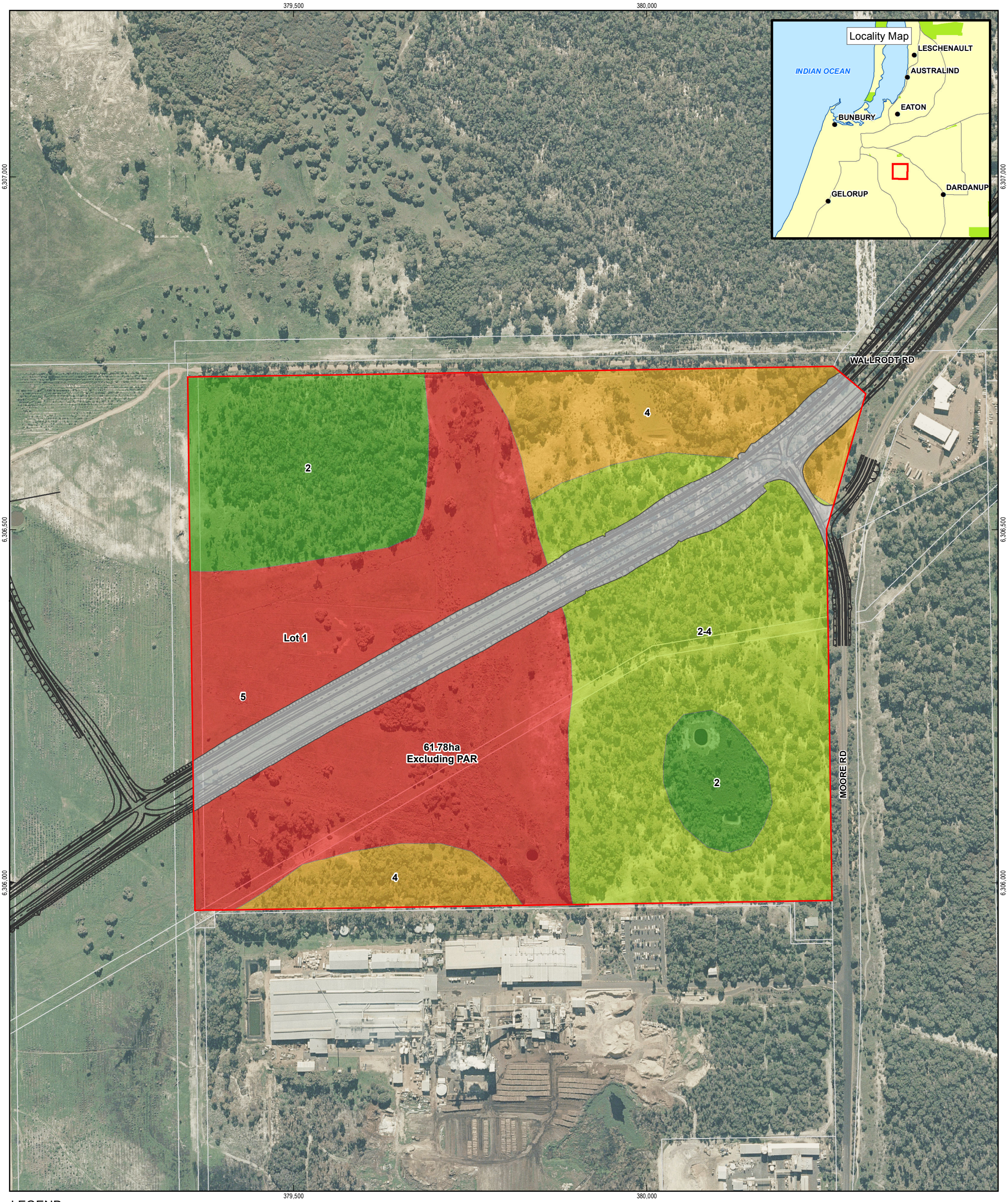
Data Source: Landgate (SLIP); Bunbury 2031 Mosaic - 200801, Cadastre - 20101104; GHD: Vegetation Type, Condition - 20101104, Study Area - 20101104, Port Access Road - 20101008; MRWA; Road Names - 2009. Created by: jhchen, slee2, RLow, mgresham



LEGEND

- Port Access Road
- Study Area
- Port Access Road
- Cadastre

Vegetation Condition

- 2 - Excellent (11.03 ha)
- 2-4 - Excellent to Good (18.69 ha)
- 4 - Good (8.56 ha)
- 5 - Degraded (23.49)

1:5,000 (at A3)

0 25 50 100 150 200 250

Metres

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

N

mainroads WESTERN AUSTRALIA

GHD CLIENTS | PEOPLE | PERFORMANCE

Main Roads WA - ETS
Environmental Values Assessment
Lot 1 Wallrodt Road, Dardanup West

Job Number	61-26239
Revision	D
Date	07 FEB 2011

Lot 1 Vegetation Condition Appendix D

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Data Source: Landgate (SLIP): Bunbury 2031 Mosaic - 200801; GHD: Vegetation Type - 20101104, Study Area - 20101104, GHD: Port Access Road - 20111008; MRWA; Road Names - 2009. Created by: jhchen, slee2, RLow, mgresham

Appendix G

Lot 5 Environmental Values Assessment

Main Roads

Part Lot 5 Boyanup - Picton Road
Environmental Values Assessment

April 2014

Executive summary

Main Roads Western Australia (Main Roads WA) commissioned GHD Pty Ltd (GHD) to conduct an Environmental Values Assessment (EVA) of a section of Lot 5 Boyanup – Picton Road, Picton East (Study Area), to determine and document the suitability of utilising it as part of an environmental offset package for the Bunbury Port Access Road (BPAR) Stage 2 project and Bunbury Outer Ring Road (BORR) Southern Section.

The scope of this EVA included:

- A literature review of previous investigations and reports of the offset site and the surrounding areas.
- A desktop assessment of environmental attributes.
- A Level 1 flora and vegetation survey.
- A Level 1 fauna survey.
- An assessment of regional significance of site vegetation and its value as part of the regional ecological linkages and reserve system (EPA Bulletin 1282).

A summary of the outcomes of the EVA is provided in Table 1.

Table 1 Summary of Environmental Values

Environmental attribute	Value
Vegetation	• The Study Area is a large area of 103 ha that includes a variety of landforms, including upland areas with remnant vegetation in excellent condition and lowland areas with wetlands. • Heddle *et al*. (1980) mapping identified two vegetation complexes within the Study Area: Guildford Complex and Southern River Complex. These complexes have 5 % and 19.8 % respectively of their pre-European extent remaining. The Study Area contains 0.35% of the current extent of the Guildford complex and 0.75% of the current extent of the Southern River complex. • The field survey determined that the vegetation types within the Study Area are most likely equivalent to the Southern River Complex. • The majority of the Study Area contains high quality vegetation with 83 % of the Study Area rated condition Good (4) or better. Sections of the Study Area that had been previously cleared and grazed still maintained good vegetation structure and showed evidence of regeneration of native species
Wetlands	• Five geomorphic wetlands occur within the Study Area including one Conservation Category, one Resource Enhancement and three Multiple Use wetlands. The Conservation Category Wetland UFI 14353 is located in the south-eastern corner of the Study Area.
Flora	• One Threatened species, *Diuris drummondii,* has been previously recorded within the wetland section of the Study Area and a Priority 4 species, *Acacia flagelliformis* was recorded in three locations during the field survey. In particular, the wetland areas of the site are considered

Environmental attribute	Value
	potential high value habitat for conservation significant flora.
Fauna	• The habitats present within the Study Area vary from predominantly good to excellent condition, and in general provide a wide-variety of habitat resources for fauna species. • The Study Area provides known habitat for seven conservation significant fauna species including the Western Ringtail Possum, Southern Brush-tailed Phascogale, Carnaby's Black Cockatoo, Forest Red-tailed Black Cockatoo, Baudin's Black Cockatoo, Quenda and Rainbow Bee-eater. • There is 82.25 ha of woodland habitat (Jarrah-Banksia-Peppermint woodland and Marri woodland) within the Study Area which is known foraging and potential breeding habitat for the three species of Black Cockatoos. • The majority of the Study Area provides suitable habitat for the Western Ringtail Possum, and 82.25 ha of woodland habitat is considered to be high value habitat for the species. • The 82.25 ha of woodland habitat also provides known habitat for the Southern Brush-tailed Phascogale, Quenda and Rainbow Bee-eater.
Connectivity and regional significance	• The EPA assessed the Study Area as part of an assessment of a larger area (EPA 2008) and considered that the ecological values of the remnant vegetation within the Study Area are considered to be of high value, and regionally significant. • The Study Area provides a large area of remnant vegetation within a largely cleared landscape, and therefore is a regionally significant area of habitat within the greater Bunbury region. The Study Area is substantial in size, and therefore able to support a wide-variety of fauna species. • Recently, a rope bridge has been constructed over the BORR, which provides an overpass for arboreal fauna to the south of the Study Area. This rope bridge was built specifically with the purpose of providing a linkage for Western Ringtail Possums between the Study Area and other areas of suitable habitat to the south of the BORR. Therefore, this rope bridge overpass allows for potential movement of individuals to and from the Study Area, providing connectivity and genetic exchange with adjacent areas.

Inclusion of the Study Area as an environmental offset would:

- Increase the area of Heddle vegetation complex Southern River in secure tenure. This complex currently has only 19.8% of its pre-European extent remaining, with only 1.5% of their current extent within secure tenure.
- Result in improved management of the land which will ultimately lead to improved vegetation condition.
- Provide protection to known habitat of conservation significant flora species.
- Provide habitat protection for threatened fauna present in the area. In particular Carnaby's Black Cockatoo, Baudin's Black Cockatoo, Forrest Red-tailed Black Cockatoo, Southern Brush-tailed Phascogale and the Western Ringtail Possum.

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Appendix E - Fauna data

Appendix F – Information from previous surveys

This report: has been prepared by GHD for Main Roads and *may only be used and relied on by Main Roads for the purpose agreed between GHD and the Main Roads as set out in section 1 of this report.*

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

The services conducted 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 (refer section 1.4 and 3.4. of this report). GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report on the basis of information provided by Main Roads and others who provided information to GHD (including Government authorities), which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

The opinions, conclusions and any recommendations in this report are based on information obtained from, and testing conducted at or in connection with, specific sample points. Site conditions at other parts of the site may be different from the site conditions found at the specific sample points.

Investigations conducted in respect of this report are constrained by the particular site conditions, such as the location of buildings, services and vegetation. As a result, not all relevant site features and conditions may have been identified in this report.

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

1. Introduction

1.1 Background

Main Roads Western Australia (Main Roads WA) has completed construction of the Bunbury Port Access Road (BPAR) Stage 2 project and is currently progressing the development of the Bunbury Outer Ring Road (BORR) Southern Section. A component of these investigations includes investigating land offset options to comply with expected approval conditions prescribed under:

- Federal *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)
- State *Environmental Protection Act 1986* (EP Act)

The WA Environmental Protection Authority (EPA) has, as its position, that environmental offsets should be used with the goal of achieving a net environmental benefit (EPA, 2006). The ideal is 'like for like or better' with the environmental offset ensuring a long lasting benefit.

A section of Lot 5 Boyanup – Picton Road, Picton East (the Study Area) has been identified as a candidate for the land offset scheme for the BPAR and the BORR. The area of Lot 5 being considered as an environmental offset is approximately 103 hectares (ha) in area.

The environmental offsets are required to fulfil the clearing offset requirements necessary for both Federal and State environmental approvals requirements. The offsets are required to 'compensate' for clearing impacts expected as a consequence of these projects as detailed in Table 2.

Table 2 Clearing impact areas

Aspect	Project	Estimated impact area (ha)
Total Clearing Impact	Bunbury Port Access Road Bunbury Outer Ring Road	16.8 ha 33.0 ha
Loss of potential Black Cockatoo foraging habitat	Bunbury Port Access Road Bunbury Outer Ring Road	13.2 ha 28.0 ha
Loss of potential Western Ringtail Possum habitat	Bunbury Port Access Road Bunbury Outer Ring Road	14.3 ha 23.0 ha

1.2 Purpose of this report

The purpose of this report is to provide an Environmental Values Assessment (EVA) of the Study Area to determine and document the suitability of utilising it as part of an environmental offset package for the BPAR Stage 2 Project and the BORR Southern Section.

1.3 Study Area

The Study Area incorporates a section of Lot 5 Boyanup – Picton Road, Picton East, within the Shire of Dardanup, as shown in Figure 1 (Appendix A). The Study Area is located to the south of Boyanup-Picton Road, to the east of the Bunbury Port Access Road and to the north of the Bunbury Outer Ring Road. The Study Area is approximately 103 ha in area.

1.4 Scope

Main Roads WA engaged GHD Pty Ltd (GHD) to conduct an EVA for the Study Area to assist in describing its ecological attributes for consideration of its value as an environmental offset for the BPAR Stage 2 Project and the BORR Southern Section. The scope of this EVA included:

- A review of previous investigations and reports of the offset site conducted by GHD over recent years including:
  - BORR Stage 1 and BPAR Stage 2 - Flora and vegetation survey (GHD 2009a)
  - BORR - Significant Fauna Survey (GHD 2009b)
  - BPAR - Flora and Vegetation Survey (GHD 2010a)
  - BPAR - Rare Fauna Survey (GHD 2010b)
  - BPAR Stage 2 - Environmental Impact Assessment (GHD 2011a)
  - BPAR Stage 2 - Supplementary Referral Information (GHD 2011b)
- A desktop assessment of environmental attributes including threatened and priority flora and fauna, wetlands, threatened and priority communities and Environmentally Sensitive Areas (ESAs).
- A Level 1 flora and vegetation survey of the Study Area in order to provide details on the:
  - vegetation types (complexes and associations)
  - vegetation condition
  - location of declared weeds
  - location of any conservation significant flora, and any other flora of local or taxonomic significance
- A Level 1 fauna survey in order to identify site fauna habitat values within the Study Area, including:
  - identification and mapping of fauna habitat types
  - presence of pest, declared or feral animals
  - opportunistic sightings of non-cryptic species
  - the presence or potential presence of other conservation significant fauna
  - identification of Black Cockatoo habitat, including breeding, foraging and roosting habitat (excluding identification and mapping of individual habitat trees)
  - identification of Western Ringtail Possum habitat, including identification of suitable habitat, presences of dreys (nests) and targeted spotlighting
- Assessment of regional significance of site vegetation
- Assessment of the value of the site vegetation as part of the regional ecological linkages and reserve system (EPA Bulletin 1282).
- A list of management issues for the property to be implemented before seeking handover to the Department of Parks and Wildlife (DPaW).

1.4.1 Exclusions

Locating and mapping of each significant habitat tree (e.g. trees with diameter at breast height (DBH) of > 500 mm) was not undertaken as part of the field survey. Instead, the Black Cockatoo habitat assessment entailed an estimate of the distribution of these trees across the Study Area, based on the site investigation.

Detailed weed or pest species surveys and mapping are not included in the scope of this EVA. General comments and location information regarding weed and pest animal species were noted during the field survey and are included in this report.

Contaminated land, Acid Sulfate Soil and heritage surveys or considerations are not included in the scope of this assessment.

2. Legal framework & background information

2.1 Legislation & conservation codes

2.1.1 Hydrology & water resources

Surface water

Table 3 Department of Water Geographic Data Atlas information

Aspect	Details
RIWI Groundwater Areas	Groundwater areas proclaimed under the *Rights in Water and Irrigation Act 1914* (RIWI Act).
RIWI Surface Water Areas	Surface water areas proclaimed under the RIWI Act.
RIWI Irrigation District	Irrigation Districts proclaimed under the RIWI Act.
RIWI Rivers	Rivers proclaimed under the RIWI Act.
Public Drinking Water Source Areas (PDWSA)	PDWSAs is a collective term used for the description of Water Reserves, Catchment Areas and Underground Pollution Control Areas declared (gazetted) under the provisions of the *Metropolitan Water Supply, Sewage and Drainage Act 1909* (MWSSD Act) or the *Country Area Water Supply Act 1947* (CAWS Act).
Waterway Management Areas	Areas proclaimed under the *Waterway Conservation Act 1976*.

Groundwater

Groundwater in Western Australia is protected under the *Rights in Water and Irrigation Act 1914* (RIWI Act).

Public Drinking Water Source Areas

Public Drinking Water Source Areas (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 *Country Areas Water Supply Act 1947*.

Wetlands

Wetlands include not only lakes with open water, but areas of seasonally, intermittently or permanently waterlogged soil. Approximately 25 per cent of the Swan Coastal Plain between Moore River and Mandurah is classified as wetland (Hill *et al*., 1996).

Though extensive in area, not all wetlands retain significant ecological values due to the concentration of urban and agricultural development in the region. Most wetlands have been cleared, filled or developed over, leaving only 20 per cent of all the wetlands that were present on the Swan Coastal Plain prior to European settlement. Of these, an estimated 15 per cent of the wetland area has retained high ecological values (Hill *et al*., 1996).

Ramsar wetlands

The Convention of Wetlands of International Importance was signed in 1971 at the small Iranian town of Ramsar. The Convention has since been referred to as the Ramsar Convention. Ramsar wetlands are “sites containing representative, rare or unique wetlands, or wetlands that are important for conserving biological diversity … because of their ecological, botanical,

zoological, limnological or hydrological importance" (DSEWPaC, 2013b). Once a Ramsar wetland is designated, the country agrees to manage its conservation and ensure its wise use. Under the Convention, wise use is broadly defined as "maintaining the ecological character of a wetland" (DSEWPaC, 2013b).

Lakes covered under the Environmental Protection (Swan Coastal Plain Lakes) Policy 1992

The *Environmental Protection (Swan Coastal Plain Lakes) Policy 1992* (EPP Lakes) protects the environmental values of selected wetlands on the Swan Coastal Plain.

Geomorphic wetlands

Categorisation of wetlands has been conducted by Hill, *et al*. (1996), delineating Swan Coastal Plain into levels of protection and management categories. 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. Multiple Use Wetlands are classified as those wetlands with few attributes that still provide important wetland functions. Multiple Use wetlands have few important ecological attributes and functions remaining.

The Geomorphic Wetlands Swan Coastal Plain dataset displays the location, boundary, geomorphic classification (wetland type) and management category of wetlands on the Swan Coastal Plain.

2.1.2 Reserves and conservation areas

Department of Parks and Wildlife managed lands and waters

DPaW manages lands and waters throughout Western Australia to conserve ecosystems and species, and to provide for recreation and appreciation of the natural environment. DPaW managed lands and waters include national parks, conservation parks and reserves, marine parks and reserves, regional parks, nature reserves, State forest and timber reserves. DPaW managed conservation estate, is vested with the Conservation Commission of Western Australia. Access to, or through, some areas of DPaW managed lands may require a permit or could be restricted due to management activities. Proposed land use changes and development proposals that abut DPaW managed lands will generally be referred to DPaW throughout the assessment process.

2.1.3 Vegetation, flora & fauna

Conservation codes

Species of significant flora, fauna and communities are protected under both Federal and State Acts. The Federal EPBC Act provides a legal framework to protect and manage nationally important flora and communities. The State Wildlife Conservation Act (WC Act) is the primary wildlife conservation legislation in Western Australia. Information on the conservation codes is provided at Appendix B and summarised in the following sections.

Vegetation extent & status

The National Objectives and Targets for Biodiversity Conservation 2001-2005 (Commonwealth of Australia, 2001) recognise that the retention of 30 percent or more of the pre-clearing extent of each ecological community is necessary if Australia's biological diversity is to be protected. This threshold level below which species loss appears to accelerate exponentially and loss below this level should not be permitted. This level of recognition is in keeping with the targets recommended in the review of the National Strategy for the Conservation of Australia's

Biological Diversity (ANZECC, 2000) and in EPA Position Statement No. 2 on environmental protection of native vegetation in Western Australia (EPA, 2000).

From a purely biodiversity perspective and taking no account of any other land degradation issues, there are a number of key criteria now being applied to the clearing of native vegetation in Western Australia (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 per cent of the pre-European extent of the vegetation type.
- A level of 10 per cent of the original extent is regarded as being a level representing Endangered.
- Clearing which would put the threat level into the class below should be avoided.
- From a biodiversity perspective, stream reserves should generally be in the order of at least 200 m wide.

Within the Swan Coastal Plain, EPA Position Statement No. 9 identifies vegetation complexes with 30 per cent or less or their pre-clearing extent remaining in a bioregion, or 10 per cent or less of their pre-clearing extent remaining in constrained areas (i.e. areas of urban development in cities and major town) on the Swan Coastal Plain, to be critical assets.

The extent of remnant native vegetation has been assessed by Shepherd *et al*. (2002) and the Government of Western Australia (2013), based on broadscale vegetation association mapping by Beard (1979).

The EPA Guidance Statement No. 10 (EPA, 2006) assesses the extent of Heddle *et al.* (1980) vegetation complexes currently present against presumed pre-European extents.

Threatened & Priority Ecological Communities

Ecological communities are defined as naturally occurring biological assemblages that occur in a particular type of habitat (English and Blythe, 1997). Federally listed Threatened Ecological Communities (TECs) are protected under the EPBC Act administered by the Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC). The DPaW also maintains a list of TEC for Western Australia; some of which are also protected under the EPBC Act. TEC 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.

Possible TEC that do not meet survey criteria are added to the DPaW's Priority Ecological Community (PEC) List 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.

Further information on the conservation codes is provided in Appendix B.

Conservation significant flora & fauna

Species of significant flora are protected under both Federal and State legislation. Any activities that are deemed to have a significant impact on species that are recognised by the EPBC Act, and/or the WC Act can warrant referral to the DSEWPaC and/or the EPA. According to the DPaW (WA Herbarium, 1998–): "Threatened flora are plants which have been assessed as being at risk of extinction. In Western Australia the term Declared Rare Flora (DRF) is applied to Threatened flora due to the laws regarding threatened flora conservation. The WC Act is the

primary wildlife conservation legislation in the State and the Minster for the Environment can declare taxa (species, subspecies or variety) as “Rare Flora” if they are considered to be in danger of extinction, rare or otherwise in need of special protection.” For the purposes of this report, flora listed by the WC Act as DRF is described as Threatened.

In Western Australia, DPaW also maintains a list of Priority listed flora species. Conservation codes for Priority species are assigned by DPaW to define the level of conservation significance. Priority species are not currently protected under the WC Act.

For the purposes of this assessment, all species listed under the EPBC Act, WC Act and DPaW Priority species are considered conservation significant. Further information on the conservation codes relevant to this report is provided in Appendix C.

The Federal conservation level of flora and fauna species and their significance status is assessed under the EPBC Act. The significance levels for fauna used in the EPBC Act are those recommended by the International Union for the Conservation of Nature and Natural Resources (IUCN).

The State conservation level of fauna species and their significance status is assessed under the State WC Act (Wildlife Conservation (Specially Protected Fauna) Notice 2010(2)). This Act uses a set of Schedules but also classifies species using some of the IUCN categories. Schedule 3 fauna species are those which are “subject to an agreement between the Government of Australia and the Governments of Japan, China and the Republic of Korea relating to the protection of migratory birds, are declared to be fauna that is in need of special protection”.

Introduced plants (weeds)

Weeds of National Significance

The spread of weeds across a range of land uses or ecosystems is important in the context of socio-economic and environmental values. The assessment of Weeds of National Significance (WoNS) is based on four major criteria:

- Invasiveness
- Impacts
- Potential for spread
- Socio-economic and environmental values

Declared Pest

Under the *Biosecurity and Agriculture Management Act 2007* (BAM Act), a Declared Pest is a prohibited organism or an organism for which a declaration under Section 22(2) is in force. The Department of Agriculture and Food Western Australia (DAFWA) maintains a list of Declared Pests for Western Australia. If a plant is declared for the whole of the State or for particular Local Government Areas, all landholders are obliged to comply with the specific category of control.

Declared plants are gazetted under categories, which define the action required. The category may apply to the whole of the State, districts, individual properties or even paddocks. Categories of control are defined in Table 4. Among the factors considered in categorising Declared Pests are:

- The impact of the plant on individuals, agricultural production and the community in general
- Whether it is already established in the area

- The feasibility and cost of possible control measures

Table 4 Department of Agriculture and Food (Western Australia) Categories for Declared Pests under the *Biosecurity and Agriculture Management Act 2007*

Control class code	Description
C1 (Exclusion)	Pests will be assigned to this category if they are not established in Western Australia and control measures are to be taken, including border checks, in order to prevent them entering and establishing in the State.
C2 (Eradication)	Pests will be assigned to this category if they are present in Western Australia in low enough numbers or in sufficiently limited areas that their eradication is still a possibility.
C3 (Management)	Pests will be assigned to this category if they are established in Western Australia but it is feasible, or desirable, to manage them in order to limit their damage. Control measures can prevent a C3 pest from increasing in population size or density or moving from an area in which it is established into an area which currently is free of that pest.

2.1.4 Environmentally Sensitive Areas

Environmentally Sensitive Areas (ESAs) are declared by a notice under Section 51B of the EP Act. Table 5 outlines the aspects of areas declared as ESA (under the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* – Regulation 6).

Table 5 Aspects of Environmentally Sensitive Areas

Aspects of Environmentally Sensitive Areas
A declared World Heritage property as defined in Section 13 of the EPBC Act.
An area that is registered on the Register of the National Estate (RNE), because of its natural values, under the Federal *Australian Heritage Commission Act 1975*.
A defined wetland and the area within 50 m of the wetland.
The area covered by vegetation within 50 m of rare flora, to the extent to which the vegetation is continuous with the vegetation in which the rare flora is located.
The area covered by a TEC.
A Bush Forever Site.
The areas covered by the following policies: a. The *Environmental Protection (Gnangara Mound Crown Land) Policy 1992*. b. The *Environmental Protection (Western Swamp Tortoise Habitat) Policy 2002*.
The areas covered by the lakes to which the *Environmental Protection (Swan Coastal Plain Lakes) Policy 1992* (SCPL) (EPP Lakes) applies.
Protected wetlands as defined in the *Environmental Protection (South West Agricultural Zone Wetlands) Policy 1998*.
Areas of fringing native vegetation in the policy area as defined in the *Environmental Protection (Swan and Canning Rivers) Policy 1997*.

2.1.5 Indigenous Heritage

The *Aboriginal Heritage Act 1972* (AHA) was introduced in Western Australia to protect Aboriginal heritage.

The AHA provides automatic protection for all places and objects in Western Australia that are important to Aboriginal people because of connections to their culture. These places and objects are referred to as Aboriginal sites.

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3. Methodology

3.1 Desktop assessment

Prior to the field assessment a review of publically available databases was conducted, this desktop assessment included:

- A review of the DPaW and Western Australian Museum (WAM) NatureMap database.
- A review of DSEWPaC's EPBC Act Protected Matters database.
- A review of the DPaW TEC and PEC databases.
- A review of the DPaW flora and communities' databases for records of conservation significant species.
- Literature review of previous reports and available documents from the vicinity of the Study Area including:
  - GHD, 2009a, Report for Bunbury Outer Ring Road (Stage 1) and Port Access Road (Stage 2), Flora and Vegetation Spring Survey, Unpublished report for Main Roads Western Australia.
  - GHD, 2009b, Report for Significant Rare Fauna Bunbury Outer Ring Road, Unpublished report for Main Roads Western Australia.
  - GHD, 2010a, Report for Flora and Vegetation Survey Bunbury Port Access Project Stage 2, Unpublished report for Main Roads Western Australia.
  - GHD, 2010b, Report for Rare Fauna Survey Bunbury Port Access Project Stage 2, Unpublished report for Main Roads Western Australia.
  - GHD, 2011a, Bunbury Port Access Project Stage 2 Environmental Impact Assessment, Unpublished report for Main Roads Western Australia.
  - GHD, 2011b, Bunbury Port Access Project Stage 2 Supplementary Referral Information, Unpublished report for Main Roads Western Australia.
  - Bennett Environmental Consulting, 2008, A review of the Significant Flora Survey of the Bunbury Outer Ring Road, Unpublished report for Main Roads Western Australia.

3.2 Flora field assessment

GHD undertook a flora and vegetation assessment of the Study Area between the 11th and 12th of June 2013. The field survey was undertaken with regards to the EPA Guidance Statement No. 51, *Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia* (EPA, 2004a) and *Terrestrial Biological Surveys as an Element of Biodiversity Protection*, Position Statement No. 3 (EPA, 2002).

Field assessment methodology involved sampling using quadrats located in representative vegetation types and recording of plant species present (visible) at the time of the survey in the Study Area. Grid-based searches allowed for targeted searches of Threatened and Priority flora and other flora of local or taxonomic significance in areas of suitable habitat.

The boundaries of potentially different vegetation types were identified by means of a combination of aerial photography interpretation, topographical features, previous mapping (Beard 1979 and Heddle *et al.* 1980) and field observations. Quadrat sampling sites involved areas of 10 m × 10 m and the position of each site was recorded using a GPS unit.

The information presented in Table 6 was recorded for each quadrat. During the field assessment 14 quadrats were assessed. The locations of quadrats are provided in Figure 5, Appendix A.

Table 6 Quadrat data recorded during the field survey

Aspect	Measurement
Physical Features	Aspect, soil attributes. Percentage cover by: rocks, logs and branches, leaf litter, bare ground.
Location	Coordinates recorded in GDA94 datum using a hand-held Global Positioning System (GPS) tool and PDA (Trimble Nomad), to accuracy approximately ± 5 m and ± 2 m respectively.
Vegetation Condition	Vegetation condition was assessed using the condition rating scale devised by Keighery (1994).
Disturbance	Level and nature of disturbances (e.g. weed presence, fire – and time since last fire, impacts from grazing, exploration activities).
Flora	List of dominant flora from each structural layer. Cover class for each structural layer.

Nomenclature used in the report follows that used by the Western Australian Herbarium as reported on FloraBase (Western Australian Herbarium 1998–).

3.3 Fauna and habitat field assessment

GHD undertook a fauna and habitat assessment of the Study Area between the 11th and 12th of June 2013. The fauna assessment was consistent with a Level 1 survey (reconnaissance survey) in regard of the requirements of the EPA Guidance Statement No. 56 *Assessment of Environmental Factors for Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia* (EPA 2004b) and the DPaW and EPA's *Technical Guide Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment* (EPA 2010).

Nomenclature used in the report follows that used by the Western Australian Museum NatureMap program for vertebrate fauna, as it is deemed to contain the most up-to-date species information for reptiles, amphibians and mammals in Western Australia. However birds follow Christidis and Boles (2008).

The methodology used to undertake the fauna assessment included:

- Opportunistic searches across all habitat types within the Study Area. This ensured the maximum suite of species potentially occurring at the Study Area was observed. The survey involved searching through microhabitats including turning over logs or rocks, turning over leaf litter and examining hollow logs.
- Opportunistic visual and aural surveys. This accounted for many bird species potentially utilising the Study Area.
- Searching for tracks, scats, bones, diggings and feeding areas for both native and feral fauna.
- Habitat assessments were conducted and included targeting the known habitat preferences of threatened vertebrate species listed under the relevant Federal and State Acts, including DPaW listed Priority fauna, which are suspected to occur in the general area. The aim of the habitat assessment was to determine the likelihood of any threatened species utilising the Study Area.
- Habitat assessments for Black Cockatoos, Western Ringtail Possum and Southern Brush-tailed Phascogale, as detailed in sections 3.3.1 and 3.3.2.

Fauna observations recorded during the field survey have been mapped at Figure 8, Appendix A.

3.3.1 Black Cockatoo habitat assessment

The Black Cockatoo habitat assessment was undertaken by GHD ecologists as part of the fauna assessment. The assessment involved visual and aural assessment of the site identifying breeding habitat (actual and potential breeding trees), feeding habitat, roosting areas, current activity and any other signs of use by Black Cockatoos. For the purpose of this assessment, the DSEWPaC (2012b) referral guidelines were used to define breeding, foraging and night roosting habitat.

Breeding habitat

Locating and mapping of individual significant habitat trees (i.e. trees with DBH > 500 mm) was not undertaken during the field survey, as it was outside the scope of this report. Instead the habitat assessment included an estimate of the distribution of these trees across the Study Area. This estimate was calculated using randomly distributed quadrat sampling sites of 50 m × 50 m throughout the Study Area. Within each of these quadrats, the number of trees with a DBH > 500 mm were recorded.

Information collected during the field survey included:

- Identification and extent of foraging habitat (through accepted feed plant species and/or evidence of feeding).
- Identification of roosting habitat.
- GPS location of actual and/or potential breeding trees that have a DBH > 500 mm and have hollows suitable for breeding within each 50 m × 50 m quadrat.

This information was used to map and calculate the amount of feeding habitat, actual and/or potential breeding habitat and roost sites within the Study Area.

3.3.2 Western Ringtail Possum habitat assessment

The Western Ringtail Possum habitat assessment was also undertaken by GHD ecologists as part of the fauna assessment, and involved targeted searches for evidence of the species throughout the Study Area. The site was opportunistically searched for scats and dreys (nests), and each habitat type was assessed for its value as Western Ringtail Possum habitat. In addition to daytime surveys, one night of spotlighting was undertaken targeting the Western Ringtail Possum. This spotlighting was also aimed at confirming the presence of the threatened Southern Brush-tailed Phascogale within the Study Area.

3.4 Limitations

3.4.1 Desktop investigation limitations

The DSEWPaC Protected Matters Search Tool (PMST) database is used to identify species listed under the EPBC Act and draws on various sources to report on the potential of the species occurrence within an area. The DSEWPaC PMST is broad-scale in its reporting and often the specific habitat requirements of the species do not occur, or are unlikely to occur, within a project area. For this reason not all species reported by the search tool need to be considered in management decisions. The DPaW NatureMap database reports on actual records of the species within the designated area and can provide more accurate information of the likelihood of species presence. Neither data base can be considered exhaustive. Species of conservation significance may be found during surveys that are not listed in the databases.

3.4.2 Field survey limitations

The limitations and constraints associated with the field survey area discussed in Table 7.

Table 7 Survey limitations

Variable	Impact on survey outcomes
Access problems	There were no issues affecting access at the site.
Experience levels	The ecologists who executed these surveys were practitioners suitably qualified in their respective fields.
Timing[1], weather and season	The survey was undertaken during winter, 11 to 12 June 2013. In the three months directly prior to the survey (March – May 2013), which is prior to the main winter rainfall period, the Bunbury Bureau of Meteorology station (9965) recorded 234.2 mm of rainfall, which is over 60 % higher than the historical mean annual rainfall for this period (146.2 mm). Some flora species, such as annuals, are only available for collection at certain times of the year and others are only identifiable at certain times (such as when they are flowering). The survey was not conducted at the optimum time of year to identify the maximum suite of flora species. Additionally, climatic and stochastic events (such as fire) may affect the presence of plant species. Species that have a very low abundance in the area are more difficult to locate, due to the above factors. Flora composition changes over time, with flora species having specific growing periods, especially annuals and ephemerals (some plants lasting for a markedly brief time, some only a day or two). Therefore, the results of future botanical surveys in this location may differ from the results of this survey. Complete flora and fauna surveys can require multiple surveys, at different times of year, and over a period of a number of years, to enable observation of all species present.
Completeness	Flora species that were insufficiently mature or dead were identified in the field to genus or family level only (where possible). The flora survey was not conducted at the optimum time (Spring) to record all flora species likely to occur within the Study Area. The numbers of species recorded would be an underrepresentation of the complete flora complement of the Study Area. The fauna assessment undertaken was a reconnaissance survey only (Level 1) and thus only sampled those species that can be easily seen, heard or have distinctive signs, such as tracks, scats, diggings etc. Many cryptic species would not have been identified during this reconnaissance survey. The fauna assessment was aimed at identifying habitat types within the Study Area. In addition, terrestrial vertebrate fauna seen using the Study Area were identified. No sampling for invertebrates or aquatic species was undertaken. The information available on the identification, distribution and conservation status of invertebrates is generally less extensive than that of vertebrate species.
Determination	The taxonomy and conservation status of the Western Australian flora and fauna is dynamic. This report was prepared with reliance on taxonomy and conservation current at the time issuing, but it should be noted this may change.

[1] EPA Guidance Statement 51 (EPA 2004) stipulates that flora and vegetation surveys should be undertaken following the season that contributes the greatest rainfall in the region. In the Northern Province, this is after summer. In the Eremaean Province, rainfall is sporadic, and in the South-west Province the main rain is in winter, requiring surveys to be undertaken in spring. Short-term variances in normal weather patterns (e.g. drought) may necessitate supplementary survey work at other times of year or in later years to take into account temporal changes in diversity.

4. Existing environment

4.1 Land use

The land within the Study Area is located in the Shire of Dardanup and is currently zoned Rural under the Greater Bunbury Region Scheme (GBRS). The Study Area has previously been used for agriculture. Main Roads WA is under negotiation to purchase Lot 5 with the intention of transferring ownership to the Department of Lands and management of the property to the DPaW.

4.2 Reserves and conservation areas

There are no DPaW-managed reserves within the Study Area (Government of Western Australia, 2012). There is, however, one Miscellaneous Reserve (R40552) present adjacent to the Study Area (Government of Western Australia, 2012) (Figure 2, Appendix A).

The Study Area will be managed by DPaW and therefore increase the area of the DPaW-managed reserves in the vicinity. This will increase the amount of native remnant vegetation reserved within the Shire of Dardanup.

4.3 Acid Sulfate Soils

The Australian Soil Resource Information System (ASRIS 2013) contains an Atlas of Australian Acid Sulfate Soils for use in hazard assessment.

Based on the above, ASRIS (2013) mapping shows that the Study Area has a low probability of having Acid Sulfate Soils (ASS).

4.4 Hydrology & water resources

Desktop searches of the Department of Water (DoW) Geographic Data Atlas (2013) identified the hydrology and hydrogeology aspects present in the Study Area provided in Table 8.

Hydrological features identified within the Study Area are mapped on Figure 3 (Appendix A).

Table 8 Department of Water Geographic Data Atlas Queries

Aspect	Results
Rights in Water and Irrigation Act 1914 (RIWI Act) Groundwater Areas	Bunbury
RIWI Surface Water Areas	None present
RIWI Irrigation District	None present
RIWI Rivers	Preston River and tributaries and Ferguson River and tributaries
Public Drinking Water Source Areas (PDWSA)	None present
Waterway Management Areas	Leschenault Inlet Management Area over the western half of the Study Area

(DoW, 2013)

4.4.1 Surface water

The Study Area is not located within any RIWI Surface Water Areas (DoW, 2013). Two RIWI Rivers (the Preston and Ferguson River and associated tributaries) were identified within the Study Area (DoW, 2013).

4.4.2 Groundwater

The Study Area is located within the Bunbury RIWI Groundwater Area (DoW, 2013).

4.4.3 Public Drinking Water Source Areas

A search of the DoW Geographic Data Atlas (2013) indicates that the Study Area is not located within any Public Drinking Water Source Areas (PDWSA).

4.4.4 Wetlands

Ramsar & Nationally Important Wetlands

The EPBC Act PMST (DSEWPaC, 2013a) did not identify any Ramsar-listed or Nationally Important Wetlands within 10 km of the Study Area.

Lakes covered under the *Environmental Protection (Swan Coastal Plain Lakes) Policy 1992*

Desktop searches (Government of Western Australia, 2012) did not identify any EPP Lakes within the Study Area.

Geomorphic wetlands

A desktop assessment (Government of Western Australia, 2012) identified five geomorphic wetlands within the Study Area (Table 9). These wetlands are shown in Figure 3

Table 9 Geomorphic wetlands identified within the Study Area

UFI	ID	Classification	Evaluation
1230	3703	Sumpland	Multiple Use
1233	3706	Sumpland	Resource Enhancement
1391	9999	Sumpland	Multiple Use
14353	703	Not Assessed	Conservation
15221	2327	Palusplain	Multiple Use

(Government of Western Australia, 2012)

4.5 Environmentally Sensitive Areas

A search of the DER's Native Vegetation Viewer identified two ESA's within the Study Area (Figure 2, Appendix A). One of these is associated with the Conservation Category Wetland UFI 14353 in the south-eastern corner of the Study Area. The other ESA is associated with a record of *Diuris drummondii*, which is listed as Vulnerable under the EPBC Act and as Threatened under the WC Act.

4.6 Bioregion

The Study Area is located within the Swan Coastal Plain Interim Biogeographic Regionalisation of Australia (IBRA) Region, Perth (Swan Coastal Plain) Sub-Region. "The Swan Coastal Plain is a low lying coastal plain, mainly covered with woodlands. It is dominated by Banksia or Tuart on sandy soils, *Casuarina obesa* on outwash plains, and paperbark in swampy areas. In the east, the plain rises to duricrusted Mesozoic sediments dominated by Jarrah [*Eucalyptus marginata*] woodland. The climate is Warm Mediterranean. Three phases of marine sand dune development provide relief. The outwash plains, once dominated by *C. obesa* – Marri [*Corymbia calophylla*] woodlands and Melaleuca shrublands, are extensive only in the south. The Perth subregion is composed of colluvial and aeolian sands, alluvial river flats, coastal limestone, heath and/or Tuart [*E. gomphocephala*] woodlands on limestone, Banksia and Jarrah – Banksia

woodlands on Quaternary marine dunes of various ages, Marri on colluvial and alluvials, and includes a complex series of seasonal wetlands which also includes Rottnest, Carnac and Garden Islands. Rainfall ranges between 600 and 1000 mm annually and the climate is Mediterranean. The subregional area is 1, 333, 901 hectares (ha)" (Mitchell et al., 2002).

4.7 Vegetation & flora

4.7.1 Vegetation complexes

Broadscale vegetation mapping of the area (Beard, 1979) identified the following three vegetation associations present within the Study Area:

- Medium woodland; jarrah marri & wandoo (association 968)
- Mosaic: Medium forest; jarrah–marri/Low woodland; banksia/Low forest; teatree (*Melaleuca* spp.) (association 1000)

Heddle *et al*. (1980) also mapped the vegetation of the Perth area and identified the following vegetation complexes within the Study Area (Figure 2, Appendix A):

- **Pinjarra Plain: *Guildford complex* –** A mixture of open forest to tall open forest of *E. calophylla* [now *Corymbia calophylla*] – *E. wandoo* – *E. marginata* and woodland of *E. wandoo* (with rare occurrences of *E. lane-poolei*). Minor components include *E. rudis* – *M. rhaphiophylla*, on Fluviatile Deposits.

- **Combinations of Bassendean Dunes/Pinjarra Plain/Spearwood Dunes: *Southern River complex*** – Open woodland of *C. calophylla* – *E. marginata* – *Banksia* species with fringing woodland of *E. rudis* – *M. rhaphiophylla* along creek beds, on Aeolian Deposits.

4.7.2 Vegetation extent & status

The extent of remnant native vegetation has been assessed by Shepherd *et al*. (2002) and the Government of Western Australia (2013), based on vegetation association mapping undertaken by Beard (1979). The remaining extent of the vegetation associations present within the Study Area for the State, IBRA region (Swan Coastal Plain) and Local Government Area (LGA) is detailed in Table 10.

Based on the current extent of these vegetation associations, association 968 has less than 30 per cent remaining at the IBRA region and LGA scale. Vegetation association 1000 has less than 30 per cent remaining at the State and IBRA region level and vegetation association 1182 has less than 30 per cent at the State level. The Study Area contains 0.161% of the current extent of association 968 (15.76 ha) and 0.348% of the current extent of association 1000 at the IBRA region level (86.92 ha).

In addition, the extent of vegetation association 968 is less than 10 per cent within the Shire of Dardanup LGA. The Study Area contains 1.93% of the current extent of vegetation association 968 within the Shire of Dardanup.

Table 10 Extent and status of Beard (1979) vegetation associations within the Study Area

Vegetation association	Vegetation description	Region	Pre-European extent (ha)	Current extent (ha)	% remaining	% current extent protected (IUCN Class I-IV) for conservation (proportion of pre-European extent)	% current extent in DPaW-Managed Land	Amount within Study Area (ha)	% of current extent within Study Area (ha)
968	Medium woodland; jarrah marri & wandoo	State	296,789	98,907.20	33.28	33.31	55.11	15.76	0.016
		Swan Coastal Plain IBRA Bioregion	136,188.22	9,795.86	7.19	15.77	16.54		0.161
		Perth IBRA sub-region	136,188.20	9,795.86	7.19	15.77	16.54		0.161
		LGA (Shire of Dardanup)	9,655.00	813.61	8.43	2.00	9.19		1.93
1000	Mosaic: Medium forest; jarrah–marri/Low woodland; banksia/Low forest; teatree (*Melaleuca* spp.)	State	99,835.85	27,966.99	28.01	8.00	16.74	86.92	0.312
		Swan Coastal Plain IBRA Bioregion	94,175.31	24,972.86	26.52	7.34	17.06		0.348
		Perth IBRA sub-region	94,175.31	24,972.86	26.52	7.34	17.06		0.348
		LGA (Shire of Dardanup)	3375.42	880.74	26.09	-	0.00		9.87

> 30 percent of pre-European extent remaining

10–30 percent of pre-European extent remaining

< 10 percent of pre-European extent remaining

The EPA Guidance Statement No. 10 (EPA 2006) assesses the extent of Heddle *et al.* (1980) vegetation complexes currently present against predicted pre-European extents; these are shown in Table 11. Based on the current extent of these vegetation complexes, both the Guildford complex and the Southern River complex each have less than 30 per cent remaining in the System 6/part System 1 area. Specifically, the Guildford complex has less than 10 per cent remaining and is considered a critical asset by the EPA (EPA 2006).

In addition, both the Guildford and Southern River complexes only have 0.2 % and 1.5 % of their current extent within secure tenure, respectively. The Study Area has been mapped as containing 0.35% of the current extent of the Guildford complex and 0.75% of the current extent of the Southern River complex.

Table 11 Extent and status of Heddle *et al.* (1980) within the Study Area

Vegetation complex	Total pre-1750 extent (ha)	Present extent (1997/98) in the System 6/part System 1 area (ha)	% of each remaining (1997/98) in the System 6/part System 1 area (ha)	% of each remaining of pre-1750 extent in secure tenure (2002)	Area within Study Area (ha)	% of current extent within Study Area (ha)
Guildford complex (32)	92,497	4,662	5.0	0.2	16.44	0.35
Southern River complex (42)	57,979	11,501	19.8	1.5	86.23	0.75

4.7.3 Site vegetation type & condition assessment

The vegetation types recorded during the field survey have been mapped at Figure 5, Appendix A and detailed in Table 12. The condition of the vegetation has been mapped at Figure 6, Appendix A and the extents of each vegetation condition rating detailed in Table 13.

The majority of the Study Area is an undulating upland area that contains 'Jarrah-Banksia-Peppermint Woodland' (77.2 ha – 75.2 % of the Study Area). A fringing 'Marri Woodland' (6.1 ha) occurs along the slope the fringes the upland area. Within the upland sections of the Study Area are two low-lying swales that support dampland vegetation recorded as 'Closed Heath of *Astartea*' (0.27 ha). Generally the upland section of the Study Area was relatively structurally intact with little weed invasion. Approximately 69.72 ha of the upland sections of the Study Area was rated Excellent to Very Good (Condition 2-3). Within the upland areas the disturbances included previous clearing for tracks, including a powerline that runs north-south through the Study Area, and previous grazing. The condition of the upland areas was reduced towards the edges of the site, which exhibited edge effects such as increased weed invasion.

The western section of the Study Area is generally low-lying and supports wetland vegetation. This area has been more heavily impacted by clearing and grazing and the vegetation in this area has been modified. The more degraded areas of this section contain introduced pasture species, particularly grass and daisy species in the understorey with scattered *Melaleuca* and Flooded Gum (*Eucalyptus rudis*) trees in the overstorey (10.81 ha). However, some areas of wetland are in better condition and contain *Melaleuca* scrub that appears to be relatively structurally intact (7.15 ha).

The vegetation mapped within the field is likely to be equivalent to the Beard (1979) vegetation association 1000 'Mosaic: Medium forest; jarrah–marri/Low woodland; banksia/Low forest; teatree (*Melaleuca* spp.)' and the Heddle *et al*. (1980) Southern River Complex.

15.1 ha of the Study Area was rated Degraded to Completely Degraded (Condition 5 or 5-6) as these areas had been previously cleared for agriculture or for tracks.

Table 12 Vegetation type of the Study Area recorded during the field survey

Vegetation Type	Description	Condition and Priority Species	Likely equivalence to mapped vegetation types	Location	Example Photo
Upland Vegetation					
VT1: *Eucalyptus-Banksia-Agonis* woodland	Woodland of *Eucalyptus marginata, Banksia attenuata, Agonis flexuosa* and occasional *Corymbia calophylla* over tall open shrubland of *Xylomelum occidentale, Kunzea glabrescens* and *Banksia illicifolia* over low shrubland of *Xanthorrhoea brunonis, Macrozamia riedlei* and *Hibbertia* spp. over open sedgeland of *Dasypogon bromeliifolius, Lyginia imberbis* and *Desmocladus fasciculatus* over very open herbland of *Pyrorchis nigricans, Lagenophora huegelii* and *Drosera erythrorhiza.*	The majority of this vegetation type is Condition 2-3. Some sections of this vegetation type indicated greater evidence of disturbance, including dieback, vegetation clearing and weed encroachment. This generally occurred on the edges of this vegetation type adjacent to the clearing paddocks. Sections of this vegetation type ranged from condition 3-5. Some sections have been more heavily impacted, including the powerline in the centre of the site and a number of access tracks and these areas were dominated by disturbance response species, such as *Kunzea glabrescens,* and were rated Condition 5-6.	Vegetation association 1000 (Beard 1979) Vegetation complex 'Southern River' (Heddle *et al.* 1980) Gibson's (1994) FCT21a 'Central *Banksia attenuata – Eucalyptus marginata* woodlands'	Occurs across the majority of the site in upland areas Extent: 77.15 ha Q1, Q2, Q3, Q6, Q7, Q9, Q10, Q11, Q12, Q13	

Vegetation Type	Description	Condition and Priority Species	Likely equivalence to mapped vegetation types	Location	Example Photo
VT2: *Corymbia* fringing woodland	Open forest of *Corymbia calophylla* over tall open shrubland of *Xanthorrhoea brunonis* over low shrubland of *Pteridium esculentum, Opercularia hispidula* over sedgeland of *Dasypogon bromeliifolius* and open grassland of **Erhrarta longiflora* and **Briza maxima* over very open herbland of *Lagenophora huegelii.*	Condition 2-3	Vegetation association 1000 (Beard 1979) Vegetation complex 'Southern River' (Heddle *et al.* 1980)	Occurs on the slope above the wetland in a narrow band Extent: 6.1 ha Q4	
Lowland Wetland Vegetation					
VT3: *Melaleuca* tall open scrub	Tall Open Scrub of *Melaleuca rhaphiophylla, M. teretifolia* and *M. viminea* over sedgeland of *Leptocarpus laxus, Gahnia trifida* and *Juncus pallidus* over open herbland of **Hypochaeris glabra, *Romulea rosea,* and juvenile grasses.	Condition 3-4	Vegetation association 1000 (Beard 1979) Vegetation complex 'Southern River' (Heddle *et al.* 1980)	Occurs in the south-west low-lying areas of the Study Area Extent: 7.15 ha Q5, Q14	

Vegetation Type	Description	Condition and Priority Species	Likely equivalence to mapped vegetation types	Location	Example Photo
VT4: Pasture species with scattered *Melaleuca preissiana* and *Eucalyptus rudis*	Pasture grasses with scattered *Melaleuca preissiana* and *Eucalyptus rudis*	Condition ranges between 4-5	Vegetation association 1000 (Beard 1979) Vegetation complex 'Southern River' (Heddle *et al.* 1980)	Occurs within the low-lying, degraded areas in the west of the Study Area. Extent: 10.82 ha	

Vegetation Type	Description	Condition and Priority Species	Likely equivalence to mapped vegetation types	Location	Example Photo
VT5: Closed heath of *Astartea* with occasional emergent *Melaleuca preissiana*	Closed Heath of *Astartea ?scoparia* with occasional emergent *Agonis flexuosa, Kunzea glabrescens* and *Melaleuca preissiana* over sedgeland of *Leptocarpus laxus, Lepidosperma* sp. and *Patersonia* sp. over very open grassland of juvenile grasses and very open herbland of *Hypochaeris glabra*	Condition 2-3 Contains the Priority species *Acacia flagelliformis*	Vegetation association 1000 (Beard 1979) Vegetation complex 'Southern River' (Heddle *et al.* 1980)	Two isolated locations within the upland regions, one on the eastern boundary of the Study Area and one along the powerline track Extent: 0.27 ha Q8	
Additional mapping					
Altered vegetation	Vegetation no longer intact, pasture grasses dominant	Condition 6	N/A	Occurs predominantly along the edges of the Study Area, adjacent to the paddocks. Extent: 1.19 ha	

Table 13 Vegetation condition rating of the Study Area recorded during the field survey

Vegetation type	Likely equivalent to Beard (1979) vegetation associations and Heddle *et al*. (1980) vegetation complexes	Vegetation Condition (Keighery, 1994)	Area (ha)	Area (ha)
VT1: *Eucalyptus-Banksia-Agonis* woodland	Vegetation association 1000 (Beard 1979) Vegetation complex 'Southern River' (Heddle *et al.* 1980)	2-3	67.08	77.15
		3-4	4.11	
		4	0.07	
		4-5	2.01	
		5-6	3.85	
		6	0.03	
VT2: Marri fringing woodland	Vegetation association 1000 (Beard 1979) Vegetation complex 'Southern River' (Heddle *et al.* 1980)	2-3	2.21	6.10
		3-4	0.43	
		4	1.52	
		5-6	1.17	
		6	0.77	
VT3: *Melaleuca* tall open scrub	Vegetation association 1000 (Beard 1979) Vegetation complex 'Southern River' (Heddle *et al.* 1980)	3-4	7.15	7.15
VT4: Pasture species with scattered *Melaleuca preissiana* and *Eucalyptus rudis*	Vegetation association 1000 (Beard 1979) Vegetation complex 'Southern River' (Heddle *et al.* 1980)	2-3	0.19	10.82
		4	2.59	
		5-6	7.33	
		6	0.71	
VT5: Closed heath of *Astartea* with occasional emergent *Melaleuca preissiana*	Vegetation association 1000 (Beard 1979) Vegetation complex 'Southern River' (Heddle *et al.* 1980)	2-3	0.24	0.27
		5-6	0.03	
Altered Vegetation	N/A	6	1.19	1.19
	Total			102.68

4.7.4 Threatened & Priority Ecological Communities

Desktop investigations (DSEWPaC, 2013a, DPaW databases), identified a number of Threatened and Priority Ecological Communities (TECs and PECs) that occur, or have the potential to occur within 10 km of the Study Area (Table 14). No TECs/PECs have been recorded within the Study Area. The location of DPaW -mapped TECs and PECs is provided in Figure 2, Appendix A.

No TECs or PECs were identified within the Study Area during the field survey.

Table 14 Threatened and Priority Ecological Communities identified within 10 km of the Study Area

TEC/PEC description	FCT	Status (DPaW)	Status (EPBC Act)	Location	Source
TECs					
Woodlands over sedgelands in the Holocene dune swales of the southern Swan Coastal Plain	SCP19b	Critically Endangered	Endangered	Located on the coast, ~ 9.6 km south-west of the Study Area	DPaW databases
Corymbia calophylla – *Xanthorrhoea preissii* woodlands and shrublands of the Swan Coastal Plain	SCP3c	Critically Endangered	Endangered	Located ~4.5 km to the north-east of the Study Area	PMST (DSEWPaC, 2013a) DPaW databases
Corymbia calophylla woodlands on heavy soils of the southern Swan Coastal Plain	SCP 1b	Vulnerable		5 km to the south of the study area	DPaW databases
Herb rich saline shrublands in clay pans (EPBC Act listed as 'Claypans of the Swan Coastal Plain')	SCP07	Vulnerable	Critically Endangered	located 3.8 km to the south-west and 4.7 km to the west of the Study Area	PMST (DSEWPaC, 2012a) DPaW databases
Herb rich shrublands in clay plans (EPBC Act listed as 'Claypans of the Swan Coastal Plain')	SCP08	Vulnerable	Critically Endangered	located ~4 km to the north-east of the Study Area	PMST (DSEWPaC, 2012a) DPaW databases
Dense shrublands on clay flats (EPBC Act listed as 'Claypans of the Swan Coastal Plain')	SCP09	Vulnerable	Critically Endangered	located 3.2 km to the west of the Study Area	PMST (DSEWPaC, 2012a) DPaW databases
Shrublands on calcareous silts of the Swan Coastal Plain	SCP18	Vulnerable		~5.4 km to the north-west of the Study Area	DPaW databases
PECs					
Southern *Banksia attenuata* woodlands:	SCP21b	Priority 3		located ~3.5 km to the west, 5 km to the south	DPaW databases

TEC/PEC description	FCT	Status (DPaW)	Status (EPBC Act)	Location	Source
				and 8.5 km to the south-east of the Study Area	
Low-lying *Banksia attenuata* woodlands or shrublands	SCP21c	Priority 3		9.5 km to the south-west of the Study Area	DPaW databases
Quindalup *Eucalyptus gomphocephala* and/or *Agonis flexuosa* woodlands	SCP30b	Priority 3		7 km to the north-west of the Study Area	DPaW databases
Southern *Eucalyptus gomphocephala – Agonis flexuosa* woodlands	SCP25	Priority 3		8 km to the north, 5-7 km west and 9.3 km to the south-west of the Study Area	DPaW databases
Coastal shrublands on shallow soils	SCP29a	Priority 3		~7.5 km to the west of the Study Area	DPaW databases
Relictual White mangrove community (Leschenault Inlet)		Priority 1		~5.9 km to the north-west of the Study Area	DPaW databases

TEC Threatened Ecological Community

PEC Priority Ecological Community

FCT Floristic Community Type, corresponds to Gibson et al. 1994 (including System 6 and System 6 Updates) vegetation types[2]

SCP Swan Coastal Plain

P Priority

Conservation codes are provided in Appendix

4.7.5 Flora species

A NatureMap search (DPaW, 2007–) identified 867 flora species within 10 km of the Study Area.

A total of 105 plant taxa (including subspecies and varieties) representing 39 families and 75 plant genera were recorded in the Study Area during the June 2013 field survey. This included 85 native species and 20 introduced species. A complete list of the flora species recorded during the June 2013 survey is included in Table 21, Appendix D.

[2] System 6 comprises a large proportion of the IBRA Jarrah Forest Bioregion and the central portion of the Swan Coastal Plain Bioregion. System 1 is to the south west of System 6 and covers the southern end of the Swan Coastal Plain Bioregion (south of Bunbury), and parts of the Jarrah Forest and Warren Bioregions. The System 1 boundary follows the southwest System 6 boundary to the Blackwood River and then continues along the Blackwood River to its mouth, at Augusta" (Environmental Protection Authority, 2006).

The dominant families recorded within the Study Area were:

- Fabaceae 13 taxa
- Myrtaceae 13 taxa
- Proteaceae 7 taxa
- Asteraceae 6 taxa
- Orchidaceae 6 taxa

The dominant genera recorded within the Study Area were:

- *Melaleuca* 6 taxa
- *Acacia* 4 taxa
- *Drosera* 4 taxa

4.7.6 Conservation significant flora

A search of the DPaW Threatened Flora and the Western Australian Herbarium (WAHERB) databases within a 10 km radius of the Study Area was conducted. These records were collated with the EPBC Act PMST and Western Australian Museum/ DPaW NatureMap records with a search radius of 10 km Area (Table 20, Appendix D). These records indicate that 55 species of conservation significance have been recorded or potentially occur within 10 km of the Study Area. One species listed as Vulnerable under the EPBC Act and as Threatened under the WC Act, *Diuris drummondii,* has been previously recorded within the Study Area (Figure 2, Appendix A). *Diuris drummondii* is known from 12 populations between Perth and Walpole with an additional two populations identified within the City of Bunbury. This species grows in low-lying depressions in peaty and sandy clay swamps (DSEWPaC, 2008).

The field assessment included targeted surveys of the habitat of the conservation significant species identified in the desktop surveys. The field survey identified one Priority flora species: *Acacia flagelliformis* (Priority 4) within the Study Area (Plate 1). This species was recorded within dampland swales of the upland areas of the site in vegetation type VT5 'Closed heath of *Astartea'.* Within these damplands this species was a common component of the understorey and comprised between 2-10 percent of the understorey. However, the dampland areas were limited to small swales within the Study Area. One plant was also recorded adjacent to the inundated wetland in the west of the Study Area, within the lowland area. The locations of this species recorded during the field survey has been mapped at Figure 5, Appendix A and detailed in Table 15.

Table 15 Locations of priority species within the Study Area

Priority species	Co-ordinates (Zone 50)		Count/Cover
	Easting	Northing	
Acacia flagelliformis (P4)	380470	6307221	2-10 % of wetland area
Acacia flagelliformis (P4)	379353	6307104	1 plant
Acacia flagelliformis (P4)	380322	6306991	2-10 % of wetland area

Acacia flagelliformis is an erect or sometimes sprawling, often multi-stemmed subshrub normally to 0.6 m high. This species occurs from south of Bunbury to near Chapman Hill and Yarloop. It grows in sand in swampy areas in closed scrub or closed heath as well as along creeks within Jarrah – Marri Forest (Maslin, 2001).

Plate 1 *Acacia flagelliformis* within the Study Area

Likelihood of occurrence assessment

A likelihood of occurrence assessment of conservation significant flora species (based on the range, habitat requirements and previous records of the species as well as taking into account the intensity of field survey, including previous surveys, and season) was conducted for all conservation significant species identified in the desktop assessment (Table 20, Appendix D). The likelihood of occurrence assessment determined that 34 species of conservation significance species could possibly occur within the Study Area, 12 species were recorded as unlikely to occur within the Study Area and seven species were recorded as highly unlikely to occur within the Study Area.

The conservation significant orchid species *Diuris drummondii* has previously been recorded in the Study Area during previous surveys by GHD (GHD, 2011a). This species is known to occur within the Conservation Category Wetland (UFI 14353).

4.7.7 Introduced flora species

A NatureMap search (DPaW, 2007–) identified 219 introduced (weed) flora species within 10 km of the Study Area. The field survey recorded a total of 20 introduced species within the Study Area. The dominant species were grasses (Poaceae) with genera including **Ehrharta* and **Briza.* Introduced species were most dominant in the low-lying areas in the west of the Study Area, which has been previously been heavily grazed. Two weed species listed as Declared Pests under the *BAM Act: Gomphocarpus fruticosus* and *Solanum linnaeanum* (Plate 2) were recorded during the field survey and the locations of these plants have been mapped at Figure 6, Appendix A.

Plate 2 **Solanum linnaeanum* within the Study Area

4.8 Fauna

4.8.1 Fauna habitat types

Two broad habitat types were identified within the Study Area based on the predominant landforms, soils and vegetation structure (Table 16). These habitat types are closely aligned with the vegetation types outlined in section 4.7.3.

Table 16 Fauna habitat types

Fauna habitat type	Photo
Woodland - Jarrah-Marri-Banksia-Peppermint The woodland habitat type corresponds with vegetation types 1 and 2, *Eucalyptus-Banksia-Agonis* woodland (VT1) and *Corymbia* fringing woodland (VT2). The Jarrah-Banksia-Peppermint woodland covers the majority of the Study Area, and is dominated by Jarrah, Banksia and Peppermint trees with scattered Marri trees (Figure 7). The mid- and understorey vegetation is predominantly open, with some patches of denser sedges and herbs. There are also areas of fringing Marri woodland, which has an open mid-storey and relatively dense groundcover layer. This woodland habitat type is in excellent condition and provides particularly high habitat value for fauna species due to the variety of microhabitats and various resource niches available. The woodland therefore provides habitat for a wide variety of fauna species, in particular the conservation significant Western Ringtail Possum (*Pseudocheirus occidentalis*), Quenda (*Isoodon obesulus fusciventer*), Chuditch (*Dasyurus geoffroii*), Southern Brush-tailed Phascogale (*Phascogale tapoatafa tapoatafa*), Western Brush Wallaby (*Macropus irma*) and all three Black Cockatoo species. The woodland habitat would also be expected to support a high diversity of bird species. Throughout this habitat there are areas of loose sands that are particularly suitable for burrowing reptiles, such as the Coastal Plains Skink (*Ctenotus ora*). The thick ground cover in some areas would also provide foraging opportunities and refuge areas for ground-dwelling mammals such as the Quenda and reptiles such as goannas and skinks. Micro-habitat features such as tree hollows and cavities provide habitat for a number of birds, reptiles and small mammal species. Specifically these tree hollows and cavities would provide nesting habitat for the Southern Brush-tailed Phascogale, Western Ringtail Possum and Black Cockatoo species, all of which are known to occur within the Study Area. There is also an abundance of hollow logs scattered throughout this habitat type, which would provide habitat for ground-dwelling mammals and reptiles. The presence of Jarrah, Marri and Banksia as well as other proteaceous species provides feeding habitat for all three conservation significant Black Cockatoo species (Carnaby's, Baudin's and Forest Red-tailed). There are also scattered breeding habitat trees throughout this habitat type, a large proportion of which were dead (section 4.8.5) There is some disturbance to this habitat type, such as previous clearing for grazing, a powerline track, dieback and weed incursion. This generally occurred on the edges of the vegetation adjacent to the cleared paddocks. However, although these disturbances have resulted in some areas having little to no understorey, the vegetation mostly remains intact.	 Jarrah-Banksia Woodland  Marri Woodland  Tree cavity

Fauna habitat type	Photo
Wetlands Wetlands cover the western portion of the Study Area, and include patches of *Melaleuca* woodlands over sedgelands associated with winter-wet depressions and some areas of standing water (Figure 7). During the wet winter months the soils in these areas are likely to be waterlogged or partially inundated. The density of the tall shrubs and canopy of the *Melaleuca* woodlands provide good foraging and nesting habitat for bird species. The wetlands also provide good habitat for reptiles and amphibians, in particular frog species, with a number recorded during the field survey. There denser understorey of ground layer of sedges, herbs and low shrubs in some areas would also provide suitable habitat for ground-dwelling mammals, in particular the Quenda. The western fringing vegetation of the wetlands also provide suitable habitat for the Western Ringtail Possum, with dreys and scats recorded during both the current (Figure 8) and previous surveys (GHD 2009b; 2010b, 2011a). In addition the fauna field survey GHD (2010b) also included an assessment and targeted netting of ephemeral wetlands within the Study Area to identify the occurrence of two conservation significant fish species Balston's Pygmy Perch (*Nannatherina balstoni*) and Black-strip Minnow (*Galaxiella nigrostriata*). The searches did not identify these species within, or in proximity to the Study Area. There are also some areas of degraded wetland vegetation over pasture grasses, which would provide limited refugia for fauna species. These areas would provide foraging habitat for bird species.	 Inundated wetland  *Melaleuca* woodland

4.8.2 Habitat value

The habitats present within the Study Area vary from predominantly Good to Excellent condition, and in general provide a wide-variety of habitat resources for fauna species. The Study Area is therefore considered to provide valuable habitat for fauna species, in particular for the conservation significant Western Ringtail Possum, Southern Brush-tailed Phascogale, and all three Black Cockatoo species.

There was abundant evidence of Western Ringtail Possums throughout the Study Area during the current field survey (Figure 8), and supported the results from previous surveys (GHD 2009b; 2010b; 2011a). This evidence suggests a high level of use by the species.

Similarly, there was abundant evidence of Black Cockatoos throughout the Study Area during the current field survey (Figure 8), as well as having been recorded during previous surveys (GHD 2009b; 2010b; 2011a). This evidence suggests that the Study Area is used for foraging by all three species of Black Cockatoos and provides potential breeding and roosting habitat.

Previous surveys of the Study Area have recorded the presence of Southern Brush-tailed Phascogales. Five individuals were recently captured and radio-collared from the Study Area as part of a recent study on arboreal mammals during the Bunbury Outer Ring Road construction (Hunter 2012).

4.8.3 Habitat linkages

Local habitat linkages

The Study Area is part of a large block and is bound by three roads, the Boyanup-Picton Road to the north-east, the Bunbury Port Access Road to the west and the BORR to the south. Within this larger block, there are habitat linkages between the Study Area and the larger wetland areas to the west, wetland patches and remnant bushland to the south (north of BORR), a wetland area to the east and remnant bushland to the north-west (south of the industrial area on Boyanup-Picton Road). This remnant bushland includes Miscellaneous Reserve (R40552, 13.72 ha), which is connected to habitat within the Study Area.

There is also a small patch of remnant bushland immediately to the north of the Study Area, within the Koppers Woods Products facility. However the majority of this remnant bushland is proposed to be cleared as part of the facility's expansion. This proposed clearing has recently received approval from DSEWPaC as part of a referral (EPBC referral 2012/6691).

Regional linkages

The Environmental Protection Authority (EPA) in its publication, Environmental Protection Bulletin 1282 (EPA 2008) listed large areas of remnant vegetation as having environmental significance. This 'significance' includes priority flora and fauna habitat, priority flora populations, ecological linkages and wetlands.

The EPA Bulletin assessed the environmental values of the wetlands, the quality and quantity of the existing remnant vegetation and the existing habitat values contained within the area assessed (Investigation Areas). EPA Bulletin 1282 assessed the regional significance of remnant vegetation within the Investigation Areas based on desktop investigations, consultant's reports and site visits by the DPaW (formerly the Department of Environment and Conservation (DEC)). A total of six biodiversity criteria were used to determine the regional significance of each remnant, including, representation of communities, diversity, rarity, maintenance of processes, scientific or evolutionary and wetland protection.

There are two Investigation Areas examined in EPA Bulletin 1282 located within the Study Area, Investigation Areas 10 and 14.

Within EPA Bulletin 1282, the natural attributes of the Investigation Area 10 include:

- Diversity – A highly diverse area with respect to diversity of landforms, wetland and upland vegetation units, habitat and fauna.
- Rarity – Guildford vegetation complex, location of one Priority and nine poorly reserved Flora, and the location for two threatened bird species (Forest Red-tailed Black Cockatoo and Carnaby's Black Cockatoo), one threatened mammal species (Western Ringtail Possum), and at least 11 bird species listed as conservation significant on the Swan Coastal Plain.
- Maintaining Ecological Processes or Natural Systems – Part of a regional ecological linkage: McLarty/Kemerton/Twin Rivers/Preston River/Gwindinnup (north-south ecological linkage).
- General Criteria for the Protection of Wetland, Streamline, and Estuarine Fringing Vegetation and Coastal Vegetation – The area contains a Conservation Category wetland.

The Natural attributes of Investigation Area 14 include:

- Rarity – Location for Declared Rare Flora *Diuris drummondii*, and the location of one threatened mammal species (Western Ringtail Possum), and at least five bird species listed as conservation significant on the Swan Coastal Plain.
- Maintaining Ecological Processes or Natural Systems – Part of a regional ecological linkage: McLarty/Kemerton/Twin Rivers/Preston River/Gwindinnup (north-south ecological linkage).

The EPA's opinion regarding Investigation Areas 10 and 14 is that they are regionally significant natural areas of high value, which should be retained within the future planning of the Preston Industrial Park area, as Regional Open Space in the GBRS (EPA 2008).

Based on the EPA's assessment of the Study Area, the ecological values of the remnant vegetation within the Study Area are considered to be of high value, and regionally significant. The results of this field survey confirm this assessment, particularly given the value of the Study Area in terms of rare flora and fauna, wetland areas and maintenance of a significant area of remnant vegetation.

Prior to the construction of the BORR and BPAR, the Study Area was well connected to ecological linkages in the region, in particular to areas of continuous remnant vegetation to the west and east. The construction of these roads currently presents a barrier to these ecological linkages, and may limit the movement of fauna along these corridors. This may, to some extent, reduce the value of the Study Area in maintaining the ecological linkages outlined by the EPA Bulletin 1282.

Regional significance

The Study Area provides a large area of remnant vegetation within a largely cleared landscape, and therefore is a regionally significant area of habitat within the greater Bunbury region. The Study Area is substantial in size (103 ha), and therefore able to support a wide-variety of fauna species. While there are some anthropogenic barriers to the movement of fauna between the Study Area and other areas of regional vegetation, some fauna species (such as small to medium birds) are still able to move through habitat linkages to the north and south.

Recently, a rope bridge has also been constructed over the BORR, which provides an overpass for arboreal fauna to the south of the Study Area. This rope bridge was built specifically with the purpose of providing a linkage for Western Ringtail Possums between the Study Area and other areas of suitable habitat to the south of the BORR. Therefore, this rope bridge overpass allows

for potential movement of individuals to and from the Study Area, providing connectivity and genetic exchange with adjacent areas.

4.8.4 Fauna diversity

A NatureMap search (DPaW, 2007–) identified 342 fauna species within 10 km of the Study Area.

The spring field survey recorded a total of 66 fauna species, consisting of 52 birds, four amphibians, one reptile and 10 mammals. Of these, 59 are native and seven species are introduced.

A list of the fauna species recorded during the survey is provided in Appendix E.

4.8.5 Conservation significant fauna

Desktop queries of the EPBC Act Protected Matters Search and NatureMap Database were undertaken over a 10 km radius of the Study Area, which identified the presence of 70 conservation significant fauna species.

A list of the conservation significant species identified in the desktop review is provided in Appendix C.

Migratory species

A number of species recorded in the desktop searches are listed as Migratory under the EPBC Act (i.e. migratory marine, migratory terrestrial or migratory wetland). Species solely listed as migratory marine (e.g. the Blue Whale, *Balaenoptera musculus*) were excluded from this assessment as no marine habitat was present within the Study Area.

Within the Study Area, there is suitable wetland habitat for migratory wetland bird species, such as the Eastern Great Egret (*Ardea modesta*). These species migrate to optimal wetlands at different times of the year, and therefore may temporarily use the wetland habitat available in the Study Area.

One migratory terrestrial species, the Rainbow Bee-eater, is known to occur and has been observed breeding within the Study Area during previous surveys, and therefore the Study Area is considered to provide good quality habitat for the species (GHD 2009b; 2010b; 2011a).

There are two migratory terrestrial species which also may occur within the Study Area, including the While-bellied Sea-Eagle and the Malleefowl. However, there is no suitable habitat for either the Malleefowl or While-bellied Sea-Eagle within the Study Area, and therefore both species are considered unlikely to occur.

Field survey

During the field survey five conservation significant species were recorded, including:

- Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*) – Endangered under EPBC Act and Threatened under WC Act
- Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) – Vulnerable under EPBC Act and Threatened under WC Act
- Baudin's Black Cockatoo (*Calyptorhynchus baudinii*) – Vulnerable under EPBC Act and Threatened under WC Act
- Western Ringtail Possum (*Pseudocheirus occidentalis*) – Vulnerable under EPBC Act and Threatened under WC Act

- Quenda/Southern Brown Bandicoot (*Isoodon obesulus fusciventer*) – Listed as Priority 5 by the DPaW

In addition to this, two other conservation significant species have previously been recorded within the Study Area:

- The Rainbow Bee-eater (*Merops ornatus*), which is listed as Migratory under the EPBC Act and the WC Act, was previously recorded breeding within the Study Area during GHD fauna surveys (GHD 2009b; GHD 2009b ; 2011a).
- The Southern Brush-tailed Phascogale (*Phascogale tapoatafa tapoatafa*), which is listed as Threatened under the WC Act, has previously been recorded as part of a study by Hunter (2012) within the Study Area.

Likelihood of occurrence

In addition to the fauna species recorded during the field survey, a number of conservation significant fauna species were identified as potentially occurring within the Study Area during the desktop investigation. An assessment on the likelihood of these species occurring in the Study Area was undertaken. This assessment is based on species biology, habitat requirements, the quality and availability of suitable habitat and records of the species in the area. The assessment is provided in Appendix E.

The assessment concluded that seven species are known to occur, four species are likely to occur, five species could possibly occur and 12 species are unlikely to occur in the Study Area. A summary of the fauna species known to be present, considered likely to occur or possibly occur in the Study Area are listed in Table 17.

Table 17 Summary of the conservation significant fauna likelihood of occurrence assessment

Species name	Common name	Status	Likelihood of occurrence
Calyptorhynchus banksii naso	Forest Red-tailed Black Cockatoo	T; V	Known
Calyptorhynchus baudinii	Baudin's Black Cockatoo	T; V	Known
Calyptorhynchus latirostris	Carnaby's Black Cockatoo	T; E	Known
Merops ornatus	Rainbow Bee-eater	Mi	Known
Isoodon obesulus fusciventer	Quenda	P5	Known
Phascogale tapoatafa tapoatafa	Southern Brush-tailed Phascogale	T	Known
Pseudocheirus occidentalis	Western Ringtail Possum	T; V	Known
Ardea ibis	Cattle Egret	Mi	Likely
Ardea modesta	Eastern Great Egret	Mi	Likely
Macropus irma	Western Brush Wallaby	P4	Likely
Ctenotus ora	Coastal Plains Skink	P1	Likely
Botaurus poiciloptilus	Australasian Bittern	T; E	Possible
Falco peregrinus macropus	Peregrine Falcon	S	Possible
Ixobrychus flavicollis subsp. australis	Australian Black Bittern	P3	Possible
Ixobrychus minutus subsp. dubius	Australian Little Bittern	P4	Possible
Dasyurus geoffroii	Chuditch	T; V	Possible

A brief description of each of these species and their associated habitat types are described below.

Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*)

The Carnaby's Black Cockatoo is listed as Endangered under the EPBC Act and Threatened (Schedule 1) under the WC Act. It is distributed across the south-west of Western Australia in uncleared or remnant areas of *Eucalyptus* woodland and shrubland of kwongan heath. Carnaby's Black Cockatoo breeds in the semi-arid and sub-humid interior ("wheatbelt") and some locations along the south and west coasts. From late January/early February most interior-breeding birds leave their breeding areas, moving west and south towards the coast. The movement back to breeding sites in the interior occurs in July/August, and September/October to breeding areas on the Swan Coastal Plain (DSEWPaC 2012).

The Carnaby's Black Cockatoo was recorded in large Marri trees during the field survey.

Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*)

The Forest Red-tailed Black Cockatoo is listed as Vulnerable under EPBC Act and Threatened (Schedule 1) under the WC Act. It is endemic to the south-west humid and sub-humid zones of Western Australia, where it inhabits dense Jarrah, Karri and Marri forests receiving more than 600 mm of annual average rainfall. The species is thought to breed in October/November, but in years with good autumn rainfall they may breed in March/April (DSEWPaC 2012).

The Forest Red-tailed Black Cockatoo was recorded foraging in large Marri trees within the Study Area during the field survey.

Baudin's Black Cockatoo (*Calyptorhynchus baudinii*)

The Baudin's Black Cockatoo is listed as Vulnerable under EPBC Act and Threatened (Schedule 1) under the WC Act. The species inhabits eucalypt forests and is endemic to the south-west humid and sub-humid zones of Western Australia, and is generally distributed within the 750 m isohyet of average annual rainfall. From March, flocks migrate north to the central and northern parts of the Darling Scarp for the non-breeding season, and then move back to breeding areas from August. Some flocks also move on to the southern Swan Coastal Plain and south coast during the non-breeding season (DSEWPaC 2012).

The Baudin's Black Cockatoo was recorded foraging in large Marri trees within the Study Area during this field survey.

Black Cockatoo habitat assessment

Foraging Habitat

Foraging habitat for Black Cockatoos includes proteaceous species such as Banksia, Hakea, Grevillea as well as *Allocasuarina* and *Eucalyptus* species (DSEWPaC 2012). Carnaby's Black Cockatoos in particular forage in native shrubland, kwongan heathland and woodland dominated by proteaceous species, as well as pine plantations, eucalyptus woodland and forest that contain foraging species. Baudin's Black Cockatoo forage is eucalypt woodlands and forests, proteaceous woodland and heath, and the Forest Red-tailed Black Cockatoo forages in eucalypt woodlands and forests (DSEWPaC 2012).

The majority of the vegetation in the Study Area contains suitable foraging species for all Black Cockatoos (Figure 7). This includes *Eucalyptus* species (particularly Marri nuts) and *Banksia* species (including *Banksia attenuata*, *B. menziesii*, *B. ilicifolia*, *B. grandis, and Hakea* spp.).These species are regarded as high value foraging species for Black Cockatoos. There is 83.25 ha of woodland vegetation type contain suitable foraging habitat for Black Cockatoos.

There was recent Black Cockatoo foraging evidence found throughout the entire Study Area, including chewed Marri and Jarrah nuts and chewed Banksia cones. Both Baudin's Black Cockatoo and the Forest Red-tailed Black Cockatoo were observed foraging within the Study

Area during the field survey (Figure 8). Two observations of Forest Red-tailed Black Cockatoos foraging within the Study Area are shown in Plate 3.

Black Cockatoo foraging evidence has been recorded within the Study Area in previous surveys (GHD 2009b; GHD 2010b; 2011a, see Appendix F).

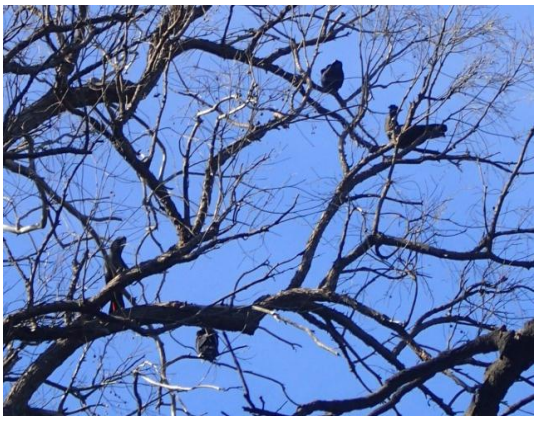

Plate 3 Forest Red-tailed Black Cockatoos observed foraging within the Study Area

Breeding Habitat

Breeding habitat is defined as a tree of species known to support breeding within the range of the Black Cockatoo species which either have a suitable nest hollow or are of a suitable diameter at breast height (DBH) to develop a nest hollow (DSWEPaC, 2012b).

Trees with potential nesting qualities include Tuart (*Eucalyptus gomphocephala*), Jarrah (*E. marginata*), Marri (*Corymbia calophylla*), Karri (*E. diversicolor*), Flooded Gum (*E. rudis*), York Gum (*E. loxophleba subsp. loxophleba*), Powderbark (*E. accedens*), Bullich (*E. megacarpa*) and Blackbutt (*E. patens*) with a DBH of greater than 500 mm, as well as Wandoo (*E. wandoo*) and Salmon Gum (*E. salmonophloia*) with a DBH of greater than 300 mm. Trees of this size are considered to have nesting potential now, or will develop hollows within 100 years. Of these species, Jarrah, Flooded Gum and Marri were all recorded from the Study Area.

The Study Area is located within the known breeding range for the Carnaby's Black Cockatoo and Baudin's Black Cockatoo, and within the modelled distribution of Forest Red-tailed Black Cockatoo (DSEWPaC 2012). The timing of the field survey was outside the breeding season of all three species of Black Cockatoos, and no records of breeding were noted during the field survey.

There is suitable breeding habitat for Black Cockatoos within the Study Area. There are scattered suitable habitat trees throughout the woodland habitat type, and a large proportion of these contain hollows suitable for Black Cockatoos to use in nesting.

This is reflected in the results of the 13 habitat tree quadrat counts (shown in Table 18). Overall, within the 50 m x 50 m quadrats, between one and six Black Cockatoo habitat trees were recorded within the woodland habitat type, with an average of 3.5 trees per quadrat. This equates to approximately 14 habitat trees per hectare. The habitat trees within the Study Area were generally very old, and therefore had a DBH of much greater than 500 mm. The average DBH for all of the quadrats was 833 mm. A large proportion of the habitat trees were also dead, some as a result of having been burnt. These particular trees generally had more hollows of a suitable size for Black Cockatoo nesting. The locations of the habitat tree quadrat counts are shown in Figure 9.

Table 18 Black Cockatoo habitat tree quadrat counts

Tree count quadrat	No. trees		Average DBH (cm)	Tree species	Habitat type
	Hollows	No Hollows			
TC1	3	3	846	Jarrah/Marri	Woodland
TC2	1	0	1120	Dead	Woodland
TC3	3	0	874	Dead	Woodland
TC4	1	1	1085	Jarrah/Marri	Woodland
TC5	0	0			Wetland
TC6	3	0	1121	Dead	Woodland
TC7	0	4	717	Jarrah/Marri	Woodland
TC8	1	5	771	Jarrah/Dead	Woodland
TC9	1	4	772	Jarrah/Dead	Woodland
TC10	1	2	593	Jarrah/Dead	Woodland
TC11	1	2	776	Marri/Dead	Woodland
TC12	2	1	640	Dead	Woodland
TC13	1	2	690	Jarrah/Dead	Woodland

Roosting Habitat

All three species of Black Cockatoos use communal night roosting sites. Flocks of Black Cockatoos show some fidelity to roost sites, with traditional night roost sites being used most years to access high quality feeding sites. Due to changing patterns of food and water availability across the landscape, not all night roosts will be used every year (DSEWPaC, 2012). Groups for birds will roost in a suitable tree or group of tall trees, usually close to an important water source, and within an area of quality foraging habitat. Night roosts are generally located in the tallest trees in the area (DSEWPaC, 2012).

Baudin's and Carnaby's Black Cockatoos generally roost in or near riparian environments, or permanent water sources, in *Eucalyptus* species. Forest Red-tailed Black Cockatoos generally roost in tall Jarrah, Marri, Blackbutt, Tuart and introduced eucalypt trees, within, or on the edges of forests (DSEWPaC, 2012).

According to mapping provided by the Department of Planning Western Australia (2011) there are no known roosting sites within 10 km of Study Area.

There was no evidence recorded of the Study Area being used for roosting during the field survey. However, there is suitable roosting habitat for the Black Cockatoos throughout the woodland habitat within the Study Area.

Western Ringtail Possum

The Western Ringtail Possum is listed as Vulnerable under the EPBC Act and Threatened under the WC Act. Western Ringtail Possums occur only in the south west region of Western Australia where they feed on Peppermint (*Agonis flexuosa*) and Eucalyptus species. In populated areas they will also feed on introduced plant species which include roses, *Ficus spp*. and suburban fruit trees (Van Dyck and Strahan 2008). The species is now restricted to wetter coastal areas of the south-west, with populations occurring inland in Jarrah, Wandoo and Marri forests (Van Dyck and Strahan 2008). The reduction in population size is primarily due to the loss of habitat, however the species is also preyed upon by feral predators.

The Study Area is mapped as supporting habitat for the Western Ringtail Possum within the significant impact guidelines for the species (DSEWPaC 2009). The majority of the Study Area, in particular the Jarrah-Banksia-Peppermint woodland, provides high value habitat for the

Western Ringtail Possum. In total there is 83.25 ha of known suitable habitat for the Western Ringtail Possum within the Study Area (Figure 7).

Western Ringtail Possums were recorded during the field survey, including sightings, dreys and scat records (Plate 4). These records are shown in Figure 8. During the targeted nocturnal spotlighting on the 11th of June, a total of 19 individuals were recorded, including 18 adults and one juvenile (juvenile shown in Plate 4a). There were also abundant scat records throughout the Study Area, and a number of dreys. It was noted that fewer dreys were recorded during the current survey, than during previous surveys by GHD (2009b; 2011a, see Appendix F).

The species has also previously been recorded in the Study Area (Hunter 2012). Individuals were radio-collared and tracked with the aim to compare the survival rate of Western Ringtail Possums depending on whether they were relocated during the construction of Stage 1 of the BORR.

The previous investigations and the field survey indicate that the Study Area contains significant habitat for the species, and supports a considerable population of Western Ringtail Possums.

Plate 4 Western Ringtail Possum evidence within the Study Area. (a) Juvenile recorded during nocturnal spotlighting, (b) scats, (c) suitable habitat (d) large hollow log which would provide habitat.

Quenda/Southern Brown Bandicoot

The Quenda, also known as the Southern Brown Bandicoot, is listed Priority 5 by the DPaW. It is widely distributed near the south-west coast from Guilderton north of Perth to east of Esperance, patchy distribution through the Jarrah and Karri forest and on the Swan Coastal Plain, and inland as far as Hyden. Its optimum habitat includes scrubby, often swampy, vegetation with dense cover up to one metre high, often feeds in adjacent forest and woodland that is burnt on a regular basis and in areas of pasture and cropland lying close to dense cover. On the Swan Coastal Plain, Quendas are often associated with wetlands (Van Dyck and Strahan 2008).

Within the Study Area the wetlands and densely vegetated areas of the woodland habitats, particularly those closely associated with the seasonal damplands and those that contain a dense understorey, provide suitable habitat for Quenda. A number of diggings were observed in the Study Area, particularly in the north-eastern corner of the Study Area in the denser parts of the woodland habitat type (Figure 8). This species has previously been recorded within the Study Area during previous surveys (GHD 2009b; GHD 2009b; 2011a, see Appendix F).

Plate 5 Suitable Quenda habitat, including dense understorey vegetation within the woodland habitat (a) and wetland heath habitat (b)

Southern Brush-tailed Phascogale

The Southern Brush-tailed Phascogale is listed as Threatened under the WC Act, and occurs in dry sclerophyll forests and open woodlands with a generally sparse ground-storey. This species requires habitat that contains suitable nesting resources such as tree hollows, rotted stumps and tree cavities (Van Dyck and Strahan 2008). In particular, tree hollows that have a small and secure entrance with a large internal cavity are highly favoured by breeding individuals.

No evidence of the Southern Brush-tailed Phascogale was recorded during the field survey, however the species has previously been recorded as part of a study by Hunter (2012) within the Study Area. Five individuals were captured and radio collared as part of this study. There is suitable habitat for this species throughout the Study Area, including tree hollows, rotted stumps and tree cavities. In total there is 83.25 ha of known woodland habitat for the Southern Brush-tailed Phascogale within the Study Area (Figure 7).

Western Brush Wallaby

The Western Brush Wallaby is listed Priority 4 by the DPaW and is endemic to the south-west of Western Australia. Its optimum habitat is open forest or woodland, particularly favouring open, seasonally wet flats with low grasses and open scrubby thickets. It is also found in some areas of mallee and heath and is uncommon in wet sclerophyll forest and absent from the true Karri forests that have dense undergrowth (Van Dyck and Strahan 2008).

Within the Study Area, the Jarrah-Banksia-Peppermint woodland and Marri woodland would provide suitable habitat for the Western Brush Wallaby. The species has also been recorded with the Bunbury region and on the Swan Coastal Plain and given the considerable size of the Study Area, it is possible that the species occurs in low numbers.

Chuditch

The Chuditch is listed as Vulnerable under the EPBC Act and Threatened under the WC Act. The species inhabits eucalypt forest (especially Jarrah), dry woodland and mallee shrublands. In Jarrah forest, Chuditch populations occur in both moist, densely vegetated, steeply sloping forest and drier, open, gently sloping forest. Most diurnal resting sites in sclerophyll forest consist of hollow logs or earth burrows. The species can travel large distances, has a large

home range and is sparsely populated through a large portion of its range (Van Dyke & Strahan, 2008).

There is suitable habitat for the Chuditch within the Study Area, and the species is known to occur between Collie and Bunbury. However due to habitat loss surrounding Bunbury, the likelihood of the species occurring in the Study Area is reduced. Given the size and largely unfragmented status of the Study Area, it is possible that the species occurs in low numbers.

Coastal Plains Skink

The Coastal Plains Skink is listed at Priority 1 by the DPaW and has been newly described and separated from *Ctenotus labillardieri* by Kay & Keogh (2012). The Coastal Plains Skink is locally restricted to the sandy regions of the Swan Coastal Plain south of Perth.

While no evidence of the Coastal Plains Skink was recorded within the Study Area, there is suitable sandy soil habitat for the species, and it has been recorded less than 1 km north of the Study Area, near the intersection of Boyanup-Picton Road and South-Western Highway.

Rainbow Bee-eater

The Rainbow Bee-eater prefers open forests and woodlands, shrublands, and in various cleared or semi-cleared habitats, including farmland and areas of human habitation. It also inhabits sand dune systems in coastal areas and at inland sites that are in close proximity to water (DSEWPaC 2013c). The species prefer to breed in open cleared areas in heavily forested woodlands or in farmlands, and in breeding season (November – February) the Rainbow Bee-eater constructs a burrow on the ground in sandy or clay soils.

Rainbow Bee-eaters have been recorded within the Study Area during previous surveys (GHD 2009b, GHD 2010b; GHD 2011a, see Appendix F). Observations were made of three pairs of Bee-eaters nesting just east of the wetland area in the Study Area. Rainbow Bee-eaters were also observed along the eastern boundary of the Study Area.

Cattle Egret, Eastern Great Egret, Australasian Bittern, Australian Little Bittern, Peregrine Falcon and Australian Black Bittern

The Cattle Egret, Eastern Great Egret, Australasian Bittern, Australian Little Bittern, Peregrine Falcon and Australian Black Bittern are wide-ranging species that may potentially utilise the Study Area occasionally.

The Australasian Bittern, Australian Little Bittern, Australian Black Bittern, Cattle Egret and Eastern Great Egret are known to inhabit wetlands, and likely to migrate to optimal wetlands at different times of the year. It is possible that these species may temporarily use the wetland areas within the Study Area.

The Peregrine Falcon is seen occasionally anywhere in the south-west of Western Australia, and is known to occur in the greater Bunbury Region. It may therefore be an occasional visitor to the Study Area, however it does not occur in or around any cliff or potential breeding areas for the species.

4.8.6 Introduced fauna species

A NatureMap search (DPaW, 2007–) identified 12 introduced fauna species within 10 km of the Study Area.

Seven introduced species were recorded during the field assessment, including the Rabbit (*Oryctolagus cuniculus*), the domestic cow (*Bos taurus*), the red fox (*Vulpes vulpes*), the domestic dog (*Canis lupus*), the horse (*Equus caballus*), Rainbow Lorikeet (*Trichoglossus haematodus*) and Laughing Kookaburra (*Dacelo novaequineae*).

4.9 Contaminated sites

A search of the DER Contaminated Sites Database (DER 2013) did not identify any contaminated sites within the Study Area.

4.10 Indigenous Heritage

A search of the Department of Aboriginal Affairs (DAA) Aboriginal Heritage Inquiry System (DAA 2013) did not identify any Registered Heritage Sites within the Study Area. However two Other Heritage Sites occur within the Study Area and a number have been recorded within the vicinity of the Study Area (Figure 4, Appendix A).

5. Summary of Environmental Values

The environmental values of the Study Area determined from the desktop and field assessments are summarised below:

- The Study Area is a large area of 103 ha that includes a variety of landforms, including upland areas with remnant vegetation in excellent condition and lowland areas with wetlands.
- Five geomorphic wetlands occur within the Study Area including one Conservation Category, one Resource Enhancement and three Multiple Use wetlands.
- There are two ESAs within the Study Area, one of these is associated with the Conservation Category Wetland in the south-eastern corner of the Study Area and the other ESA is associated with the record of a Threatened flora species.
- Heddle *et al*. (1980) mapping identified two vegetation complexes within the Study Area: Guildford Complex and Southern River Complex. These complexes have 5 % and 19.8 % respectively of their pre-European extent remaining. The Study Area contains 0.35% of the current extent of the Guildford complex and 0.75% of the current extent of the Southern River complex. The field survey determined that the vegetation types within the Study Area are most likely equivalent to the Southern River Complex.
- The majority of the Study Area contains high quality vegetation with 83 % of the Study Area rated condition Good (4) or better. Sections of the Study Area that had been previously cleared and grazed still maintained good vegetation structure and showed evidence of regeneration of native species.
- One Threatened species, *Diuris drummondii,* has been previously recorded within the wetland section of the Study Area and a Priority 4 species, *Acacia flagelliformis* was recorded in three locations during the field survey.
- The wetland areas of the site are considered high value habitat for conservation significant flora.
- The habitats present within the Study Area vary from predominantly good to excellent condition, and in general provide a wide-variety of habitat resources for fauna species. The Study Area is therefore considered to provide valuable habitat for fauna species, in particular for the conservation significant Western Ringtail Possum, Southern Brush-tailed Phascogale, and all three Black Cockatoo species. In total the Study Area provides 82.25 ha of known habitat for the Western Ringtail Possum, Southern Brush-tailed Phascogale, and all three Black Cockatoo species.
- The EPA assessed the Study Area as part of an assessment of a large area (EPA 2008) and considered that the ecological values of the remnant vegetation within the Study Area are considered to be of high value, and regionally significant.
- The Study Area provides a large area of remnant vegetation within a largely cleared landscape, and therefore is a regionally significant area of habitat within the greater Bunbury region. The Study Area is substantial in size, and therefore able to support a wide-variety of fauna species. While there are some anthropogenic barriers to the movement of fauna between the Study Area and other areas of regional vegetation, some fauna species (such as small to medium birds) are still able to move through habitat linkages to the north and south.
- Recently, a rope bridge has also been constructed over the BORR, which provides an overpass for arboreal fauna to the south of the Study Area. This rope bridge was built

specifically with the purpose of providing a linkage for Western Ringtail Possums between the Study Area and other areas of suitable habitat to the south of the BORR. Therefore, this rope bridge overpass allows for potential movement of individuals to and from the Study Area, providing connectivity and genetic exchange with adjacent areas.

Inclusion of the site as an environmental offset would:

- Increase the area of Heddle vegetation complex Southern River in secure tenure. This complex currently has only 19.8 % of its pre-European extent remaining, with only 1.5 % of their current extent within secure tenure.
- Result in improved management of the land which will ultimately lead to improved vegetation condition.
- Provide protection to known habitat of conservation significant flora species.
- Provide habitat protection for threatened fauna present in the area. In particular Carnaby's Black Cockatoo, Baudin's Black Cockatoo, Forrest Red-tailed Black Cockatoo, Southern Brush-tailed Phascogale and the Western Ringtail Possum.

5.1 Land management measures

Should the Study Area be considered a suitable offset then a Management Plan should be prepared and implemented for the site. This Management Plan would include issues as site fencing, fire break installation, dieback management weed control (particularly the Declared Pests identified during the field survey) and site revegetation. This management plan should be agreed with DPaW prior to implementation.

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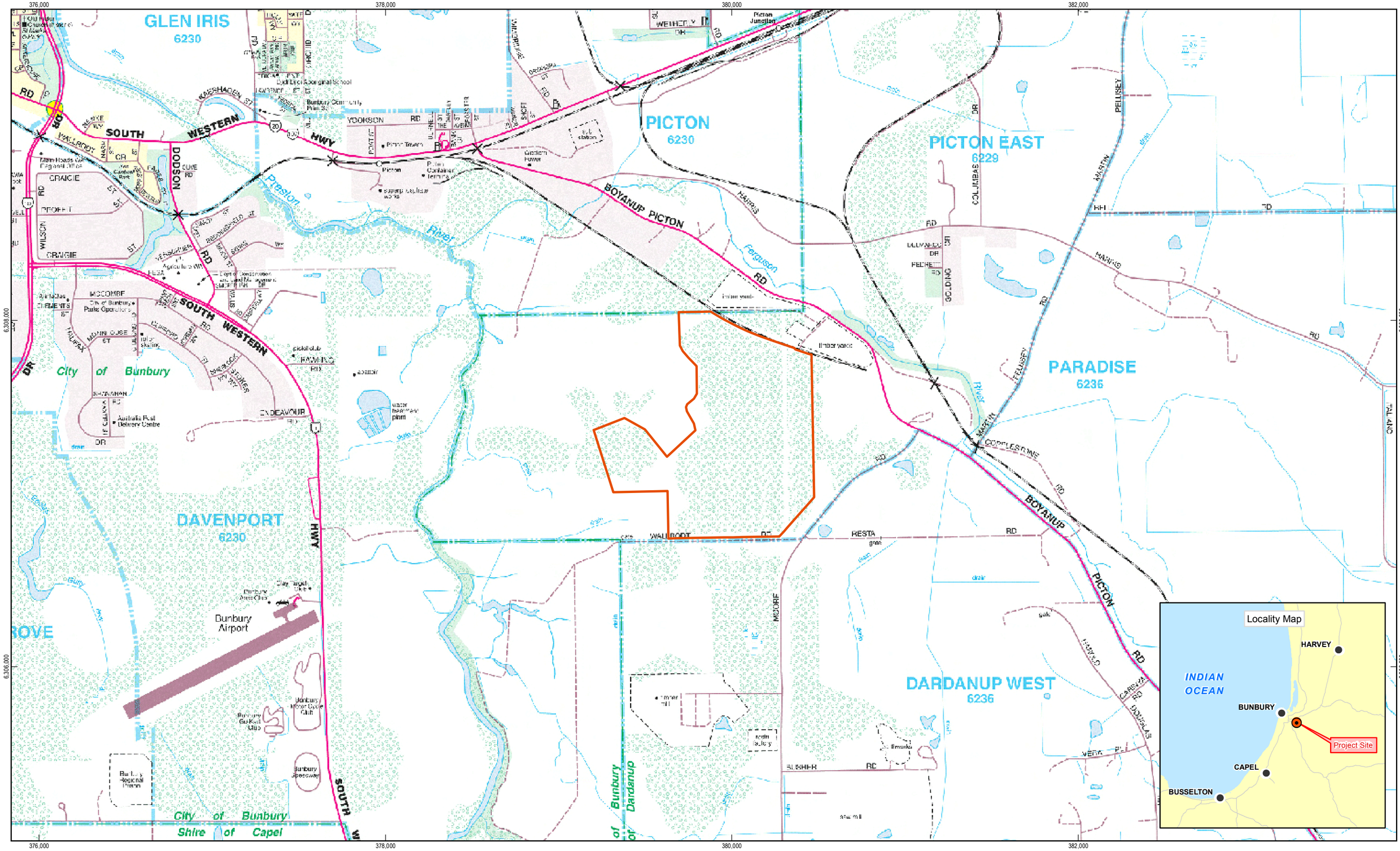
Appendices

Appendix A – Figures



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0 100 200 400 600 800 1,000

Metres

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

N

LEGEND

Study Area

Main Roads WA
Lot 5 - Boyanup Picton Road, Picton East
Environmental Values Assessment

Job Number	61-29512
Revision	0
Date	15 Jul 2013

Study Area: Locality

Figure 1

G:\61\29512\GIS\Maps\MXD\6129512_G001_Fig1_Rev0.mxd

Data source: Landgate: Bunbury ext Aug2006 - 20130618; GHD: Study Area - 20130610; GA: Topo 250k Series 3 - 2006. Created by: radeleon

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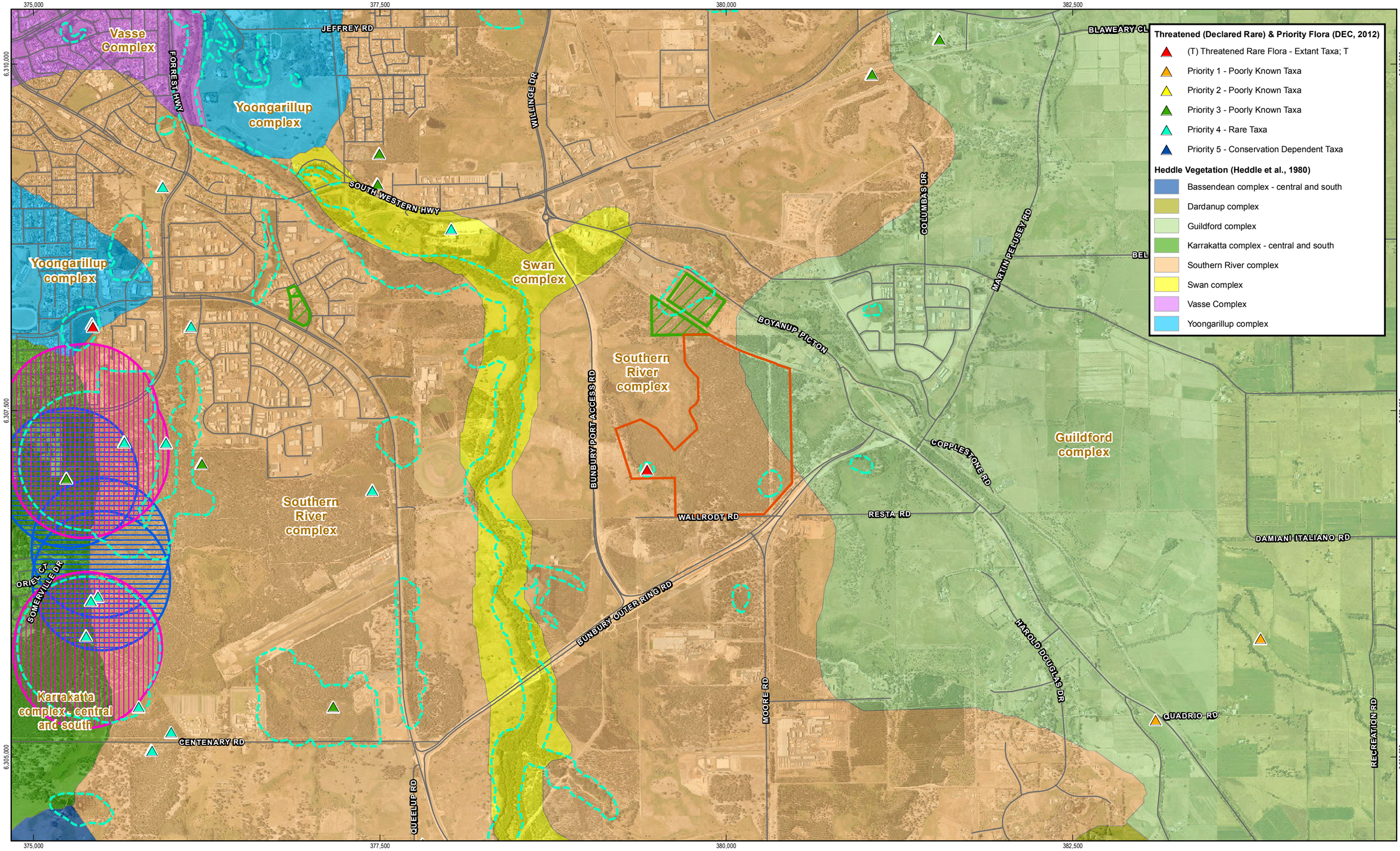

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0 125 250 500 750 1,000 1,250

Metres

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

N

LEGEND

- Roads
- Study Area
- DEC Estate (Government of Western Australia, 2013)
- Environmentally Sensitive Areas (Government of Western Australia, 2013)
- Threatened Ecological Community (DEC, 2011a and 2011b)
- Priority Ecological Community (DEC, 2011a and 2011b)

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Main Roads WA
Lot 5 - Boyanup Picton Road, Picton East
Environmental Values Assessment

Job Number	61-29512
Revision	0
Date	15 Jul 2013

Environmental Context: Biological

Figure 2

G:\61\29512\GIS\Maps\MXD\6129512_G002_Fig2_Rev0.mxd

Data source: Landgate: WMS Chargeable Service Mosaic - 20130621; GHD: Study Area - 20130610, Roads - 20130621; DEC: Threatened (Declared Rare) & Priority Flora (DEC, 2012) - 20130612, Threatened Ecological Community (DEC, 2011a and 2011b) - 20130620, Priority Ecological Community (DEC, 2011a and 2011b) - 20130620, Environmentally Sensitive Areas (Government of Western Australia, 2013) - 20130606, DEC Estate (Government of Western Australia, 2013) - 20130606, Heddle Vegetation (Heddle et al., 1980) - 20080114; MRWA: Roads - 20120528. Created by: radeleon

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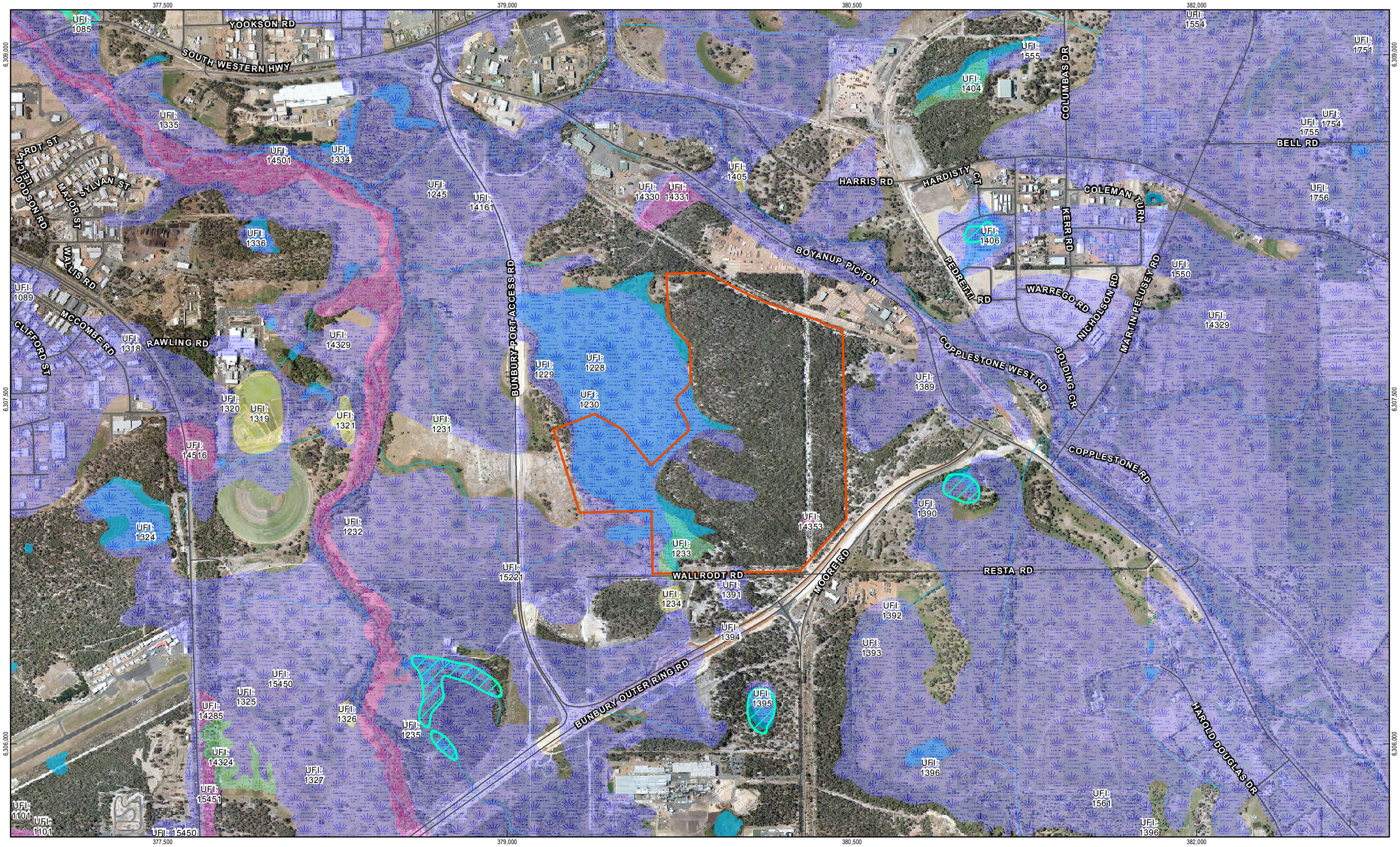

1:15,000 (at A3)

0 75 150 300 450 600 750

Metres

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

N

LEGEND

- Roads
- Study Area
- EPP Lakes (Government of Western Australia, 2013)
- Hydrology
- **Geomorphic Wetlands (Hill et al., 1996)**
  - Conservation
  - Resource Enhancement
  - Multiple Use
  - Not Assessed

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Main Roads WA
Lot 5 - Boyanup Picton Road, Picton East
Environmental Values Assessment

Job Number	61-29512
Revision	0
Date	15 Jul 2013

Environmental Context: Hydrological

Figure 3

G:\61\29512\GIS\Maps\MXD\6129512_G003_Fig3_Rev0.mxd

Data source: Landgate:WMS Chargeable Service Mosaic - 20130621, Hydrology - 20130606; GHD: Study Area - 20130610, Roads - 20130621; DEC: Geomorphic Wetlands (Hill et al., 1996) - 20080116, EPP Lakes (Government of Western Australia, 2013) - 20080116; MRWA: Roads - 20120528. Created by: radeleon

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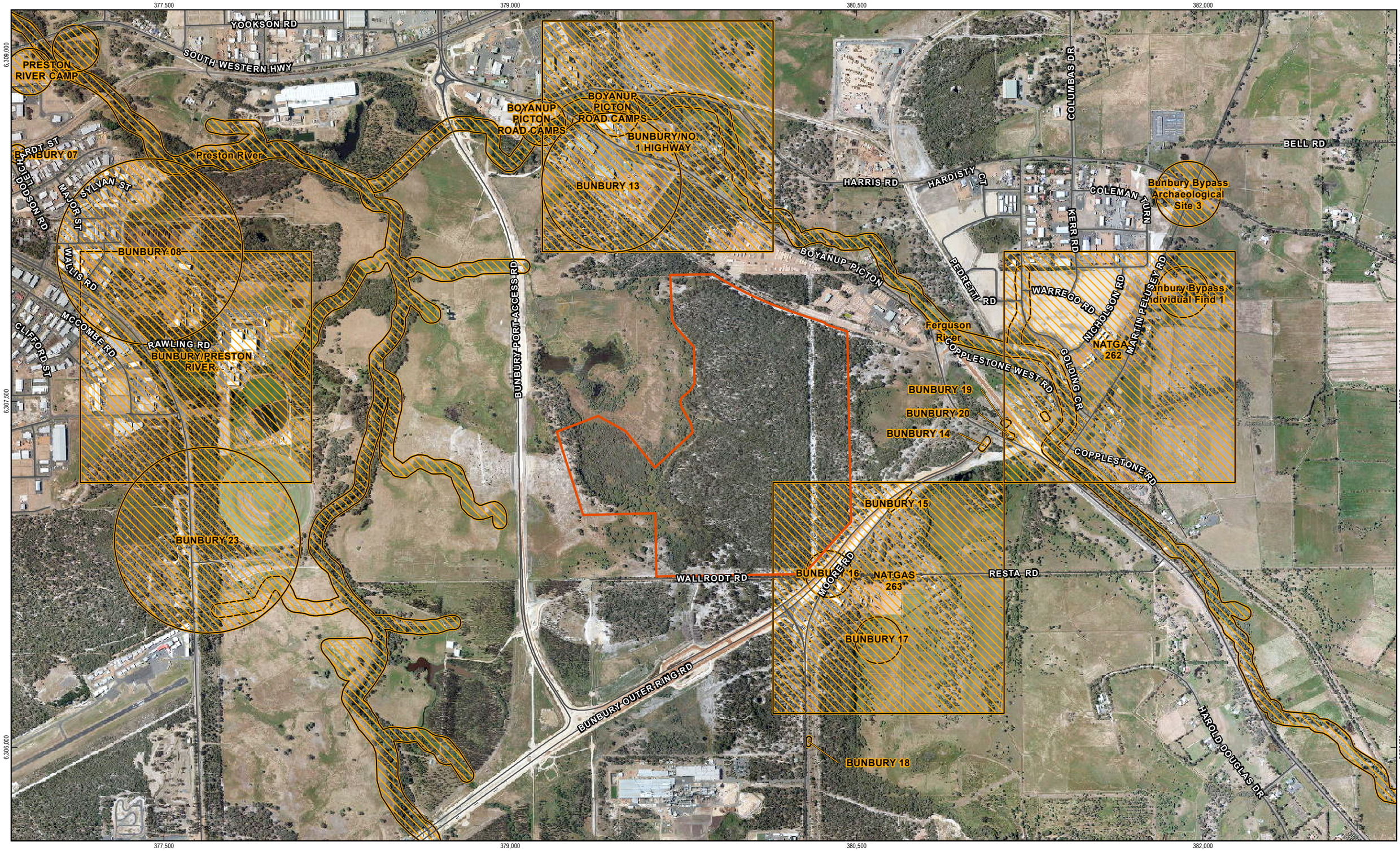

1:15,000 (at A3)

0 75 150 300 450 600 750

Metres

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

N

LEGEND

- Roads
- Study Area
- Aboriginal Heritage (DIA, 2013)

Main Roads WA
Lot 5 - Boyanup Picton Road, Picton East
Environmental Values Assessment

Job Number	61-29512
Revision	0
Date	15 Jul 2013

Environmental Context: Heritage

Figure 4

G:\61\29512\GIS\Maps\MXD\6129512_G004_Fig4_Rev0.mxd

Data source: Landgate: WMS Chargeable Service Mosaic - 20130621; GHD: Study Area - 20130610, Roads - 20130621; DIA: Aboriginal Heritage (DIA, 2013) - 20130606; MRWA: Roads - 20120528. Created by: radeleon

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BUNBURY PORT ACCESS RD

PEDRETTI RD

BOYANUP PICTON

COPPLESTONE WEST RD

MOORE RD

BUNBURY OUTER RING RD

RESTA RD

WALLRODT RD

Q1 Q2 Q3 Q4 Q5 Q6 Q7 Q8 Q9 Q10 Q11 Q12 Q13 Q14

Acacia flagelliformis (P4)

Acacia flagelliformis (P4)

Acacia flagelliformis (P4)

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 50

N

LEGEND

- Quadrat Location
- Priority Flora Locations (GHD Survey)
- Roads
- Study Area

Vegetation Type

- VT1: Jarrah - *Banksia* - Peppermint woodland
- VT2: Marri fringing woodland
- VT3: *Melaleuca* tall open scrub
- VT4: Pasture with scattered *Melaleuca* and Flooded Gum
- VT5: Closed heath of *Astartea*
- Altered Vegetation

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Main Roads WA
Lot 5 - Boyanup Picton Road, Picton East
Environmental Values Assessment

Job Number	61-29512
Revision	0
Date	15 Jul 2013

Vegetation Type and Quadrat Locations

Figure 5

G:\61\29512\GIS\Maps\MXD\6129512_G005_Fig5_Rev0.mxd

Data source: Landgate: WMS Chargeable Service Mosaic - 20130621; GHD: Study Area - 20130610, Vegetation Type - 20130701, Quadrat Location - 20130618, Priority Flora Locations (GHD Survey) - 20130711, Roads - 20130621; MRWA: Roads - 20120528. Created by: radeleon

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BUNBURY PORT ACCESS RD
PEDRETTI RD
BOYANUP PICTON
COPPLESTONE WEST RD
MOORE RD
WALLRODT RD
BUNBURY OUTER RING RD
RESTA RD

5-6
2-3
4-5
6
3-4
4
*Gomphocarpus fruticosus (Narrowleaf Cottonbush) - juvenile
*Solanum linnaeanum

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 50

N

LEGEND

Weed Location

*Gomphocarpus fruticosus (Narrowleaf Cottonbush) - juvenile

*Solanum linnaeanum

Roads

Study Area

Vegetation Condition

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

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Main Roads WA
Lot 5 - Boyanup Picton Road, Picton East
Environmental Values Assessment

Job Number 61-29512
Revision 0
Date 15 Jul 2013

Vegetation Condition and Weed Locations

Figure 6

G:\61\29512\GIS\Maps\MXD\6129512_G006_Fig6_Rev0.mxd

Data source: Landgate: WMS Chargeable Service Mosaic - 20130621; GHD: Study Area - 20130610, Vegetation Condition - 20130701, Weed Location - 20130618, Roads - 20130621; MRWA: Roads - 20120528. Created by: radeleon

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BUNBURY PORT ACCESS RD

BOYANUP PICTON

COPPLESTONE WEST RD

PEDRETTI RD

MOORE RD

WALLRODT RD

BUNBURY OUTER RING RD

RESTA RD

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 50

N

LEGEND

- Roads
- Study Area

Fauna Habitat Types

- Jarrah-*Banksia*-Peppermint Woodland
- Marri Woodland
- Wetlands
- Degraded Wetlands
- Altered Vegetation

Conservation Significant Fauna Habitat

- Black Cockatoos known foraging and potential breeding habitat
- Western Ringtail Possum known habitat
- Southern Brush-tailed Phascogale known habitat

Main Roads WA
Lot 5 - Boyanup Picton Road, Picton East
Environmental Values Assessment

Job Number	61-29512
Revision	2
Date	25 Mar 2014

Fauna Habitat Types

Figure 7

G:\61\29512\GIS\Maps\MXD\6129512_G007_Fig7_Rev2.mxd

Data source: Landgate: WMS Chargeable Service Mosaic - 20130621; GHD: Study Area - 20130610, Fauna Habitat Types - 20130702, Conservation Significant Fauna Habitat - 20130702, Roads - 20130621; MRWA: Roads - 20120528. Created by: radeleon, mczekaj

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BUNBURY PORT ACCESS RD

BOYANUP PICTON

COPPLESTONE WEST RD

PEDRETTI RD

WALLRODT RD

BUNBURY OUTER RING RD

MOORE RD

RESTA RD

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 50

N

LEGEND

Cockatoo Observations

- Baudin's Black Cockatoo Sighting
- Black Cockatoo Foraging Evidence
- Carnaby's Black Cockatoo Sighting
- Forest Red-tailed Black Cockatoo Sighting

Possum Observations

- Common Brushtail Possum Scats
- Common Brushtail Possum Sighting
- Western Ringtail Possum Drey - Active
- Western Ringtail Possum Drey - Old
- Western Ringtail Possum Scats
- Western Ringtail Possum Sighting
- Quenda Evidence
- Roads
- Study Area

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Main Roads WA
Lot 5 - Boyanup Picton Road, Picton East
Environmental Values Assessment

Job Number	61-29512
Revision	0
Date	15 Jul 2013

Fauna Observations

Figure 8

G:\61\29512\GIS\Maps\MXD\6129512_G008_Fig8_Rev0.mxd

Data source: Landgate: WMS Chargeable Service Mosaic - 20130621; GHD: Study Area - 20130610, Cockatoo Observations - 20130618, Possum Observations - 20130618, Quenda Evidence - 20130618, Roads - 20130621; MRWA: Roads - 20120528. Created by: radeleon

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BUNBURY PORT ACCESS RD

PEDRETTI RD

BOYANUP PICTON

COPPLESTONE WEST RD

MOORE RD

BUNBURY OUTER RING RD

WALLRODT RD

RESTA RD

TC1 TC2 TC3 TC4 TC5 TC6 TC7 TC8 TC9 TC10 TC11 TC12 TC13

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 50

N

LEGEND

Habitat Tree Locations

- Jarrah
- Marri
- Dead

- Roads
- Study Area
- Habitat Tree Quadrats

Main Roads WA
Lot 5 - Boyanup Picton Road, Picton East
Environmental Values Assessment

Job Number	61-29512
Revision	0
Date	15 Jul 2013

Habitat Tree Quadrats

Figure 9

G:\61\29512\GIS\Maps\MXD\6129512_G009_Fig9_Rev0.mxd

Data source: Landgate: WMS Chargeable Service Mosaic - 20130621; GHD: Study Area - 20130610, Habitat Tree Quadrats - 20130619, Habitat Tree Locations - 20130702, Roads - 20130621; MRWA: Roads - 20120528. Created by: radeleon

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Appendix B – Conservation Codes

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

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

Migratory Species listed under the EPBC Act

The EPBC Act protects lands and migratory species that are listed under International Agreements. The list of migratory species established under section 209 of the EPBC Act comprises:

- Migratory species which are native to Australia and are included in the appendices to the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animals Appendices I and II);
- Migatory species included in annexes established under the Japan-Australia Migratory Bird Agreement (JAMBA) and the China-Australia Migratory Bird Agreement (CAMBA); and
- Native, migratory species identified in a list established under, or an instrument made under, an international agreement approved by the Minister, such as the republic of Korea-Australia Migratory Bird Agreement (ROKAMBA).

Conservation codes and descriptions for Western Australian Flora and Fauna

Code	Conservation category	Description
Wildlife Conservation Act 1950		
T	Schedule 1 under the WC Act	Threatened Fauna (Fauna that is rare or is likely to become extinct Threatened Flora (Declared Rare Flora – Extant) Taxa that have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection, and have been gazetted as such. CR: Critically Endangered – considered to be facing an extremely high risk of extinction in the wild. EN: Endangered – considered to be facing a very high risk of extinction in the wild. VU: Vulnerable – considered to be facing a high risk of extinction in the wild.
X	Schedule 2 under the WC Act	Presumed Extinct Fauna Presumed Extinct Flora (Declared Rare Flora – Extinct) Taxa which have been adequately searched for and there is no reasonable doubt that the last individual has died, and have been gazetted as such.
IA	Schedule 3 under the WC Act	Birds protected under an international agreement. Birds that are subject to an agreement between governments of Australia and Japan relating to the protection of migratory birds and birds in danger of extinction.
S	Schedule 4 under the WC Act	Other specially protected fauna. Fauna that is in need of special protection, otherwise than for the reasons mentioned in the above schedules.
DEC Priority Listed		
1	Priority One: Poorly-known taxa	Taxa that are known from one or a few collections or sight records (generally less than five), all on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, Shire, Westrail and Main Roads WA road, gravel and soil reserves, and active mineral leases and under threat of habitat destruction or degradation. Taxa may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes.
2	Priority Two: Poorly-known taxa	Taxa that are known from one or a few collections or sight records, some of which are on lands not under imminent threat of habitat destruction or degradation, e.g. national parks, conservation parks, nature reserves, State forest, vacant Crown land, water reserves, etc. Taxa may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes.
3	Priority Three: Poorly-known taxa	Taxa that are known from collections or sight records from several localities not under imminent threat, or from few but widespread localities with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Taxa may be included if they are comparatively well known from several

Code	Conservation category	Description
		localities but do not meet adequacy of survey requirements and known threatening processes exist that could affect them.
4	Priority Four: Rare, Near Threatened and other taxa in need of monitoring	(a) Rare. Taxa that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These taxa are usually represented on conservation lands. (b) Near Threatened. Taxa that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable. (c) Taxa that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.
5	Priority 5: Conservation Dependent taxa	Taxa that are not threatened but are subject to a specific conservation program, the cessation of which would result in the taxon becoming threatened within five years.

Department of Agriculture and Food Western Australia Categories for Declared Pests under the *Biosecurity and Agriculture Management Act 2007*.

Control Class Code	Description
C1 (Exclusion)	Pests will be assigned to this category if they are not established in Western Australia and control measures are to be taken, including border checks, in order to prevent them entering and establishing in the State.
C2 (Eradication)	Pests will be assigned to this category if they are present in Western Australia in low enough numbers or in sufficiently limited areas that their eradication is still a possibility.
C3 (Management)	Pests will be assigned to this category if they are established in Western Australia but it is feasible, or desirable, to manage them in order to limit their damage. Control measures can prevent a C3 pest from increasing in population size or density or moving from an area in which it is established into an area which currently is free of that pest.

Conservation codes for Threatened Ecological Communities (TECs) endorsed by the Western Australian Minister for the Environment and listed under the EPBC Act.

Western Australia Conservation Categories		Federal Government Conservation Categories (EPBC Act)	
Presumed Totally Destroyed (PD)	The community has been found to be totally destroyed or so extensively modified throughout its range that no occurrence of it is likely to recover its species composition and/or structure in the foreseeable future.	Critically Endangered (CR)	If, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future
Critically Endangered (CR)	An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or that was originally of limited distribution and is facing severe modification or destruction throughout its range in the immediate future, or is already severely degraded throughout its range but capable of being substantially restored or rehabilitated	Endangered (EN)	If, at that time, it is not critically endangered and is facing a very high risk of extinction in the wild in the near future
Endangered (EN)	An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or was originally of limited distribution and is in danger of significant modification throughout its range or severe modification or destruction over most of its range in the near future.	Vulnerable (VU)	If, at that time, it is not critically endangered or endangered, and is facing a high risk of extinction in the wild in the medium-term future
Vulnerable (VU)	An ecological community that has been adequately surveyed and is found to be declining and/or has declined in distribution and/or condition and whose ultimate security has not yet been assured and/or a community that is still widespread but is believed likely to move into a category of higher threat in the near future if threatening processes continue or begin operating throughout its range.		

Conservation categories and definitions for Priority Ecological Communities (PECs) as listed by the DEC

Category	Description
Priority 1	Poorly known ecological communities. Ecological communities that are known from very few occurrences with a very restricted distribution (generally ≤5 occurrences or a total area of ≤100ha). Occurrences are believed to be under threat either due to limited extent, or being on lands under immediate threat (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) or for which current threats exist. May include communities with occurrences on protected lands. Communities may be included if they are comparatively well-known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.
Priority 2	Poorly known ecological communities. Communities that are known from few occurrences with a restricted distribution (generally ≤10 occurrences or a total area of ≤200ha). At least some occurrences are not believed to be under immediate threat of destruction or degradation. Communities may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under threat from known threatening processes.
Priority 3	Poorly known ecological communities. (i) Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or: (ii) communities known from a few widespread occurrences, which are either large or with significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat, or; (iii) communities made up of large, and/or widespread occurrences, that may or may not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, and inappropriate fire regimes. Communities may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and/or are not well defined, and known threatening processes exist that could affect them.
Priority 4	Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list. These communities require regular monitoring. (i) Rare. Ecological communities known from few occurrences that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These communities are usually represented on conservation lands. (ii) Near Threatened. Ecological communities that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable.

Category	Description
	(iii) Ecological communities that have been removed from the list of threatened communities during the past five years.
Priority 5	Conservation Dependent ecological communities. Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

Appendix C – Desktop searches

Naturemap searches with a radius of 10 km (DPaW, 2007–,)

EPBC Act Protected Matters Report with a buffer of 10 km (DSEWPaC, 2013a)

NatureMap
Mapping Western Australia's biodiversity

NatureMap Flora Species Report 10 km buffer

Created By Melissa Longman on 04/06/2013

Kingdom Plantae
Current Names Only Yes
Core Datasets Only Yes
Method 'By Line'
Group By Family

Family	Species	Records
Acanthaceae	1	10
Aizoaceae	1	3
Alliaceae	1	2
Amaranthaceae	4	6
Amaryllidaceae	2	3
Anacardiaceae	1	1
Anarthriaceae	3	13
Apiaceae	11	41
Apocynaceae	4	5
Aponogetonaceae	1	19
Araceae	1	1
Araliaceae	5	18
Areschougiaceae	1	1
Asparagaceae	27	83
Asphodelaceae	1	2
Asteraceae	60	133
Bignoniaceae	1	1
Boryaceae	2	4
Brassicaceae	8	16
Bryaceae	3	3
Campanulaceae	8	12
Caprifoliaceae	2	3
Caryophyllaceae	5	8
Casuarinaceae	3	6
Celastraceae	2	7
Centrolepidaceae	5	15
Chenopodiaceae	16	27
Cladophoraceae	1	1
Colchicaceae	3	12
Commelinaceae	1	4
Convolvulaceae	7	11
Crassulaceae	4	6
Cucurbitaceae	1	1
Cymodoceaceae	1	1
Cyperaceae	54	122
Dasypogonaceae	3	12
Dennstaedtiaceae	1	1
Dicranaceae	1	3
Dilleniaceae	11	54
Droseraceae	18	43
Elaeocarpaceae	2	15
Elatinaceae	1	1
Ericaceae	18	47
Euphorbiaceae	6	14
Fabaceae	95	286
Fissidentaceae	2	3
Frankeniaceae	1	2
Gelidiaceae	1	1
Gentianaceae	4	5
Geraniaceae	4	5
Goodeniaceae	15	36
Haemodoraceae	20	49
Haloragaceae	1	3
Halymeniaceae	3	4
Hemerocallidaceae	11	23
Hydatellaceae	2	4
Hydrocharitaceae	2	2
Hypoxidaceae	1	2
Iridaceae	24	84
Juncaceae	8	19
Juncaginaceae	3	4
Lamiaceae	6	18
Lauraceae	3	9
Lentibulariaceae	2	2
Linaceae	1	2
Loganiaceae	3	5
Loranthaceae	1	2
Lythraceae	1	1
Malvaceae	5	15
Marsileaceae	1	1
Melianthaceae	1	2
Menyanthaceae	5	11
Myrtaceae	49	118
Onagraceae	2	4
Orchidaceae	60	158
Orobanchaceae	3	6
Oxalidaceae	2	4
Papaveraceae	1	2
Passifloraceae	1	1

Phacelocarpaceae	1	1
Philydraceae	2	4
Phrymaceae	1	1
Phyllanthaceae	1	4
Pittosporaceae	2	2
Plantaginaceae	4	7
Poaceae	60	127
Podocarpaceae	1	1
Polygalaceae	3	9
Polygonaceae	6	6
Posidoniaceae	1	1
Potamogetonaceae	1	1
Pottiaceae	3	3
Primulaceae	4	7
Proteaceae	35	94
Racopilaceae	1	4
Ranunculaceae	1	1
Restionaceae	22	47
Rhamnaceae	2	2
Rhodomelaceae	3	4
Rosaceae	2	4
Rubiaceae	2	2
Rutaceae	6	22
Salviniaceae	1	1
Santalaceae	5	5
Scrophulariaceae	3	4
Selaginellaceae	1	2
Solanaceae	4	9
Stylidiaceae	17	45
Thuidiaceae	1	2
Thymelaeaceae	5	13
Ulvaceae	1	1
Urticaceae	1	1
Verbenaceae	1	1
Violaceae	3	7
Xanthorrhoeaceae	3	9
Zamiaceae	1	3
TOTAL	**867**	**2141**

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
Acanthaceae					
1.	14555	*Avicennia marina subsp. marina*			
Aizoaceae					
2.	11571	*Galenia pubescens var. pubescens*	Y		
Alliaceae					
3.	1381	*Nothoscordum gracile*	Y		
Amaranthaceae					
4.	2655	*Amaranthus albus (Tumbleweed)*	Y		
5.	25840	*Amaranthus blitum*	Y		
6.	2718	*Ptilotus drummondii (Narrowleaf Mulla Mulla)*			
7.	15856	*Ptilotus sericostachyus subsp. sericostachyus*			
Amaryllidaceae					
8.	1493	*Leucojum aestivum (Snowflake)*	Y		
9.	1495	*Narcissus tazetta (Jonquil)*	Y		
Anacardiaceae					
10.	11027	*Schinus terebinthifolius*	Y		
Anarthriaceae					
11.	1062	*Anarthria prolifera*			
12.	1097	*Lyginia barbata*			
13.	18049	*Lyginia imberbis*			
Apiaceae					
14.	6203	*Actinotus glomeratus*			
15.	6210	*Apium annuum*			
16.	12040	*Apium prostratum var. prostratum (Sea Celery)*			
17.	6221	*Foeniculum vulgare (Fennel)*	Y		
18.	6222	*Homalosciadium homalocarpum*			
19.	6244	*Pastinaca sativa (Wild Parsnip)*	Y		
20.	6249	*Platysace compressa (Tapeworm Plant)*			
21.	6253	*Platysace filiformis*			
22.	11132	*Platysace ramosissima*		P3	
23.	6263	*Schoenolaena juncea*			
24.	6289	*Xanthosia huegelii*			
Apocynaceae					
25.	6565	*Alyxia buxifolia (Dysentery Bush)*			
26.	17355	*Araujia sericifera*	Y		
27.	6587	*Gomphocarpus fruticosus (Narrowleaf Cottonbush)*	Y		
28.	6575	*Vinca major (Blue Periwinkle)*	Y		
Aponogetonaceae					
29.	141	*Aponogeton hexatepalus (Stalked Water Ribbons)*		P4	
Araceae					
30.	1049	*Zantedeschia aethiopica (Arum Lily)*	Y		
Araliaceae					
31.	6223	*Hydrocotyle alata*			
32.	6224	*Hydrocotyle blepharocarpa*			
33.	6225	*Hydrocotyle bonariensis*	Y		
34.	11546	*Hydrocotyle pilifera var. glabrata*			
35.	6280	*Trachymene pilosa (Native Parsnip)*			
Areschougiaceae					
36.	26854	*Gigartina disticha*			
Asparagaceae					
37.	1208	*Acanthocarpus preissii*			
38.	8779	*Asparagus asparagoides (Bridal Creeper)*	Y		
39.	16943	*Asparagus declinatus*	Y		
40.	16945	*Asparagus plumosus*	Y		
41.	1280	*Chamaescilla corymbosa (Blue Squill)*			
42.	19338	*Chamaescilla gibsonii*		P3	
43.	1287	*Dichopogon capillipes*			
44.	1308	*Laxmannia sessiliflora (Nodding Lily)*			
45.	11464	*Laxmannia sessiliflora subsp. australis*			
46.	1223	*Lomandra caespitosa (Tufted Mat Rush)*			
47.	1228	*Lomandra hermaphrodita*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
48.	1232	*Lomandra micrantha (Small-flower Mat-rush)*			
49.	1234	*Lomandra nigricans*			
50.	1236	*Lomandra odora (Tiered Matrush)*			
51.	1239	*Lomandra preissii*			
52.	1240	*Lomandra purpurea (Purple Mat Rush)*			
53.	1243	*Lomandra sericea (Silky Mat Rush)*			
54.	1246	*Lomandra suaveolens*			
55.	20664	*Ornithogalum longebracteatum*	Y		
56.	1312	*Sowerbaea laxiflora (Purple Tassels)*			
57.	1318	*Thysanotus arbuscula*			
58.	1319	*Thysanotus arenarius*			
59.	1339	*Thysanotus multiflorus (Many-flowered Fringe Lily)*			
60.	1343	*Thysanotus patersonii*			
61.	1351	*Thysanotus sparteus*			
62.	1354	*Thysanotus tenellus*			
63.	1357	*Thysanotus thyrsoideus*			
Asphodelaceae					
64.	1368	*Trachyandra divaricata*	Y		
Asteraceae					
65.	7829	*Angianthus drummondii*		P3	
66.	7833	*Angianthus preissianus*			
67.	7838	*Arctotheca calendula (Cape Weed)*	Y		
68.	7839	*Arctotheca populifolia (Dune Arctotheca)*	Y		
69.	7851	*Asteridea pulverulenta (Common Bristle Daisy)*			
70.	7853	*Berkheya rigida (African Thistle)*	Y		
71.	7878	*Brachyscome iberidifolia*			
72.	7929	*Chrysanthemum segetum (Corn Marigold)*	Y		
73.	7935	*Cichorium intybus (Chicory)*	Y		
74.	7939	*Conyza bonariensis (Flaxleaf Fleabane)*	Y		
75.	20074	*Conyza sumatrensis*	Y		
76.	7946	*Cotula cotuloides (Smooth Cotula)*			
77.	7947	*Cotula turbinata (Funnel Weed)*	Y		
78.	42008	*Craspedia sp. Waterloo (G.J. Keighery 13724)*		P2	
79.	42009	*Craspedia sp. Yalgorup National Park (G.J. Keighery 14449)*			
80.	13354	*Craspedia variabilis*			
81.	29054	*Crepis foetida subsp. foetida*	Y		
82.	7961	*Dittrichia graveolens (Stinkwort)*	Y		
83.	15137	*Euchiton sphaericus*			
84.	16311	*Gazania linearis*	Y		
85.	8008	*Helianthus annuus (Sunflower)*	Y		
86.	12016	*Helianthus debilis subsp. cucumerifolius*	Y		
87.	29594	*Helichrysum luteoalbum (Jersey Cudweed)*			
88.	12741	*Hyalosperma cotula*			
89.	12717	*Hyalosperma pusillum*			
90.	8086	*Hypochaeris glabra (Smooth Catsear)*	Y		
91.	9352	*Hypochaeris radicata (Flat Weed)*	Y		
92.	8096	*Lactuca serriola (Prickly Lettuce)*	Y		
93.	16449	*Leucophyta brownii*			
94.	8105	*Millotia myosotidifolia*			
95.	8106	*Millotia tenuifolia (Soft Millotia)*			
96.	29418	*Monoculus monstrosus*	Y		
97.	8117	*Myriocephalus helichrysoides*			
98.	8127	*Olearia axillaris (Coastal Daisybush)*			
99.	8133	*Olearia elaeophila*			
100.	42281	*Pithocarpa cordata*			
101.	18352	*Pithocarpa pulchella var. melanostigma*			
102.	8172	*Podolepis canescens (Bright Podolepis, Grey Podolepis)*			
103.	8175	*Podolepis gracilis (Slender Podolepis)*			
104.	8177	*Podolepis lessonii*			
105.	8188	*Pogonolepis stricta*			
106.	8195	*Quinetia urvillei*			
107.	13300	*Rhodanthe citrina*			
108.	13312	*Rhodanthe pyrethrum*			
109.	8208	*Senecio hispidulus (Hispid Fireweed)*			
110.	20663	*Senecio multicaulis subsp. multicaulis*			
111.	20161	*Senecio pinnatifolius*			
112.	8220	*Senecio vulgaris (Common Groundsel)*	Y		
113.	8225	*Siloxerus humifusus (Procumbent Siloxerus)*			
114.	8227	*Silybum marianum (Variegated Thistle)*	Y		

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115.	10920	*Soliva sessilis (Jo-jo, Onehunga Weed)*	Y		
116.	9367	*Sonchus hydrophilus (Native Sowthistle)*			
117.	8231	*Sonchus oleraceus (Common Sowthistle)*	Y		
118.	25902	*Symphyotrichum squamatum (Bushy Starwort)*	Y		
119.	17406	*Trichocline sp. Treeton (B.J. Keighery & N. Gibson 564)*		P2	
120.	8251	*Trichocline spathulata (Native Gerbera)*			
121.	8255	*Ursinia anthemoides (Ursinia)*	Y		
122.	38388	*Ursinia anthemoides subsp. anthemoides*	Y		
123.	8257	*Vellereophyton dealbatum (White Cudweed)*	Y		
124.	8282	*Waitzia suaveolens (Fragrant Waitzia)*			
Bignoniaceae					
125.	19713	*Campsis radicans*	Y		
Boryaceae					
126.	1272	*Borya scirpoidea*			
127.	1273	*Borya sphaerocephala (Pincushions)*			
Brassicaceae					
128.	2994	*Brassica juncea (Indian Mustard)*	Y		
129.	3002	*Cakile maritima (Sea Rocket)*	Y		
130.	3012	*Diplotaxis tenuifolia (Sand Rocket)*	Y		
131.	19989	*Lepidium didymum*	Y		
132.	3048	*Lobularia maritima (Sweet Alyssum)*	Y		
133.	3061	*Raphanus raphanistrum (Wild Radish)*	Y		
134.	3066	*Rorippa nasturtium-aquaticum (Watercress)*	Y		
135.	19403	*Stenopetalum gracile*			
Bryaceae					
136.	32380	*Gemmabryum pachythecum*			
137.	32424	*Rosulabryum albolimbatum*			
138.	32425	*Rosulabryum billarderi*			
Campanulaceae					
139.	7394	*Grammatotheca bergiana*			
140.	37500	*Grammatotheca bergiana var. bergiana*	Y		
141.	7396	*Isotoma hypocrateriformis (Woodbridge Poison)*			
142.	9289	*Lobelia anceps (Angled Lobelia)*			
143.	7408	*Lobelia tenuior (Slender Lobelia)*			
144.	37440	*Monopsis debilis var. depressa*	Y		
145.	7384	*Wahlenbergia capensis (Cape Bluebell)*	Y		
146.	7389	*Wahlenbergia preissii*			
Caprifoliaceae					
147.	7366	*Centranthus macrosiphon*	Y		
148.	7365	*Lonicera japonica (Japanese Honeysuckle)*	Y		
Caryophyllaceae					
149.	2891	*Corrigiola litoralis (Strapwort)*	Y		
150.	19825	*Petrorhagia dubia*	Y		
151.	2908	*Sagina maritima*	Y		
152.	2912	*Spergula arvensis (Corn Spurry)*	Y		
153.	2918	*Stellaria media (Chickweed)*	Y		
Casuarinaceae					
154.	1732	*Allocasuarina humilis (Dwarf Sheoak)*			
155.	1739	*Allocasuarina thuyoides (Horned Sheoak)*			
156.	1742	*Casuarina obesa (Swamp Sheoak, Kuli)*			
Celastraceae					
157.	4733	*Stackhousia monogyna*			
158.	4737	*Tripterococcus brunonis (Winged Stackhousia)*			
Centrolepidaceae					
159.	1117	*Aphelia cyperoides*			
160.	1121	*Centrolepis aristata (Pointed Centrolepis)*			
161.	1125	*Centrolepis drummondiana*			
162.	1132	*Centrolepis mutica*			
163.	1134	*Centrolepis polygyna (Wiry Centrolepis)*			
Chenopodiaceae					
164.	2452	*Atriplex cinerea (Grey Saltbush)*			
165.	2460	*Atriplex hortensis (Garden Orache)*	Y		
166.	2463	*Atriplex isatidea (Coast Saltbush)*			
167.	2483	*Chenopodium album (Fat Hen)*	Y		
168.	2490	*Chenopodium glaucum (Glaucous Goosefoot)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
			Y		
169.	2491	*Chenopodium macrospermum*	Y		
170.	2494	*Chenopodium murale (Nettle-leaf Goosefoot)*	Y		
171.	33500	*Dysphania ambrosioides (Mexican Tea)*	Y		
172.	33517	*Dysphania multifida (Scented Goosefoot)*	Y		
173.	33480	*Dysphania pumilio (Clammy Goosefoot)*			
174.	2578	*Rhagodia baccata (Berry Saltbush)*			
175.	11341	*Rhagodia baccata subsp. baccata*			
176.	2591	*Sarcocornia blackiana*			
177.	2639	*Suaeda australis (Seablite)*			
178.	33236	*Tecticornia halocnemoides (Shrubby Samphire)*			
179.	33319	*Tecticornia indica subsp. bidens*			
Cladophoraceae					
180.	26607	*Chaetomorpha aerea*			
Colchicaceae					
181.	12770	*Burchardia congesta*			
182.	1385	*Burchardia multiflora (Dwarf Burchardia)*			
183.	12072	*Wurmbea dioica subsp. alba*			
Commelinaceae					
184.	1162	*Cartonema philydroides*			
Convolvulaceae					
185.	19881	*Convolvulus angustissimus subsp. angustissimus*			
186.	6611	*Convolvulus arvensis (Field Bindweed)*	Y		
187.	13732	*Cuscuta campestris (Golden dodder)*	Y		
188.	6663	*Cuscuta epithymum (Lesser Dodder, Greater Dodder)*	Y		
189.	6630	*Ipomoea indica (Morning Glory)*	Y		
190.	6658	*Wilsonia backhousei (Narrow-leaf Wilsonia)*			
191.	6659	*Wilsonia humilis (Silky Wilsonia)*			
Crassulaceae					
192.	3136	*Crassula alata*	Y		
193.	3137	*Crassula colorata (Dense Stonecrop)*			
194.	11563	*Crassula colorata var. colorata*			
195.	15706	*Crassula natans var. minus*	Y		
Cucurbitaceae					
196.	16411	*Cucumis sp. Bunbury (G. Brayshaw s.n. 26/2/91)*	Y		Y
Cymodoceaceae					
197.	126	*Amphibolis antarctica (Sea Nymph)*			
Cyperaceae					
198.	740	*Baumea arthrophylla*			
199.	743	*Baumea juncea (Bare Twigrush)*			
200.	15837	*Baumea preissii subsp. laxa*			
201.	748	*Baumea vaginalis (Sheath Twigrush)*			
202.	749	*Bolboschoenus caldwellii (Marsh Club-rush)*			
203.	754	*Carex divisa (Divided Sedge)*	Y		
204.	758	*Carex pumila (Strand Sedge)*			
205.	759	*Carex tereticaulis*		P1	
206.	763	*Chorizandra enodis (Black Bristlerush)*			
207.	768	*Cyathochaeta avenacea*			
208.	783	*Cyperus congestus (Dense Flat-sedge)*	Y		
209.	792	*Cyperus eragrostis (Umbrella Sedge)*	Y		
210.	18318	*Cyperus involucratus*	Y		
211.	801	*Cyperus laevigatus*	Y		
212.	815	*Cyperus tenellus (Tiny Flatsedge)*	Y		
213.	816	*Cyperus tenuiflorus (Scaly Sedge)*	Y		
214.	822	*Eleocharis acuta (Common Spikerush)*			
215.	17605	*Eleocharis keigheryi*		T	
216.	835	*Evandra pauciflora*			
217.	20216	*Ficinia nodosa (Knotted Club Rush)*			
218.	907	*Gahnia trifida (Coast Saw-sedge)*			
219.	20199	*Isolepis cernua var. cernua*			
220.	20200	*Isolepis cernua var. setiformis*			
221.	912	*Isolepis cyperoides*			
222.	917	*Isolepis marginata (Coarse Club-rush)*	Y		
223.	919	*Isolepis oldfieldiana*			
224.	10831	*Isolepis prolifera (Budding Club-rush)*	Y		
225.	925	*Lepidosperma angustatum*			

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226.	930	*Lepidosperma costale*			
227.	932	*Lepidosperma effusum (Spreading Sword-sedge)*			
228.	937	*Lepidosperma longitudinale (Pithy Sword-sedge)*			
229.	940	*Lepidosperma pubisquameum*			
230.	29150	*Lepidosperma sp. Margaret River (B.J. Lepschi 1841)*			
231.	945	*Lepidosperma squamatum*			
232.	946	*Lepidosperma striatum*			
233.	957	*Mesomelaena tetragona (Semaphore Sedge)*			
234.	968	*Schoenoplectus pungens (Sharpleaf Rush)*			
235.	970	*Schoenus acuminatus*			
236.	973	*Schoenus asperocarpus (Poison Sedge)*			
237.	974	*Schoenus benthamii*		P3	
238.	975	*Schoenus bifidus*			
239.	980	*Schoenus capillifolius*		P3	
240.	984	*Schoenus curvifolius*			
241.	986	*Schoenus efoliatus*			
242.	999	*Schoenus loliaceus*		P2	
243.	1006	*Schoenus odontocarpus*			
244.	17614	*Schoenus plumosus*			
245.	1011	*Schoenus rigens*			
246.	1013	*Schoenus sculptus (Gimlet Bog-rush)*			
247.	1020	*Schoenus sublateralis*			
248.	1023	*Schoenus tenellus*			
249.	17409	*Schoenus variicellae*			
250.	1034	*Tetraria capillaris (Hair Sedge)*			
251.	1036	*Tetraria octandra*			
Dasypogonaceae					
252.	19309	*Calectasia narragara*			
253.	1218	*Dasypogon bromeliifolius (Pineapple Bush)*			
254.	1219	*Dasypogon hookeri (Pineapple Bush)*			
Dennstaedtiaceae					
255.	41651	*Pteridium esculentum subsp. esculentum*			
Dicranaceae					
256.	32338	*Campylopus introflexus*	Y		
Dilleniaceae					
257.	5109	*Hibbertia amplexicaulis*			
258.	5114	*Hibbertia commutata*			
259.	5117	*Hibbertia cuneiformis (Cutleaf Hibbertia)*			
260.	5118	*Hibbertia cunninghamii*			
261.	20051	*Hibbertia diamesogenos*			
262.	5134	*Hibbertia huegelii*			
263.	5135	*Hibbertia hypericoides (Yellow Buttercups)*			
264.	5162	*Hibbertia racemosa (Stalked Guinea Flower)*			
265.	5172	*Hibbertia stellaris (Orange Stars)*			
266.	5173	*Hibbertia subvaginata*			
267.	5176	*Hibbertia vaginata*			
Droseraceae					
268.	3091	*Drosera bulbigena (Midget Sundew)*			
269.	3095	*Drosera erythrorhiza (Red Ink Sundew)*			
270.	13217	*Drosera erythrorhiza subsp. erythrorhiza*			
271.	3097	*Drosera gigantea (Giant Sundew)*			
272.	15453	*Drosera gigantea subsp. gigantea*			
273.	3098	*Drosera glanduligera (Pimpernel Sundew)*			
274.	19256	*Drosera intricata*			
275.	3106	*Drosera macrantha (Bridal Rainbow)*			
276.	13209	*Drosera marchantii subsp. marchantii*			
277.	3109	*Drosera menziesii (Pink Rainbow)*			
278.	11853	*Drosera menziesii subsp. menziesii*			
279.	13216	*Drosera menziesii subsp. penicillaris*			
280.	3117	*Drosera paleacea (Dwarf Sundew)*			
281.	13188	*Drosera paleacea subsp. paleacea*			
282.	3118	*Drosera pallida (Pale Rainbow)*			
283.	8911	*Drosera rosulata*			
284.	3131	*Drosera stolonifera (Leafy Sundew)*			
285.	13205	*Drosera tubaestylis*			
Elaeocarpaceae					
286.	4524	*Platytheca galioides*			

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287.	4535	*Tetratheca hirsuta (Black Eyed Susan)*			
Elatinaceae					
288.	5187	*Elatine gratioloides (Waterwort)*			
Ericaceae					
289.	6306	*Andersonia caerulea (Foxtails)*			
290.	6323	*Astroloma ciliatum (Candle Cranberry)*			
291.	6334	*Astroloma pallidum (Kick Bush)*			
292.	6348	*Conostephium pendulum (Pearl Flower)*			
293.	6360	*Leucopogon australis (Spiked Beard-heath)*			
294.	6374	*Leucopogon conostephioides*			
295.	6396	*Leucopogon glabellus*			
296.	6425	*Leucopogon oxycedrus*			
297.	6427	*Leucopogon parviflorus (Coast Beard-heath)*			
298.	6428	*Leucopogon pendulus*			
299.	6434	*Leucopogon polymorphus*			
300.	6436	*Leucopogon propinquus*			
301.	6439	*Leucopogon pulchellus (Beard-heath)*			
302.	6440	*Leucopogon racemulosus*			
303.	29492	*Leucopogon sp. Busselton (D. Cooper 243)*		P2	
304.	6456	*Lysinema ciliatum (Curry Flower)*			
305.	34736	*Lysinema pentapetalum*			
306.	6476	*Styphelia tenuiflora (Common Pinheath)*			
Euphorbiaceae					
307.	4582	*Adriana quadripartita (Bitter Bush)*			
308.	4585	*Amperea ericoides*			
309.	16493	*Calycopeplus oligandrus*			
310.	4636	*Euphorbia paralias (Sea Spurge)*	Y		
311.	4666	*Monotaxis occidentalis*			
312.	4705	*Ricinus communis (Castor Oil Plant)*	Y		
Fabaceae					
313.	3207	*Acacia alata (Winged Wattle)*			
314.	15466	*Acacia applanata*			
315.	3282	*Acacia cyclops (Coastal Wattle)*			
316.	3331	*Acacia extensa (Wiry Wattle)*			
317.	3339	*Acacia flagelliformis*		P4	
318.	3374	*Acacia huegelii*			
319.	3383	*Acacia incurva*			
320.	3410	*Acacia lateriticola*			
321.	17861	*Acacia longifolia*	Y		
322.	17464	*Acacia longifolia subsp. longifolia*	Y		
323.	3442	*Acacia microbotrya (Manna Wattle, Kalyang)*			
324.	17860	*Acacia podalyriifolia*	Y		
325.	3502	*Acacia pulchella (Prickly Moses)*			
326.	15481	*Acacia pulchella var. glaberrima*			
327.	15482	*Acacia pulchella var. goadbyi*			
328.	15483	*Acacia pulchella var. pulchella*			
329.	3527	*Acacia saligna (Orange Wattle, Kudjong)*			
330.	30036	*Acacia saligna subsp. stolonifera*			
331.	3537	*Acacia semitrullata*		P4	
332.	3557	*Acacia stenoptera (Narrow Winged Wattle)*			
333.	3576	*Acacia tetragonocarpa*			
334.	3591	*Acacia urophylla*			
335.	15487	*Acacia varia var. varia*			
336.	3602	*Acacia willdenowiana (Grass Wattle)*			
337.	3688	*Aotus gracillima*			
338.	3692	*Aotus procumbens*			
339.	14396	*Bossiaea aquifolium subsp. aquifolium*			
340.	3710	*Bossiaea eriocarpa (Common Brown Pea)*			
341.	18497	*Bossiaea sp. Waroona (B.J. Keighery & N. Gibson 229)*			
342.	8971	*Chorizema cordatum*			
343.	3793	*Daviesia angulata*			
344.	3805	*Daviesia decurrens (Prickly Bitter-pea)*			
345.	11879	*Daviesia hakeoides subsp. hakeoides*			
346.	3816	*Daviesia incrassata*			
347.	3832	*Daviesia physodes*			
348.	3834	*Daviesia polyphylla*			
349.	3835	*Daviesia preissii*			
350.	3867	*Dipogon lignosus (Dolichos Pea)*	Y		

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
351.	3872	*Euchilopsis linearis (Swamp Pea)*			
352.	3880	*Eutaxia virgata*			
353.	3891	*Gastrolobium bilobum (Heart Leaf Poison)*			
354.	20475	*Gastrolobium capitatum*			
355.	19190	*Gastrolobium cuneatum*			
356.	20473	*Gastrolobium ebracteolatum*			
357.	20512	*Gastrolobium praemorsum*			
358.	30453	*Gastrolobium sp. Yoongarillup (S.Dilkes s.n. 1/9/1969)*		P1	
359.	3936	*Genista linifolia (Flaxleaf Broom)*	Y		
360.	3948	*Gompholobium capitatum*			
361.	3951	*Gompholobium marginatum*			
362.	3954	*Gompholobium polymorphum*			
363.	3956	*Gompholobium shuttleworthii*			
364.	3957	*Gompholobium tomentosum (Hairy Yellow Pea)*			
365.	3961	*Hardenbergia comptoniana (Native Wisteria)*			
366.	3968	*Hovea trisperma (Common Hovea)*			
367.	12859	*Hovea trisperma var. trisperma*			
368.	3992	*Isotropis cuneifolia (Granny Bonnets)*			
369.	4012	*Jacksonia furcellata (Grey Stinkwood)*			
370.	4017	*Jacksonia horrida*			
371.	4028	*Jacksonia spinosa*			
372.	4029	*Jacksonia sternbergiana (Stinkwood, Kapur)*			
373.	4037	*Kennedia coccinea (Coral Vine)*			
374.	37960	*Kennedia coccinea subsp. calcaria*			
375.	4044	*Kennedia prostrata (Scarlet Runner)*			
376.	3669	*Labichea punctata (Lance-leaved Cassia)*			
377.	4047	*Lathyrus tingitanus (Tangier Pea)*	Y		
378.	4052	*Latrobea tenella*			
379.	4059	*Lotus angustissimus (Narrowleaf Trefoil)*	Y		
380.	8564	*Lotus subbiflorus*	Y		
381.	4065	*Lupinus angustifolius (Narrowleaf Lupin)*	Y		
382.	4067	*Lupinus luteus (Yellow Lupin)*	Y		
383.	4075	*Medicago littoralis (Strand Medic)*	Y		
384.	4079	*Medicago polymorpha (Burr Medic)*	Y		
385.	4085	*Melilotus indicus*	Y		
386.	19827	*Melilotus siculus*	Y		
387.	4113	*Ornithopus compressus (Yellow Serradella)*	Y		
388.	4115	*Ornithopus sativus (French Serradella)*	Y		
389.	4180	*Pultenaea radiata*			
390.	4181	*Pultenaea reticulata*			
391.	4183	*Pultenaea skinneri (Skinner's Pea)*		P4	
392.	19183	*Retama raetam*	Y		
393.	4205	*Sphaerolobium linophyllum*			
394.	4207	*Sphaerolobium medium*			
395.	4291	*Trifolium arvense (Hare's Foot Clover)*	Y		
396.	17763	*Trifolium campestre var. campestre (Hop Clover)*	Y		
397.	4295	*Trifolium dubium (Suckling Clover)*	Y		
398.	17759	*Trifolium fragiferum var. fragiferum*	Y		
399.	4298	*Trifolium hirtum (Rose Clover)*	Y		
400.	4302	*Trifolium ligusticum (Ligurian Clover)*	Y		
401.	17788	*Trifolium pratense var. sativum*	Y		
402.	4313	*Trifolium subterraneum (Subterranean Clover)*	Y		
403.	4319	*Vicia benghalensis (Purple Vetch)*	Y		
404.	4320	*Vicia hirsuta (Hairy Vetch)*	Y		
405.	4322	*Vicia sativa (Common Vetch)*	Y		
406.	11474	*Vicia sativa subsp. nigra*	Y		
407.	4325	*Viminaria juncea (Swishbush, Koweda)*			
Fissidentaceae					
408.	32367	*Fissidens megalotis*			
409.	32369	*Fissidens tenellus*			
Frankeniaceae					
410.	5209	*Frankenia pauciflora (Seaheath)*			
Gelidiaceae					
411.	27195	*Pterocladia lucida*			
Gentianaceae					
412.	6539	*Centaurium erythraea (Common Centaury)*	Y		
413.	6542	*Centaurium tenuiflorum*	Y		
414.	6543	*Cicendia filiformis (Slender Cicendia)*	Y		

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415.	41660	*Schenkia australis*			
Geraniaceae					
416.	4332	*Erodium botrys (Long Storksbill)*	Y		
417.	4336	*Erodium moschatum (Musky Crowfoot)*	Y		
418.	4337	*Geranium dissectum (Cutleaf Cranesbill)*	Y		
419.	4343	*Pelargonium capitatum (Rose Pelargonium)*	Y		
Goodeniaceae					
420.	12724	*Anthotium junciforme*			
421.	7428	*Dampiera coronata (Wedge-leaved Dampiera)*			
422.	7454	*Dampiera linearis (Common Dampiera)*			
423.	7462	*Dampiera pedunculata*			
424.	7484	*Dampiera trigona (Angled-stem Dampiera)*			
425.	7505	*Goodenia eatoniana*			
426.	7517	*Goodenia incana (Hoary Goodenia)*			
427.	12551	*Goodenia micrantha*			
428.	19286	*Goodenia pulchella subsp. Coastal Plain A (M. Hislop 634)*			
429.	19284	*Goodenia pulchella subsp. Coastal Plain B (L.W. Sage 2336)*			
430.	7572	*Lechenaultia expansa*			
431.	7574	*Lechenaultia floribunda (Free-flowering Leschenaultia)*			
432.	7602	*Scaevola calliptera*			
433.	7613	*Scaevola glandulifera (Viscid Hand-flower)*			
434.	7619	*Scaevola lanceolata*			
Haemodoraceae					
435.	1409	*Anigozanthos humilis (Catspaw)*			
436.	11434	*Anigozanthos humilis subsp. humilis*			
437.	1411	*Anigozanthos manglesii (Mangles Kangaroo Paw, Kurulbrang)*			
438.	11261	*Anigozanthos manglesii subsp. manglesii*			
439.	29487	*Anigozanthos manglesii var. x angustifolius*			
440.	1416	*Anigozanthos viridis (Green Kangaroo Paw, Kurulbardang)*			
441.	11566	*Anigozanthos viridis subsp. viridis*			
442.	1418	*Conostylis aculeata (Prickly Conostylis)*			
443.	11826	*Conostylis aculeata subsp. aculeata*			
444.	12118	*Conostylis aculeata subsp. gracilis*			
445.	1436	*Conostylis juncea*			
446.	1453	*Conostylis serrulata*			
447.	1468	*Haemodorum laxum*			
448.	1470	*Haemodorum paniculatum (Mardja)*			
449.	1472	*Haemodorum simplex*			
450.	1474	*Haemodorum sparsiflorum*			
451.	1478	*Phlebocarya ciliata*			
452.	1481	*Tribonanthes australis*			
453.	1482	*Tribonanthes brachypetala*			
454.	1483	*Tribonanthes longipetala*			
Haloragaceae					
455.	6189	*Myriophyllum crispatum*			
Halymeniaceae					
456.	26667	*Codiophyllum flabelliforme*			
457.	26877	*Grateloupia filicina*			
458.	27327	*Thamnoclonium dichotomum*			
Hemerocallidaceae					
459.	23474	*Agrostocrinum hirsutum*			
460.	1261	*Agrostocrinum scabrum (Blue Grass Lily)*			
461.	23501	*Agrostocrinum scabrum subsp. scabrum*			
462.	1276	*Caesia micrantha (Pale Grass Lily)*			
463.	1277	*Caesia occidentalis*			
464.	1285	*Corynotheca micrantha (Sand Lily)*			
465.	11283	*Corynotheca micrantha var. micrantha*			
466.	16326	*Dianella brevicaulis*			
467.	1295	*Johnsonia acaulis*			
468.	1361	*Tricoryne elatior (Yellow Autumn Lily)*			
469.	1362	*Tricoryne humilis*			
Hydatellaceae					
470.	1139	*Trithuria bibracteata*			
471.	1141	*Trithuria submersa*			
Hydrocharitaceae					
472.	168	*Ottelia ovalifolia (Swamp Lily)*			

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473.	14531	*Ottelia ovalifolia subsp. ovalifolia*			
Hypoxidaceae					
474.	11845	*Hypoxis occidentalis var. quadriloba*			
Iridaceae					
475.	18279	*Babiana angustifolia*	Y		
476.	1513	*Chasmanthe floribunda (African Cornflag)*	Y		
477.	18392	*Freesia alba x leichtlinii*	Y		
478.	1520	*Gladiolus caryophyllaceus (Wild Gladiolus)*	Y		
479.	1524	*Gladiolus undulatus (Wild Gladiolus)*	Y		
480.	19179	*Moraea flaccida (One-leaf Cape Tulip)*	Y		
481.	19178	*Moraea lewisiae*	Y		
482.	19180	*Moraea miniata (Two-leaf Cape Tulip)*	Y		
483.	1546	*Patersonia juncea (Rush Leaved Patersonia)*			
484.	1550	*Patersonia occidentalis (Purple Flag, Koma)*			
485.	11550	*Patersonia umbrosa var. xanthina (Yellow Flags)*			
486.	14485	*Romulea flava var. minor*	Y		
487.	1555	*Romulea obscura*	Y		
488.	1556	*Romulea rosea (Guildford Grass)*	Y		
489.	11544	*Romulea rosea var. australis (Guildford Grass)*	Y		
490.	14924	*Romulea rosea var. communis*	Y		
491.	1558	*Sparaxis bulbifera*	Y		
492.	13103	*Watsonia borbonica*	Y		
493.	18375	*Watsonia knysnana*	Y		
494.	1566	*Watsonia marginata*	Y		
495.	1567	*Watsonia meriana (Bulbil Watsonia)*	Y		
496.	18108	*Watsonia meriana var. bulbillifera*	Y		
497.	18118	*Watsonia meriana var. meriana*	Y		
498.	1569	*Watsonia versfeldii*	Y		
Juncaceae					
499.	1178	*Juncus bufonius (Toad Rush)*	Y		
500.	1179	*Juncus caespiticius (Grassy Rush)*			
501.	1184	*Juncus holoschoenus (Jointleaf Rush)*			
502.	11922	*Juncus kraussii subsp. australiensis*			
503.	1186	*Juncus microcephalus*	Y		
504.	1188	*Juncus pallidus (Pale Rush)*			
505.	1195	*Juncus subsecundus (Finger Rush)*			
506.	1198	*Luzula meridionalis (Field Woodrush)*			
Juncaginaceae					
507.	147	*Triglochin mucronata*			
508.	18587	*Triglochin nana*			
509.	151	*Triglochin striata*			
Lamiaceae					
510.	6839	*Hemiandra pungens (Snakebush)*			
511.	6855	*Hemigenia humilis*			
512.	41020	*Hemiphora bartlingii (Woolly Dragon)*			
513.	38323	*Lavandula stoechas subsp. stoechas*	Y		
514.	6880	*Leonotis leonurus (Lion's Ear)*	Y		
515.	6930	*Stachys arvensis (Staggerweed)*	Y		
Lauraceae					
516.	11501	*Cassytha glabella forma casuarinae*			
517.	2957	*Cassytha racemosa (Dodder Laurel)*			
518.	11799	*Cassytha racemosa forma racemosa*			
Lentibulariaceae					
519.	7145	*Utricularia menziesii (Redcoats)*			
520.	7148	*Utricularia multifida*			
Linaceae					
521.	4363	*Linum trigynum (French Flax)*	Y		
Loganiaceae					
522.	13128	*Logania serpyllifolia subsp. angustifolia*			
523.	16395	*Mitreola minima*		P3	
524.	16825	*Phyllangium divergens*			
Loranthaceae					
525.	2401	*Nuytsia floribunda (Christmas Tree, Mudja)*			
Lythraceae					
526.	5281	*Lythrum hyssopifolia (Lesser Loosestrife)*			

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			Y		
Malvaceae					
527.	14647	*Lagunaria patersonia subsp. patersonia*	Y		
528.	5038	*Lasiopetalum membranaceum*		P3	
529.	4958	*Lawrencia spicata*			
530.	36480	*Malva arborea (Tree Mallow)*	Y		
531.	5084	*Thomasia grandiflora (Large Flowered Thomasia)*			
Marsileaceae					
532.	78	*Pilularia novae-hollandiae (Austral Pillwort)*			
Melianthaceae					
533.	4785	*Melianthus major*	Y		
Menyanthaceae					
534.	36160	*Liparophyllum capitatum*			
535.	36180	*Liparophyllum latifolium*			
536.	36177	*Ornduffia albiflora*			
537.	36181	*Ornduffia parnassifolia*			
538.	36200	*Ornduffia submersa*		P4	
Myrtaceae					
539.	5316	*Agonis flexuosa (Peppermint, Wonil)*			
540.	17202	*Agonis flexuosa var. flexuosa*			
541.	20350	*Astartea affinis*			
542.	20130	*Astartea laricifolia*			
543.	20283	*Astartea scoparia*			
544.	17708	*Astartea sp. Gingalup (N. Gibson & M. Lyons 119)*			
545.	5415	*Calothamnus lateralis*			
546.	35797	*Calothamnus lateralis var. lateralis*			
547.	5429	*Calothamnus sanguineus (Silky-leaved Blood flower, Pindak)*			
548.	5458	*Calytrix flavescens (Summer Starflower)*			
549.	5465	*Calytrix leschenaultii*			
550.	35657	*Chamelaucium sp. Yoongarillup (G.J. Keighery 3635)*		P4	
551.	17105	*Corymbia haematoxylon (Mountain Marri)*			
552.	5508	*Darwinia citriodora (Lemon-scented Darwinia)*			
553.	13538	*Eucalyptus decipiens subsp. chalara*			
554.	5659	*Eucalyptus gomphocephala (Tuart, Duart)*			
555.	5708	*Eucalyptus marginata (Jarrah, Djara)*			
556.	5763	*Eucalyptus rudis (Flooded Gum, Kulurda)*			
557.	13512	*Eucalyptus rudis subsp. cratyantha*		P4	
558.	13511	*Eucalyptus rudis subsp. rudis*			
559.	13032	*Eucalyptus vegrandis*			
560.	12906	*Eucalyptus wandoo subsp. wandoo*			
561.	5816	*Homalospermum firmum*			
562.	5817	*Hypocalymma angustifolium (White Myrtle, Kudjid)*			
563.	35070	*Hypocalymma angustifolium subsp. Swan Coastal Plain (G.J. Keighery 16777)*			
564.	5825	*Hypocalymma robustum (Swan River Myrtle)*			
565.	5832	*Kunzea ericifolia (Spearwood, Pondil)*			
566.	15498	*Kunzea glabrescens (Spearwood)*			
567.	5835	*Kunzea micrantha*			
568.	17461	*Kunzea micrantha subsp. micrantha*			
569.	5841	*Kunzea recurva*			
570.	13273	*Melaleuca incana subsp. incana*			
571.	5926	*Melaleuca lateritia (Robin Redbreast Bush)*			
572.	5938	*Melaleuca microphylla*			
573.	20297	*Melaleuca osullivanii*			
574.	18394	*Melaleuca parviceps*			
575.	5946	*Melaleuca pauciflora*			
576.	5952	*Melaleuca preissiana (Moonah)*			
577.	5959	*Melaleuca rhaphiophylla (Swamp Paperbark)*			
578.	18598	*Melaleuca systena*			
579.	5978	*Melaleuca teretifolia (Banbar)*			
580.	5980	*Melaleuca thymoides*			
581.	5987	*Melaleuca viminea (Mohan)*			
582.	6006	*Pericalymma ellipticum (Swamp Teatree)*			
583.	16477	*Pericalymma ellipticum var. ellipticum*			
584.	16478	*Pericalymma ellipticum var. floridum*			
585.	6033	*Scholtzia involucrata (Spiked Scholtzia)*			
586.	20133	*Taxandria parviceps*			
587.	12392	*Verticordia attenuata*		P3	

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Onagraceae					
588.	16390	*Oenothera drummondii subsp. drummondii*	Y		
589.	6140	*Oenothera mollissima*	Y		
Orchidaceae					
590.	15332	*Caladenia attingens subsp. attingens*			
591.	15579	*Caladenia chapmanii*			
592.	1586	*Caladenia discoidea (Dancing Orchid)*			
593.	1592	*Caladenia flava (Cowslip Orchid)*			
594.	15348	*Caladenia flava subsp. flava*			
595.	15352	*Caladenia georgei*			
596.	15354	*Caladenia hirta subsp. hirta*			
597.	1599	*Caladenia latifolia (Pink Fairy Orchid)*			
598.	13859	*Caladenia longicauda subsp. clivicola*			
599.	1605	*Caladenia marginata (White Fairy Orchid)*			
600.	15371	*Caladenia nana subsp. nana*			
601.	17760	*Caladenia nobilis*			
602.	15503	*Caladenia paludosa*			
603.	18026	*Caladenia pendens subsp. pendens*			
604.	15377	*Caladenia reptans subsp. reptans*			
605.	13862	*Caladenia speciosa*		P4	
606.	15380	*Caladenia splendens*			
607.	18019	*Caladenia vulgata*			
608.	15114	*Cyanicula gemmata*			
609.	15404	*Cyanicula sericea*			
610.	10916	*Cyrtostylis huegelii*			
611.	19649	*Disa bracteata*	Y		
612.	11049	*Diuris corymbosa*			
613.	10796	*Diuris drummondii (Tall Donkey Orchid)*		T	
614.	10938	*Diuris filifolia (Cat's Face Orchid)*			
615.	1639	*Drakaea elastica (Glossy-leaved Hammer Orchid)*		T	
616.	1640	*Drakaea glyptodon (King-in-his-carriage)*			
617.	11156	*Drakaea livida*			
618.	13635	*Drakaea micrantha*		T	
619.	1643	*Elythranthera brunonis (Purple Enamel Orchid)*			
620.	1644	*Elythranthera emarginata (Pink Enamel Orchid)*			
621.	1646	*Eriochilus dilatatus (White Bunny Orchid)*			
622.	15410	*Eriochilus dilatatus subsp. dilatatus*			
623.	15412	*Eriochilus dilatatus subsp. multiflorus*			
624.	15415	*Eriochilus scaber subsp. scaber*			
625.	1653	*Leporella fimbriata (Hare Orchid)*			
626.	1656	*Lyperanthus serratus (Rattle Beak Orchid)*			
627.	10954	*Microtis media (Tall Mignonette Orchid)*			
628.	15419	*Microtis media subsp. media*			
629.	1667	*Paracaleana nigrita (Flying Duck Orchid)*			
630.	15424	*Praecoxanthus aphyllus*			
631.	1674	*Prasophyllum giganteum (Bronze Leek Orchid)*			
632.	1676	*Prasophyllum hians (Yawning Leek Orchid)*			
633.	1680	*Prasophyllum parvifolium (Autumn Leek Orchid)*			
634.	10853	*Prasophyllum plumiforme*			
635.	1685	*Pterostylis angusta*			
636.	15426	*Pterostylis aspera*			
637.	11118	*Pterostylis pyramidalis (Snail Orchid)*			
638.	1693	*Pterostylis recurva (Jug Orchid)*			
639.	1694	*Pterostylis rogersii (Curled-tongue Shell Orchid)*			
640.	18655	*Pterostylis sp. crinkled leaf (G.J. Keighery 13426)*			
641.	1698	*Pterostylis vittata (Banded Greenhood)*			
642.	16367	*Pyrorchis nigricans (Red beaks, Elephants ears)*			
643.	1701	*Thelymitra antennifera (Vanilla Orchid)*			
644.	1705	*Thelymitra crinita (Blue Lady Orchid)*			
645.	1707	*Thelymitra flexuosa (Twisted Sun Orchid)*			
646.	11143	*Thelymitra graminea*			
647.	11053	*Thelymitra macrophylla*			
648.	20730	*Thelymitra paludosa*			
649.	20731	*Thelymitra vulgaris*			
Orobanchaceae					
650.	15037	*Bartsia trixago*	Y		
651.	7122	*Orobanche minor (Lesser Broomrape)*	Y		
652.	7090	*Parentucellia viscosa (Sticky Bartsia)*	Y		

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Oxalidaceae					
653.	4348	*Oxalis caprina*	Y		
654.	4352	*Oxalis glabra*	Y		
Papaveraceae					
655.	2969	*Fumaria capreolata (Whiteflower Fumitory)*	Y		
Passifloraceae					
656.	5225	*Passiflora filamentosa*	Y		
Phacelocarpaceae					
657.	27131	*Phacelocarpus alatus*			
Philydraceae					
658.	1173	*Philydrella pygmaea (Butterfly Flowers)*			
659.	14306	*Philydrella pygmaea subsp. pygmaea*			
Phrymaceae					
660.	7060	*Glossostigma diandrum*			
Phyllanthaceae					
661.	4675	*Phyllanthus calycinus (False Boronia)*			
Pittosporaceae					
662.	3165	*Billardiera variifolia*			
663.	16322	*Pittosporum undulatum*	Y		
Plantaginaceae					
664.	4717	*Callitriche stagnalis (Common Starwort)*	Y		
665.	14282	*Gratiola pubescens*			
666.	7303	*Plantago lanceolata (Ribwort Plantain)*	Y		
667.	7108	*Veronica arvensis (Wall Speedwell)*	Y		
Poaceae					
668.	184	*Aira caryophyllea (Silvery Hairgrass)*	Y		
669.	186	*Aira elegantissima*	Y		
670.	35159	*Ammophila arenaria subsp. arenaria*	Y		
671.	13380	*Amphibromus nervosus*			
672.	200	*Amphipogon turbinatus*			
673.	202	*Anthoxanthum odoratum (Sweet Vernal Grass)*	Y		
674.	17233	*Austrostipa campylachne*			
675.	17234	*Austrostipa compressa*			
676.	38481	*Austrostipa jacobsiana*		P1	
677.	17253	*Austrostipa semibarbata*			
678.	231	*Avellinia michelii*	Y		
679.	233	*Avena barbata (Bearded Oat)*	Y		
680.	234	*Avena fatua (Wild Oat)*	Y		
681.	235	*Avena sativa (Common Oat)*	Y		
682.	244	*Briza maxima (Blowfly Grass)*	Y		
683.	245	*Briza minor (Shivery Grass)*	Y		
684.	248	*Bromus catharticus (Prairie Grass)*	Y		
685.	249	*Bromus diandrus (Great Brome)*	Y		
686.	41570	*Cenchrus spinifex (Spiny Burrgrass)*	Y		
687.	267	*Chloris gayana (Rhodes Grass)*	Y		
688.	277	*Cortaderia selloana (Pampas Grass)*	Y		
689.	283	*Cynodon dactylon (Couch)*	Y		
690.	285	*Cynosurus echinatus (Rough Dogstail)*	Y		
691.	287	*Dactylis glomerata (Cocksfoot)*	Y		
692.	299	*Deyeuxia quadriseta (Reed Bentgrass)*			
693.	306	*Dichelachne crinita (Longhair Plumegrass)*			
694.	347	*Ehrharta calycina (Perennial Veldt Grass)*	Y		
695.	349	*Ehrharta longiflora (Annual Veldt Grass)*	Y		
696.	353	*Eleusine indica (Crowsfoot Grass)*	Y		
697.	376	*Eragrostis curvula (African Lovegrass)*	Y		
698.	430	*Festuca arundinacea (Tall Fescue)*	Y		
699.	17043	*Glyceria declinata*	Y		
700.	11451	*Hemarthria uncinata var. uncinata*			
701.	444	*Holcus lanatus (Yorkshire Fog)*	Y		
702.	19955	*Lachnagrostis plebeia*			
703.	19124	*Leptochloa fusca subsp. fusca*			
704.	476	*Lolium perenne (Perennial Ryegrass)*	Y		
705.	478	*Lolium rigidum (Wimmera Ryegrass)*	Y		
706.	485	*Microlaena stipoides (Weeping Grass)*			
707.	492	*Neurachne alopecuroidea (Foxtail Mulga Grass)*			
708.	502	*Panicum capillare (Witchgrass)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
			Y		
709.	527	*Paspalum dilatatum*	Y		
710.	547	*Phalaris angusta*	Y		
711.	571	*Poa annua (Winter Grass)*	Y		
712.	573	*Poa drummondiana (Knotted Poa)*			
713.	577	*Poa poiformis (Coastal Poa)*			
714.	583	*Polypogon tenellus*			
715.	31673	*Puccinellia vassica*		P1	
716.	40426	*Rytidosperma occidentale*			
717.	40430	*Rytidosperma pilosum*			
718.	40427	*Rytidosperma setaceum*			
719.	609	*Setaria palmifolia (Palm Grass)*	Y		
720.	624	*Spinifex hirsutus (Hairy Spinifex)*			
721.	625	*Spinifex longifolius (Beach Spinifex)*			
722.	626	*Spinifex sericeus*	Y		
723.	635	*Sporobolus virginicus (Marine Couch)*			
724.	636	*Stenotaphrum secundatum (Buffalo Grass)*	Y		
725.	667	*Tetrarrhena laevis (Forrest Ricegrass)*			
726.	722	*Vulpia bromoides (Squirrel Tail Fescue)*	Y		
727.	724	*Vulpia myuros (Rat's Tail Fescue)*	Y		
Podocarpaceae					
728.	86	*Podocarpus drouynianus (Wild Plum, Kula)*			
Polygalaceae					
729.	4554	*Comesperma flavum*			
730.	4559	*Comesperma polygaloides (Small Milkwort)*			
731.	4564	*Comesperma virgatum (Milkwort)*			
Polygonaceae					
732.	17739	*Acetosa vesicaria*	Y		
733.	17774	*Acetosella vulgaris*	Y		
734.	16896	*Muehlenbeckia complexa*	Y		Y
735.	11052	*Persicaria prostrata*			
736.	2419	*Polygonum aviculare (Wireweed)*	Y		
737.	2433	*Rumex crispus (Curled Dock)*	Y		
Posidoniaceae					
738.	122	*Posidonia angustifolia*			
Potamogetonaceae					
739.	110	*Potamogeton drummondii*			
Pottiaceae					
740.	32315	*Barbula calycina*			
741.	32345	*Didymodon australasiae*			
742.	32437	*Syntrichia antarctica*			
Primulaceae					
743.	36375	*Lysimachia arvensis (Pimpernel)*	Y		
744.	6483	*Samolus junceus*			
745.	6484	*Samolus repens (Creeping Brookweed)*			
746.	14107	*Samolus repens var. paucifolius*			
Proteaceae					
747.	1790	*Adenanthos meisneri*			
748.	1791	*Adenanthos obovatus (Basket Flower)*			
749.	28281	*Adenanthos sp. Whicher Range (G.J. Keighery 9736)*			
750.	1800	*Banksia attenuata (Slender Banksia, Piara)*			
751.	32580	*Banksia dallanneyi var. dallanneyi*			
752.	1822	*Banksia ilicifolia (Holly-leaved Banksia)*			
753.	1830	*Banksia littoralis (Swamp Banksia, Pungura)*			
754.	32202	*Banksia nivea (Honeypot Dryandra, Pudjarn)*			
755.	1863	*Conospermum capitatum*			
756.	1945	*Franklandia triaristata (Lanoline Bush)*		P4	
757.	1964	*Grevillea bipinnatifida (Fuchsia Grevillea)*			
758.	19628	*Grevillea bipinnatifida subsp. bipinnatifida*			
759.	13427	*Grevillea manglesioides subsp. manglesioides*			
760.	2066	*Grevillea pilulifera (Woolly-flowered Grevillea)*			
761.	2122	*Grevillea wilsonii (Native Fuchsia)*			
762.	2128	*Hakea amplexicaulis (Prickly Hakea)*			
763.	2137	*Hakea ceratophylla (Horned Leaf Hakea)*			
764.	2152	*Hakea cyclocarpa (Ramshorn)*			
765.	2175	*Hakea lissocarpha (Honey Bush)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
766.	2212	*Hakea sulcata (Furrowed Hakea)*			
767.	2216	*Hakea varia (Variable-leaved Hakea)*			
768.	2222	*Isopogon attenuatus*			
769.	2267	*Persoonia longifolia (Snottygobble)*			
770.	2273	*Persoonia saccata (Snottygobble)*			
771.	2299	*Petrophile linearis (Pixie Mops)*			
772.	2316	*Stirlingia latifolia (Blueboy)*			
773.	15529	*Synaphea floribunda*			
774.	2323	*Synaphea gracillima*			
775.	16769	*Synaphea hians*		P3	
776.	16865	*Synaphea odocoileops*		P1	
777.	2324	*Synaphea petiolaris (Synaphea)*			
778.	16864	*Synaphea petiolaris subsp. petiolaris*			
779.	16863	*Synaphea petiolaris subsp. triloba*			
780.	15532	*Synaphea spinulosa subsp. spinulosa*			
781.	2331	*Xylomelum occidentale (Woody Pear, Djandin)*			
Racopilaceae					
782.	32480	*Racopilum cuspidigerum var. convolutaceum*			
Ranunculaceae					
783.	2929	*Clematis pubescens (Common Clematis)*			
Restionaceae					
784.	17685	*Chaetanthus aristatus*			
785.	17691	*Desmocladus fasciculatus*			
786.	16595	*Desmocladus flexuosus*			
787.	16455	*Desmocladus virgatus*			
788.	1067	*Empodisma gracillimum*			
789.	1070	*Hypolaena exsulca*			
790.	1071	*Hypolaena fastigiata*			
791.	17841	*Hypolaena pubescens*			
792.	15556	*Leptocarpus elegans*			
793.	19833	*Leptocarpus laxus*			
794.	1082	*Leptocarpus tenax (Slender Twine Rush)*			
795.	1085	*Lepyrodia glauca*			
796.	1088	*Lepyrodia macra (Large Scale Rush)*			
797.	1090	*Lepyrodia muirii*			
798.	1092	*Loxocarya cinerea*			
799.	17683	*Meeboldina cana*			
800.	17679	*Meeboldina coangustata*			
801.	17747	*Meeboldina decipiens*			
802.	17976	*Meeboldina decipiens subsp. decipiens*		P3	
803.	1098	*Meeboldina denmarkica*			
804.	17677	*Meeboldina roycei*			
805.	18381	*Stenotalis ramosissima*			
Rhamnaceae					
806.	13484	*Cryptandra arbutiflora var. tubulosa*			
807.	4828	*Spyridium globulosum (Basket Bush)*			
Rhodomelaceae					
808.	35909	*Amansia pinnatifida*			
809.	26663	*Cladurus elatus*			
810.	26666	*Cliftonaea pectinata*			
Rosaceae					
811.	10931	*Rosa chinensis x moschata*	Y		
812.	3187	*Rosa rubiginosa (Sweet Briar)*	Y		
Rubiaceae					
813.	18254	*Opercularia apiciflora*			
814.	7348	*Opercularia hispidula (Hispid Stinkweed)*			
Rutaceae					
815.	4417	*Boronia dichotoma*			
816.	16618	*Boronia humifusa*		P1	
817.	4441	*Boronia spathulata (Boronia)*			
818.	17804	*Boronia tetragona*		P3	
819.	4454	*Diplolaena dampieri (Southern Diplolaena)*			
820.	18529	*Philotheca spicata (Pepper and Salt)*			
Salviniaceae					
821.	17737	*Azolla pinnata*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
Santalaceae					
822.	10765	*Exocarpos sparteus (Broom Ballart, Djuk)*			
823.	2342	*Leptomeria cunninghamii*			
824.	2344	*Leptomeria empetriformis*			
825.	17702	*Leptomeria furtiva*		P2	
826.	2353	*Leptomeria scrobiculata*			
Scrophulariaceae					
827.	17175	*Eremophila glabra subsp. albicans*			
828.	7289	*Myoporum caprarioides (Slender Myoporum)*			
829.	7107	*Verbascum virgatum (Twiggy Mullein)*	Y		
Selaginellaceae					
830.	6	*Selaginella gracillima (Tiny Clubmoss)*			
Solanaceae					
831.	6949	*Anthocercis littorea (Yellow Tailflower)*			
832.	31275	*Physalis hederifolia (Sticky Cape Gooseberry)*	Y		Y
833.	7005	*Solanum elaeagnifolium (White Horse Nettle, Silverleaf Nightshade)*	Y		
834.	7022	*Solanum nigrum (Black Berry Nightshade)*	Y		
Stylidiaceae					
835.	7676	*Levenhookia pusilla (Midget Stylewort)*			
836.	7677	*Levenhookia stipitata (Common Stylewort)*			
837.	25831	*Stylidium araeophyllum*			
838.	7693	*Stylidium brunonianum (Pink Fountain Triggerplant)*			
839.	7696	*Stylidium calcaratum (Book Triggerplant)*			
840.	7713	*Stylidium dichotomum (Pins-and-needles)*			
841.	7719	*Stylidium ecorne (Foot Triggerplant)*			
842.	25801	*Stylidium hesperium*			
843.	7742	*Stylidium inundatum (Hundreds and Thousands)*			
844.	7745	*Stylidium junceum (Reed Triggerplant)*			
845.	7756	*Stylidium longitubum (Jumping Jacks)*		P3	
846.	7774	*Stylidium piliferum (Common Butterfly Triggerplant)*			
847.	7785	*Stylidium repens (Matted Triggerplant)*			
848.	7798	*Stylidium schoenoides (Cow Kicks)*			
849.	23511	*Stylidium thesioides (Delicate Triggerplant)*			
850.	7806	*Stylidium utricularioides (Pink Fan Triggerplant)*			
851.	7808	*Stylidium violaceum (Violet Triggerplant)*			
Thuidiaceae					
852.	32486	*Thuidium sparsum var. hastatum*			
Thymelaeaceae					
853.	11928	*Pimelea ciliata subsp. ciliata*			
854.	11402	*Pimelea imbricata var. piligera*			
855.	5252	*Pimelea lanata*			
856.	11639	*Pimelea longiflora subsp. longiflora*			
857.	18117	*Pimelea rosea subsp. rosea*			
Ulvaceae					
858.	35260	*Ulva compressa*			
Urticaceae					
859.	1765	*Soleirolia soleirolii (Babys Tears)*	Y		
Verbenaceae					
860.	20120	*Verbena litoralis*	Y		Y
Violaceae					
861.	5216	*Hybanthus calycinus (Wild Violet)*			
862.	5221	*Hybanthus floribundus*			
863.	12007	*Hybanthus floribundus subsp. floribundus*			
Xanthorrhoeaceae					
864.	1251	*Xanthorrhoea brunonis*			
865.	14545	*Xanthorrhoea brunonis subsp. semibarbata*			
866.	1256	*Xanthorrhoea preissii (Grass tree, Palga)*			
Zamiaceae					
867.	85	*Macrozamia riedlei (Zamia, Djiridji)*			

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

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

2 - Priority 2
3 - Priority 3
4 - Priority 4
5 - Priority 5

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

NatureMap
Mapping Western Australia's biodiversity

NatureMap Fauna Species Report 10 km buffer

Created By Melissa Longman on 04/06/2013

Kingdom Animalia
Current Names Only Yes
Core Datasets Only Yes
Method 'By Line'
Group By Family

Family	Species	Records
Acanthizidae	6	160
Accipitridae	6	50
Actinopodidae	3	17
Agamidae	2	5
Anatidae	11	589
Araneidae	9	26
Ardeidae	7	109
Arripidae	1	1
Artamidae	2	42
Atherinidae	1	1
Balaenidae	1	1
Balaenopteridae	1	1
Blenniidae	1	1
Bothriuridae	1	2
Bovidae	1	1
Burhinidae	1	1
Burramyidae	1	20
Campephagidae	1	55
Carangidae	2	3
Carcharhinidae	2	2
Charadriidae	6	52
Cheilodactylidae	1	1
Cheloniidae	2	9
Cheluidae	1	2
Cinclosomatidae	1	1
Clupeidae	1	1
Columbidae	5	134
Corvidae	2	135
Cracticidae	3	162
Cuculidae	3	7
Dasyuridae	2	8
Delphinidae	4	7
Dicruridae	4	226
Diodontidae	2	2
Diomedeidae	4	5
Echeneidae	1	1
Elapidae	11	28
Elopidae	1	1
Falconidae	4	27
Felidae	1	1
Garypidae	1	1
Gekkonidae	1	12
Gempylidae	1	1
Geotriidae	1	7
Gobiidae	3	6
Gonorynchidae	1	1
Haematopodidae	1	55
Halcyonidae	2	66
Hemigaleidae	1	1
Hemiramphidae	2	2
Hersiliidae	1	1
Heterodontidae	1	2
Hirundinidae	1	130
Hydrobatidae	1	1
Hylidae	2	26
Idiopidae	1	16
Istiophoridae	1	1
Labridae	1	2
Laridae	4	4
Leporidae	1	2
Limnodynastidae	2	103
Linyphiidae	1	1
Lycosidae	5	12
Macropodidae	3	6
Macroramphosidae	1	1
Maluridae	3	68
Meliphagidae	7	290
Meropidae	1	17
Miturgidae	2	3
Monacanthidae	2	2
Monocentrididae	1	6
Mugilidae	2	4
Muraenidae	1	1
Muridae	3	8
Myliobatidae	1	1

Myobatrachidae	6	66
Nemesiidae	2	38
Neosittidae	1	2
Ophichthidae	2	4
Ostraciidae	2	3
Otariidae	1	1
Pachycephalidae	3	94
Pardalotidae	2	52
Passeridae	2	2
Pataecidae	1	1
Pelecanidae	1	57
Pelecanoididae	1	1
Pentacerotidae	1	1
Peramelidae	1	7
Petroicidae	2	4
Phalacrocoracidae	5	203
Phalangeridae	2	3
Phasianidae	1	1
Phocidae	1	1
Pholcidae	1	1
Physeteridae	1	1
Platycephalidae	1	1
Podargidae	1	5
Podicipedidae	3	104
Pristiophoridae	1	1
Procellariidae	10	28
Prodidomidae	1	1
Pseudocheiridae	1	530
Psittacidae	14	75
Pygopodidae	2	6
Rachycentridae	1	1
Rallidae	7	289
Recurvirostridae	3	31
Scincidae	17	220
Scolopacidae	13	162
Scolopendridae	1	1
Scombridae	2	4
Scorpaenidae	1	5
Scutigeridae	1	2
Scyliorhinidae	2	2
Sillaginidae	1	2
Sparassidae	1	9
Spheniscidae	3	4
Sphyraenidae	1	1
Squalidae	1	3
Squatinidae	1	1
Strigidae	1	5
Suidae	1	3
Sylviidae	2	61
Syngnathidae	3	8
Tetraodontidae	2	2
Theridiidae	2	3
Threskiornithidae	4	234
Triaenonychidae	1	15
Triakidae	2	2
Trichiuridae	2	3
Triglidae	2	3
Trochanteriidae	1	2
Typhlopidae	1	8
Uranoscopidae	1	1
Urolophidae	2	2
Ziphiidae	3	4
Zosteropidae	1	124
TOTAL	**342**	**5268**

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
Acanthizidae					
1.	24260	*Acanthiza apicalis (Broad-tailed Thornbill, Inland Thornbill)*			
2.	24261	*Acanthiza chrysorrhoa (Yellow-rumped Thornbill)*			
3.	24262	*Acanthiza inornata (Western Thornbill)*			
4.	25530	*Gerygone fusca (Western Gerygone)*			
5.	25534	*Sericornis frontalis (White-browed Scrubwren)*			
6.	30948	*Smicrornis brevirostris (Weebill)*			
Accipitridae					
7.	25535	*Accipiter cirrocephalus (Collared Sparrowhawk)*			
8.	25536	*Accipiter fasciatus (Brown Goshawk)*			
9.	24285	*Aquila audax (Wedge-tailed Eagle)*			
10.	24288	*Circus approximans (Swamp Harrier)*			
11.	24293	*Haliaeetus leucogaster (White-bellied Sea-Eagle)*		IA	
12.	24295	*Haliastur sphenurus (Whistling Kite)*			
Actinopodidae					
13.	-11780	*Missulena granulosa subsp. granulosa*			
14.	-13148	*Missulena granulosa subsp. hoggi*			
15.	-13130	*Missulena occatoria*			
Agamidae					
16.	25510	*Pogona minor (Dwarf Bearded Dragon)*			
17.	24907	*Pogona minor subsp. minor (Dwarf Bearded Dragon)*			
Anatidae					
18.	24310	*Anas castanea (Chestnut Teal)*			
19.	24312	*Anas gracilis (Grey Teal)*			
20.	24313	*Anas platyrhynchos (Mallard)*			
21.	24315	*Anas rhynchotis (Australasian Shoveler)*			
22.	24316	*Anas superciliosa (Pacific Black Duck)*			
23.	24318	*Aythya australis (Hardhead)*			
24.	24319	*Biziura lobata (Musk Duck)*			
25.	24321	*Chenonetta jubata (Australian Wood Duck, Wood Duck)*			
26.	24322	*Cygnus atratus (Black Swan)*			
27.	24328	*Oxyura australis (Blue-billed Duck)*			
28.	24331	*Tadorna tadornoides (Australian Shelduck, Mountain Duck)*			
Araneidae					
29.	-11998	*Argiope protensa*			
30.	-13091	*Arkys walckenaeri*			
31.	-12035	*Austracantha minax*			
32.	-11966	*Backobourkia brounii*			
33.	-11711	*Backobourkia heroine*			
34.	-11928	*Celaenia excavata*			
35.	-11783	*Cyclosa trilobata*			
36.	-12029	*Cyrtophora parnasia*			
37.	-13122	*Eriophora biapicata*			
Ardeidae					
38.	25558	*Ardea ibis (Cattle Egret)*		IA	
39.	41324	*Ardea modesta (Eastern Great Egret)*		IA	
40.	24340	*Ardea novaehollandiae (White-faced Heron)*			
41.	24341	*Ardea pacifica (White-necked Heron)*			
42.	24347	*Ixobrychus flavicollis subsp. australis (Australian Black Bittern)*		P3	
43.	24348	*Ixobrychus minutus subsp. dubius (Australian Little Bittern)*		P4	
44.	25564	*Nycticorax caledonicus (Rufous Night Heron)*			
Arripidae					
45.	-17373	*Arripis truttacea*			
Artamidae					
46.	25566	*Artamus cinereus (Black-faced Woodswallow)*			
47.	24353	*Artamus cyanopterus (Dusky Woodswallow)*			
Atherinidae					
48.	-14831	*Atherinosoma elongata*			
Balaenidae					
49.	24043	*Eubalaena australis (Southern Right Whale)*		T	
Balaenopteridae					
50.	24044	*Balaenoptera acutorostrata (Dwarf Minke Whale)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
Blenniidae					
51.	-16094	*Parablennius postoculomaculatus*			
Bothriuridae					
52.	-13111	*Cercophonius sulcatus*			
Bovidae					
53.	24251	*Bos taurus (European Cattle)*	Y		
Burhinidae					
54.	24359	*Burhinus grallarius (Bush Stone-curlew)*		P4	
Burramyidae					
55.	24086	*Cercartetus concinnus (Western Pygmy-possum, Mundarda)*			
Campephagidae					
56.	25568	*Coracina novaehollandiae (Black-faced Cuckoo-shrike)*			
Carangidae					
57.	-15324	*Trachinotus baillonii*			
58.	-14145	*Trachurus novaezelandiae*			
Carcharhinidae					
59.	-16168	*Carcharhinus sp.*			
60.	-16775	*Prionace glauca*			
Charadriidae					
61.	25575	*Charadrius leschenaultii (Greater Sand Plover)*		IA	
62.	24376	*Charadrius rubricollis (Hooded Plover)*		P4	
63.	24377	*Charadrius ruficapillus (Red-capped Plover)*			
64.	24382	*Pluvialis fulva (Pacific Golden Plover)*		IA	
65.	24383	*Pluvialis squatarola (Grey Plover)*		IA	
66.	24386	*Vanellus tricolor (Banded Lapwing)*			
Cheilodactylidae					
67.	-13654	*Dactylophora nigricans*			
Cheloniidae					
68.	25335	*Caretta caretta (Loggerhead Turtle)*		T	
69.	25344	*Natator depressus (Flatback Turtle)*		T	
Cheluidae					
70.	25337	*Chelodina oblonga (Oblong Turtle)*			
Cinclosomatidae					
71.	24388	*Psophodes nigrogularis subsp. nigrogularis (Western Whipbird (western heath))*		T	
Clupeidae					
72.	-16030	*Hyperlophus vittatus*			
Columbidae					
73.	24399	*Columba livia (Domestic Pigeon)*	Y		
74.	24407	*Ocyphaps lophotes (Crested Pigeon)*			
75.	24409	*Phaps chalcoptera (Common Bronzewing)*			
76.	25589	*Streptopelia chinensis (Spotted Turtle-Dove)*	Y		
77.	25590	*Streptopelia senegalensis (Laughing Turtle-Dove)*	Y		
Corvidae					
78.	25592	*Corvus coronoides (Australian Raven)*			
79.	24417	*Corvus coronoides subsp. perplexus (Australian Raven)*			
Cracticidae					
80.	25595	*Cracticus tibicen (Australian Magpie)*			
81.	25596	*Cracticus torquatus (Grey Butcherbird)*			
82.	25597	*Strepera versicolor (Grey Currawong)*			
Cuculidae					
83.	25598	*Cacomantis flabelliformis (Fan-tailed Cuckoo)*			
84.	42307	*Cacomantis pallidus (Pallid Cuckoo)*			
85.	24432	*Chrysococcyx lucidus subsp. plagosus (Shining Bronze Cuckoo)*			
Dasyuridae					
86.	24092	*Dasyurus geoffroii (Chuditch, Western Quoll)*		T	
87.	24099	*Phascogale tapoatafa subsp. tapoatafa (Southern Brush-tailed Phascogale, Wambenger)*		T	
Delphinidae					
88.	-17636	*Stenella coeruleoalba*			
89.	-17718	*Stenella longirostris*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
90.	30954	*Tursiops aduncus (Indo-Pacific Bottlenose Dolphin)*			
91.	24069	*Tursiops truncatus (Bottlenose Dolphin)*			
Dicruridae					
92.	24443	*Grallina cyanoleuca (Magpie-lark)*			
93.	25613	*Rhipidura fuliginosa (Grey Fantail)*			
94.	25614	*Rhipidura leucophrys (Willie Wagtail)*			
95.	25616	*Rhipidura rufiventris (Northern Fantail)*			
Diodontidae					
96.	-14379	*Diodon nicthemerus*			
97.	-15221	*Diodon sp.*			
Diomedeidae					
98.	24468	*Diomedea chrysostoma (Grey-headed Albatross)*		T	
99.	25618	*Diomedea exulans (Wandering Albatross)*		T	
100.	34134	*Thalassarche carteri (Indian Yellow-nosed Albatross)*		T	
101.	34137	*Thalassarche melanophrys (Black-browed Albatross)*		T	
Echeneidae					
102.	-16148	*Echeneis naucrates*			
Elapidae					
103.	25359	*Disteira major*			
104.	25251	*Echiopsis curta (Bardick)*			
105.	25250	*Elapognathus coronatus (Crowned Snake)*			
106.	42410	*Hydrophis ornatus*			
107.	25248	*Neelaps bimaculatus (Black-naped Snake)*			
108.	25252	*Notechis scutatus (Tiger Snake)*			
109.	25253	*Parasuta gouldii*			
110.	25255	*Parasuta nigriceps*			
111.	-17934	*Pelamis platurus*			
112.	25259	*Pseudonaja affinis subsp. affinis (Dugite)*			
113.	25266	*Simoselaps bertholdi (Jan's Banded Snake)*			
Elopidae					
114.	-17038	*Elops hawaiensis*			
Falconidae					
115.	25621	*Falco berigora (Brown Falcon)*			
116.	25622	*Falco cenchroides (Australian Kestrel)*			
117.	25623	*Falco longipennis (Australian Hobby)*			
118.	25624	*Falco peregrinus (Peregrine Falcon)*		S	
Felidae					
119.	24041	*Felis catus (Cat)*	Y		
Garypidae					
120.	-12934	*Synsphyronus magnus*			
Gekkonidae					
121.	24980	*Christinus marmoratus (Marbled Gecko)*			
Gempylidae					
122.	-17379	*Thyrsites atun*			
Geotriidae					
123.	34030	*Geotria australis (Pouched Lamprey)*		P1	
Gobiidae					
124.	-14838	*Acentrogobius bifrenatus*			
125.	-16371	*Arenigobius bifrenatus*			
126.	-16086	*Pseudogobius olorum*			
Gonorynchidae					
127.	-16981	*Gonorynchus greyi*			
Haematopodidae					
128.	24487	*Haematopus longirostris (Pied Oystercatcher)*			
Halcyonidae					
129.	30901	*Dacelo novaeguineae (Laughing Kookaburra)*	Y		
130.	25549	*Todiramphus sanctus (Sacred Kingfisher)*			
Hemigaleidae					
131.	-16561	*Hemipristis elongata*			
Hemiramphidae					
132.	-15828	*Euleptorhamphus viridis*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
133.	-13510	*Hyporhamphus melanochir*			
Hersiliidae					
134.	-11990	*Tamopsis distinguenda*			
Heterodontidae					
135.	-15985	*Heterodontus portusjacksoni*			
Hirundinidae					
136.	24491	*Hirundo neoxena (Welcome Swallow)*			
Hydrobatidae					
137.	24497	*Oceanites oceanicus (Wilson's Storm Petrel)*		IA	
Hylidae					
138.	25378	*Litoria adelaidensis (Slender Tree Frog)*			
139.	25388	*Litoria moorei (Motorbike Frog)*			
Idiopidae					
140.	-12487	*Idiosoma sigillatum*			
Istiophoridae					
141.	-17417	*Makaira indica*			
Labridae					
142.	-16966	*Ophthalmolepis lineolatus*			
Laridae					
143.	24506	*Anous tenuirostris subsp. melanops (Australian Lesser Noddy)*		T	
144.	25638	*Larus pacificus (Pacific Gull)*			
145.	24522	*Sterna bergii (Crested Tern)*			
146.	25644	*Sterna nereis (Fairy Tern)*			
Leporidae					
147.	24085	*Oryctolagus cuniculus (Rabbit)*	Y		
Limnodynastidae					
148.	25410	*Heleioporus eyrei (Moaning Frog)*			
149.	25415	*Limnodynastes dorsalis (Western Banjo Frog)*			
Linyphiidae					
150.	-11589	*Erigone prominens*			
Lycosidae					
151.	-12919	*Artoria linnaei*			
152.	-12010	*Artoriopsis expolita*			
153.	-11733	*Dingosa serrata*			
154.	-11729	*Tasmanicosa leuckartii*			
155.	-12011	*Venator immansueta*			
Macropodidae					
156.	24132	*Macropus fuliginosus (Western Grey Kangaroo)*			
157.	24133	*Macropus irma (Western Brush Wallaby)*		P4	
158.	24145	*Setonix brachyurus (Quokka)*		T	
Macroramphosidae					
159.	-13655	*Macroramphosus scolopax*			
Maluridae					
160.	25654	*Malurus splendens (Splendid Fairy-wren)*			
161.	25655	*Stipiturus malachurus (Southern Emu-wren)*			
162.	24554	*Stipiturus malachurus subsp. westernensis (Southern Emu-wren)*			
Meliphagidae					
163.	24560	*Acanthorhynchus superciliosus (Western Spinebill)*			
164.	24561	*Anthochaera carunculata (Red Wattlebird)*			
165.	24562	*Anthochaera lunulata (Western Little Wattlebird)*			
166.	24567	*Epthianura albifrons (White-fronted Chat)*			
167.	25661	*Lichmera indistincta (Brown Honeyeater)*			
168.	24596	*Phylidonyris novaehollandiae (New Holland Honeyeater)*			
169.	42340	*Ptilotula ornatus (Yellow-plumed Honeyeater)*			
Meropidae					
170.	24598	*Merops ornatus (Rainbow Bee-eater)*		IA	
Miturgidae					
171.	-12868	*Mituliodon tarantulinus*			
172.	-12086	*Mitzoruga insularis*			
Monacanthidae					

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
173.	-14454	*Eubalichthys sp.*			
174.	-17133	*Nelusetta ayraudi*			
Monocentrididae					
175.	-15830	*Cleidopus gloriamaris*			
Mugilidae					
176.	-15816	*Aldrichetta forsteri*			
177.	-16016	*Mugil cephalus*			
Muraenidae					
178.	-14151	*Gymnothorax woodwardi*			
Muridae					
179.	24215	*Hydromys chrysogaster (Water-rat)*		P4	
180.	24243	*Rattus fuscipes (Western Bush Rat)*			
181.	24245	*Rattus rattus (Black Rat)*	Y		
Myliobatidae					
182.	-17007	*Myliobatis sp.*			
Myobatrachidae					
183.	25398	*Crinia georgiana (Quacking Frog)*			
184.	25399	*Crinia glauerti (Clicking Frog)*			
185.	25400	*Crinia insignifera (Squelching Froglet)*			
186.	25401	*Crinia pseudinsignifera (Bleating Froglet)*			
187.	25404	*Geocrinia leai (Ticking Frog)*			
188.	25433	*Pseudophryne guentheri (Crawling Toadlet)*			
Nemesiidae					
189.	-12397	*Aname mainae*			
190.	-11485	*Aname tepperi*			
Neosittidae					
191.	25673	*Daphoenositta chrysoptera (Varied Sittella)*			
Ophichthidae					
192.	-14568	*Muraenichthys tasmaniensis*			
193.	-17083	*Ophisurus serpens*			
Ostraciidae					
194.	-17589	*Anoplocapros lenticularis*			
195.	-15925	*Aracana aurita*			
Otariidae					
196.	24210	*Neophoca cinerea (Australian Sea Lion)*		S	
Pachycephalidae					
197.	25675	*Colluricincla harmonica (Grey Shrike-thrush)*			
198.	25679	*Pachycephala pectoralis (Golden Whistler)*			
199.	25680	*Pachycephala rufiventris (Rufous Whistler)*			
Pardalotidae					
200.	25681	*Pardalotus punctatus (Spotted Pardalote)*			
201.	25682	*Pardalotus striatus (Striated Pardalote)*			
Passeridae					
202.	25687	*Passer domesticus (House Sparrow)*	Y		
203.	24642	*Passer montanus (Eurasian Tree Sparrow)*	Y		
Pataecidae					
204.	-15150	*Aetapcus maculatus*			
Pelecanidae					
205.	24648	*Pelecanus conspicillatus (Australian Pelican)*			
Pelecanoididae					
206.	24649	*Pelecanoides urinatrix subsp. exsul (Common Diving Petrel)*			
Pentacerotidae					
207.	-17348	*Parazanclistius hutchinsi*			
Peramelidae					
208.	24153	*Isoodon obesulus subsp. fusciventer (Quenda, Southern Brown Bandicoot)*		P5	
Petroicidae					
209.	24651	*Eopsaltria australis subsp. griseogularis (Western Yellow Robin)*			
210.	24652	*Eopsaltria georgiana (White-breasted Robin)*			
Phalacrocoracidae					
211.	25697	*Phalacrocorax carbo (Great Cormorant)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
212.	24664	*Phalacrocorax carbo subsp. novaehollandiae (Great Cormorant)*			
213.	24667	*Phalacrocorax sulcirostris (Little Black Cormorant)*			
214.	25699	*Phalacrocorax varius (Pied Cormorant)*			
215.	24668	*Phalacrocorax varius subsp. hypoleucos (Pied Cormorant)*			
Phalangeridae					
216.	25521	*Trichosurus vulpecula (Common Brushtail Possum)*			
217.	24158	*Trichosurus vulpecula subsp. vulpecula (Common Brushtail Possum)*			
Phasianidae					
218.	24671	*Coturnix pectoralis (Stubble Quail)*			
Phocidae					
219.	-17619	*Lobodon carcinophaga*			
Pholcidae					
220.	-12079	*Pholcus phalangioides*			
Physeteridae					
221.	24073	*Physeter macrocephalus (Sperm Whale)*		P4	
Platycephalidae					
222.	-14874	*Platycephalus speculator*			
Podargidae					
223.	25703	*Podargus strigoides (Tawny Frogmouth)*			
Podicipedidae					
224.	25704	*Podiceps cristatus (Great Crested Grebe)*			
225.	24681	*Poliocephalus poliocephalus (Hoary-headed Grebe)*			
226.	25705	*Tachybaptus novaehollandiae (Australasian Grebe, Black-throated Grebe)*			
Pristiophoridae					
227.	-13561	*Pristiophorus nudipinnis*			
Procellariidae					
228.	24689	*Halobaena caerulea (Blue Petrel)*			
229.	24690	*Macronectes giganteus (Southern Giant Petrel)*		P4	
230.	24692	*Pachyptila belcheri (Slender-billed Prion)*			
231.	24693	*Pachyptila desolata (Antarctic Prion)*			
232.	25707	*Pachyptila salvini (Salvin's Prion)*			
233.	24702	*Pterodroma brevirostris (Kerguelen Petrel)*			
234.	24703	*Pterodroma lessonii (White-headed Petrel)*			
235.	-13287	*Pterodroma macroptera subsp. macoptera*			
236.	25711	*Pterodroma mollis (Soft-plumaged Petrel)*			
237.	24711	*Puffinus assimilis subsp. assimilis (Little Shearwater)*			
Prodidomidae					
238.	-11476	*Cryptoerithus quobba*			
Pseudocheiridae					
239.	24166	*Pseudocheirus occidentalis (Western Ringtail Possum)*		T	
Psittacidae					
240.	25714	*Cacatua pastinator (Western Long-billed Corella)*			
241.	25716	*Cacatua sanguinea (Little Corella)*			
242.	25717	*Calyptorhynchus banksii (Red-tailed Black-Cockatoo)*			
243.	24731	*Calyptorhynchus banksii subsp. naso (Forest Red-tailed Black-Cockatoo)*		T	
244.	24733	*Calyptorhynchus baudinii (Baudin's Cockatoo (long-billed black-cockatoo), Baudin's Cockatoo)*		T	
245.	24734	*Calyptorhynchus latirostris (Carnaby's Cockatoo (short-billed black-cockatoo), Carnaby's Cockatoo)*		T	
246.	24735	*Glossopsitta porphyrocephala (Purple-crowned Lorikeet)*			
247.	24738	*Neophema elegans (Elegant Parrot)*			
248.	24739	*Neophema petrophila (Rock Parrot)*			
249.	25720	*Platycercus icterotis (Western Rosella)*			
250.	24747	*Platycercus spurius (Red-capped Parrot)*			
251.	25721	*Platycercus zonarius (Australian Ringneck, Ring-necked Parrot)*			
252.	25722	*Polytelis anthopeplus (Regent Parrot)*			
253.	24755	*Trichoglossus haematodus subsp. moluccanus (Rainbow Lorikeet)*	Y		
Pygopodidae					
254.	24991	*Aprasia repens*			
255.	25005	*Lialis burtonis*			
Rachycentridae					
256.	-14715	*Rachycentron canadus*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
Rallidae					
257.	25727	*Fulica atra (Eurasian Coot)*			
258.	25729	*Gallinula tenebrosa (Dusky Moorhen)*			
259.	24763	*Gallinula tenebrosa subsp. tenebrosa (Dusky Moorhen)*			
260.	25730	*Gallirallus philippensis (Buff-banded Rail)*			
261.	24765	*Gallirallus philippensis subsp. mellori (Buff-banded Rail)*			
262.	25731	*Porphyrio porphyrio (Purple Swamphen)*			
263.	24771	*Porzana tabuensis (Spotless Crake)*			
Recurvirostridae					
264.	24774	*Cladorhynchus leucocephalus (Banded Stilt)*			
265.	25734	*Himantopus himantopus (Black-winged Stilt)*			
266.	24776	*Recurvirostra novaehollandiae (Red-necked Avocet)*			
Scincidae					
267.	42368	*Acritoscincus trilineatus*			
268.	30893	*Cryptoblepharus buchananii*			
269.	25027	*Ctenotus australis*			
270.	25039	*Ctenotus fallens*			
271.	25047	*Ctenotus impar*			
272.	25049	*Ctenotus labillardieri*			
273.	41641	*Ctenotus ora (Coastal Plains Skink)*		P1	
274.	25096	*Egernia kingii (King's Skink)*			
275.	25100	*Egernia napoleonis*			
276.	30919	*Hemiergis gracilipes*			
277.	25119	*Hemiergis quadrilineata*			
278.	25131	*Lerista distinguenda*			
279.	25133	*Lerista elegans*			
280.	42413	*Lissolepis luctuosa (Western Swamp Skink)*			
281.	25184	*Menetia greyii*			
282.	25191	*Morethia lineoocellata*			
283.	25519	*Tiliqua rugosa*			
Scolopacidae					
284.	41323	*Actitis hypoleucos (Common Sandpiper)*		IA	
285.	25736	*Arenaria interpres (Ruddy Turnstone)*		IA	
286.	24779	*Calidris acuminata (Sharp-tailed Sandpiper)*		IA	
287.	25738	*Calidris canutus (Red Knot)*		IA	
288.	24784	*Calidris ferruginea (Curlew Sandpiper)*		T	
289.	24788	*Calidris ruficollis (Red-necked Stint)*		IA	
290.	24790	*Calidris tenuirostris (Great Knot)*		T	
291.	30932	*Limosa lapponica (Bar-tailed Godwit)*		IA	
292.	24798	*Numenius madagascariensis (Eastern Curlew)*		T	
293.	25742	*Numenius phaeopus (Whimbrel)*		IA	
294.	24803	*Tringa brevipes (Grey-tailed Tattler)*		IA	
295.	24808	*Tringa nebularia (Common Greenshank)*		IA	
296.	24809	*Tringa stagnatilis (Marsh Sandpiper)*		IA	
Scolopendridae					
297.	-12062	*Cormocephalus hartmeyeri*			
Scombridae					
298.	-15237	*Auxis thazard*			
299.	-15810	*Scomber australasicus*			
Scorpaenidae					
300.	-15996	*Gymnapistes marmoratus*			
Scutigeridae					
301.	-12063	*Allothereua maculata*			
Scyliorhinidae					
302.	-15321	*Asymbolus submaculatus*			
303.	-17310	*Aulohalaelurus labiosus*			
Sillaginidae					
304.	-14479	*Sillago fraseri (invalid)*			Y
Sparassidae					
305.	-12392	*Isopeda leishmanni*			
Spheniscidae					
306.	24813	*Eudyptes chrysocome subsp. filholi (Rockhopper Penguin)*			Y
307.	24814	*Eudyptes chrysocome subsp. moseleyi (Rockhopper Penguin)*			
308.	25746	*Eudyptula minor (Little Penguin)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
Sphyraenidae					
309.	-17313	*Sphyraena obtusata*			
Squalidae					
310.	-17020	*Squalus megalops*			
Squatinidae					
311.	-16330	*Squatina australis*			
Strigidae					
312.	25748	*Ninox novaeseelandiae (Boobook Owl)*			
Suidae					
313.	24259	*Sus scrofa (Pig)*	Y		
Sylviidae					
314.	25755	*Acrocephalus australis (Australian Reed Warbler)*			
315.	25758	*Megalurus gramineus (Little Grassbird)*			
Syngnathidae					
316.	-17251	*Hippocampus sp.*			
317.	-14611	*Phyllopteryx taeniolatus*			
318.	-14632	*Stigmatopora argus*			
Tetraodontidae					
319.	-13562	*Lagocephalus sceleratus*			
320.	-16015	*Omegophora armilla*			
Theridiidae					
321.	-12087	*Steatoda capensis*			
322.	-12171	*Steatoda grossa*			
Threskiornithidae					
323.	24841	*Platalea flavipes (Yellow-billed Spoonbill)*			
324.	24843	*Plegadis falcinellus (Glossy Ibis)*		IA	
325.	24844	*Threskiornis molucca (Australian White Ibis)*			
326.	24845	*Threskiornis spinicollis (Straw-necked Ibis)*			
Triaenonychidae					
327.	-12858	*Nunciella aspera*			
Triakidae					
328.	-14367	*Furgaleus macki*			
329.	-14404	*Galeorhinus galeus*			
Trichiuridae					
330.	-17187	*Trichiurus lepturus*			
331.	-14101	*Trichiurus sp.*			
Triglidae					
332.	-14437	*Chelidonichthys kumu*			
333.	-14689	*Pterygotrigla polyommata*			
Trochanteriidae					
334.	-12570	*Platorish gelorup*			
Typhlopidae					
335.	25271	*Ramphotyphlops australis*			
Uranoscopidae					
336.	-15213	*Ichthyscopus barbatus*			
Urolophidae					
337.	-14578	*Trygonoptera mucosa*			
338.	-15989	*Urolophus sp.*			
Ziphiidae					
339.	24076	*Mesoplodon bowdoini (Andrew's Beaked Whale)*			
340.	24078	*Mesoplodon grayi (Gray's Beaked Whale)*			
341.	24081	*Mesoplodon mirus (True's Beaked Whale)*			
Zosteropidae					
342.	25765	*Zosterops lateralis (Grey-breasted White-eye, Silvereye)*			

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

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

5 - Priority 5

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

Australian Government

Department of Sustainability, Environment, Water, Population and Communities

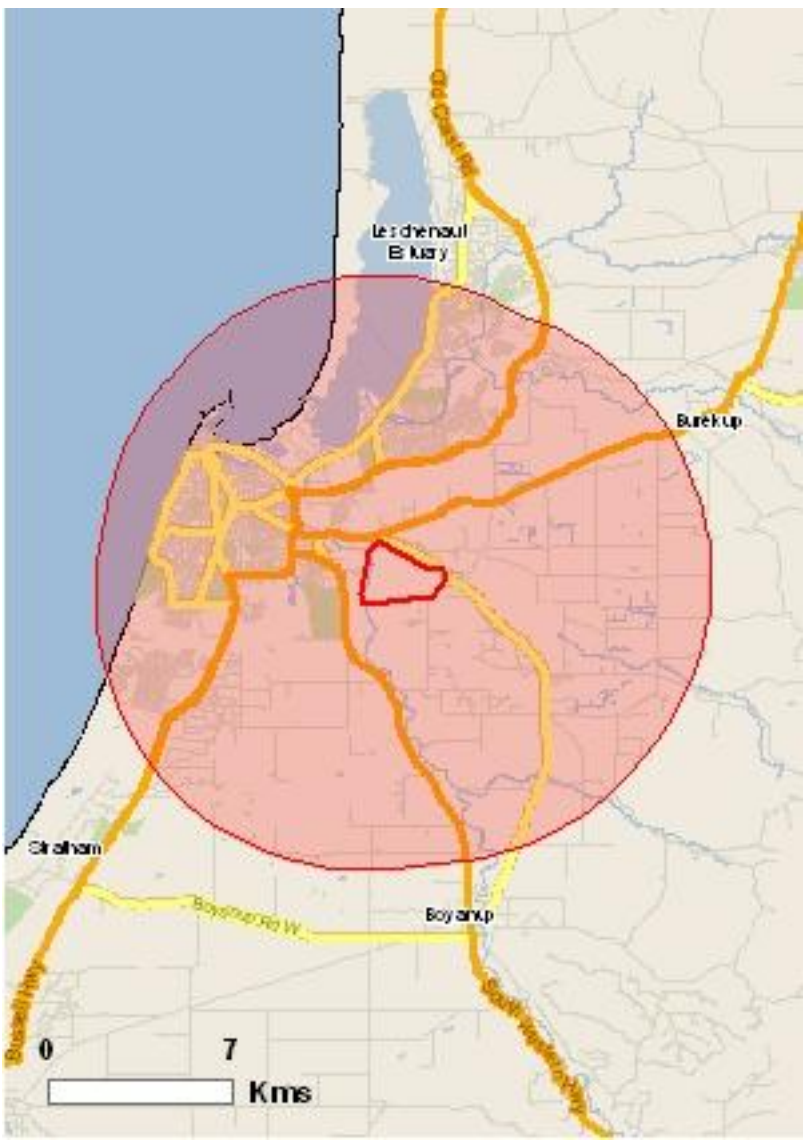
EPBC Act Protected Matters Report

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

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

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 06/06/13 17:09:28



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Coordinates

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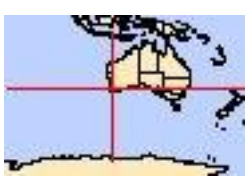

Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Areas:	None
Listed Threatened Ecological Communities:	2
Listed Threatened Species:	55
Listed Migratory Species:	31

Other Matters Protected by the EPBC Act

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

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place and the heritage values of a place on the Register of the National Estate.

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

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	2
Commonwealth Heritage Places:	None
Listed Marine Species:	52
Whales and Other Cetaceans:	13
Critical Habitats:	None
Commonwealth Reserves:	None

Extra Information

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

Place on the RNE:	51
State and Territory Reserves:	5
Regional Forest Agreements:	1
Invasive Species:	30
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Listed Threatened Ecological Communities [Resource Information]

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

Name	Status	Type of Presence
Corymbia calophylla - Xanthorrhoea preissii woodlands and shrublands of the Swan Coastal Plain	Endangered	Community known to occur within area
Claypans of the Swan Coastal Plain	Critically Endangered	Community likely to occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Anous tenuirostris melanops Australian Lesser Noddy [26000]	Vulnerable	Species or species habitat may occur within area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area
Calyptorhynchus banksii naso Forest Red-tailed Black-Cockatoo [67034]	Vulnerable	Species or species habitat may occur within area
Calyptorhynchus baudinii Baudin's Black-Cockatoo, Long-billed Black-Cockatoo [769]	Vulnerable	Breeding known to occur within area
Calyptorhynchus latirostris Carnaby's Black-Cockatoo, Short-billed Black-Cockatoo [59523]	Endangered	Breeding likely to occur within area
Diomedea exulans amsterdamensis Amsterdam Albatross [82330]	Endangered	Species or species habitat may occur within area
Diomedea exulans exulans Tristan Albatross [82337]	Endangered	Species or species habitat may occur within area

Name	Status	Type of Presence
Diomedea exulans (sensu lato)		
Wandering Albatross [1073]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Halobaena caerulea		
Blue Petrel [1059]	Vulnerable	Species or species habitat may occur within area
Leipoa ocellata		
Malleefowl [934]	Vulnerable	Species or species habitat may occur within area
Macronectes giganteus		
Southern Giant-Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli		
Northern Giant-Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Pterodroma mollis		
Soft-plumaged Petrel [1036]	Vulnerable	Species or species habitat may occur within area
Rostratula australis		
Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
Sternula nereis nereis		
Australian Fairy Tern [82950]	Vulnerable	Species or species habitat likely to occur within area
Thalassarche carteri		
Indian Yellow-nosed Albatross [64464]	Vulnerable	Foraging, feeding or related behaviour may occur within area
Thalassarche cauta cauta		
Shy Albatross, Tasmanian Shy Albatross [82345]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris		
Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Fish		
Nannatherina balstoni		
Balston's Pygmy Perch [66698]	Vulnerable	Species or species habitat may occur within area
Mammals		
Balaenoptera musculus		
Blue Whale [36]	Endangered	Congregation or aggregation known to occur within area
Dasyurus geoffroii		
Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat likely to occur within area
Eubalaena australis		
Southern Right Whale [40]	Endangered	Breeding known to occur within area
Megaptera novaeangliae		
Humpback Whale [38]	Vulnerable	Congregation or aggregation known to occur within area
Neophoca cinerea		
Australian Sea-lion [22]	Vulnerable	Species or species habitat may occur within area
Pseudocheirus occidentalis		
Western Ringtail Possum [25911]	Vulnerable	Breeding known to occur within area

Name	Status	Type of Presence
Setonix brachyurus		
Quokka [229]	Vulnerable	Species or species habitat may occur within area
Other		
Idiosoma nigrum		
Shield-backed Trapdoor Spider, Black Rugose Trapdoor Spider [66798]	Vulnerable	Species or species habitat likely to occur within area
Plants		
Andersonia gracilis		
Slender Andersonia [14470]	Endangered	Species or species habitat may occur within area
Banksia nivea subsp. uliginosa		
Swamp Honeypot [82766]	Endangered	Species or species habitat may occur within area
Banksia squarrosa subsp. argillacea		
Whicher Range Dryandra [82769]	Vulnerable	Species or species habitat may occur within area
Brachyscias verecundus		
Ironstone Brachyscias [81321]	Critically Endangered	Species or species habitat may occur within area
Caladenia huegelii		
King Spider-orchid, Grand Spider-orchid, Rusty Spider-orchid [7309]	Endangered	Species or species habitat known to occur within area
Caladenia winfieldii		
Majestic Spider-orchid [64504]	Endangered	Species or species habitat may occur within area
Centrolepis caespitosa		
[6393]	Endangered	Species or species habitat likely to occur within area
Chamelaucium sp. C Coast Plain (R.D.Royce 4872)		
Royce's Waxflower [82023]	Vulnerable	Species or species habitat may occur within area
Darwinia foetida		
Muchea Bell [83190]	Critically Endangered	Species or species habitat likely to occur within area
Darwinia whicherensis		
Abba Bell [83193]	Endangered	Species or species habitat may occur within area
Diuris drummondii		
Tall Donkey Orchid [4365]	Vulnerable	Species or species habitat likely to occur within area
Diuris micrantha		
Dwarf Bee-orchid [55082]	Vulnerable	Species or species habitat likely to occur within area
Diuris purdiei		
Purdie's Donkey-orchid [12950]	Endangered	Species or species habitat may occur within area
Drakaea elastica		
Glossy-leafed Hammer-orchid, Praying Virgin [16753]	Endangered	Species or species habitat known to occur within area
Drakaea micrantha		
Dwarf Hammer-orchid [56755]	Vulnerable	Species or species habitat known to occur within area
Eleocharis keigheryi		
Keighery's Eleocharis [64893]	Vulnerable	Species or species habitat likely to occur

Name	Status	Type of Presence
		within area
[Isopogon uncinatus](#) Hook-leaf Isopogon [20871]	Endangered	Species or species habitat may occur within area
[Lambertia echinata subsp. occidentalis](#) Western Prickly Honeysuckle [64528]	Endangered	Species or species habitat may occur within area
[Synaphea sp. Fairbridge Farm (D.Papenfus 696)](#) Selena's Synaphea [82881]	Critically Endangered	Species or species habitat may occur within area
[Synaphea stenoloba](#) Dwellingup Synaphea [66311]	Endangered	Species or species habitat may occur within area
[Verticordia fimbrilepis subsp. fimbrilepis](#) Shy Featherflower [24631]	Endangered	Species or species habitat may occur within area
Reptiles		
[Caretta caretta](#) Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
[Chelonia mydas](#) Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
[Dermochelys coriacea](#) Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
[Natator depressus](#) Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Sharks		
[Carcharias taurus (west coast population)](#) Grey Nurse Shark (west coast population) [68752]	Vulnerable	Species or species habitat may occur within area
[Carcharodon carcharias](#) Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
[Rhincodon typus](#) Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
[Apus pacificus](#) Fork-tailed Swift [678]		Species or species habitat likely to occur within area
[Diomedea amsterdamensis](#) Amsterdam Albatross [64405]	Endangered*	Species or species habitat may occur within area
[Diomedea dabbenena](#) Tristan Albatross [66471]	Endangered*	Species or species habitat may occur within area
[Diomedea exulans (sensu lato)](#) Wandering Albatross [1073]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area

Name	Threatened	Type of Presence
Macronectes giganteus		
Southern Giant-Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli		
Northern Giant-Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Puffinus carneipes		
Flesh-footed Shearwater, Fleshy-footed Shearwater [1043]		Species or species habitat likely to occur within area
Sterna anaethetus		
Bridled Tern [814]		Foraging, feeding or related behaviour likely to occur within area
Sterna caspia		
Caspian Tern [59467]		Foraging, feeding or related behaviour known to occur within area
Thalassarche carteri		
Indian Yellow-nosed Albatross [64464]	Vulnerable	Foraging, feeding or related behaviour may occur within area
Thalassarche cauta (sensu stricto)		
Shy Albatross, Tasmanian Shy Albatross [64697]	Vulnerable*	Species or species habitat may occur within area
Thalassarche melanophris		
Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Migratory Marine Species		
Balaenoptera edeni		
Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus		
Blue Whale [36]	Endangered	Congregation or aggregation known to occur within area
Caperea marginata		
Pygmy Right Whale [39]		Species or species habitat may occur within area
Carcharodon carcharias		
Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
Caretta caretta		
Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas		
Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea		
Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Eubalaena australis		
Southern Right Whale [40]	Endangered	Breeding known to occur within area
Lagenorhynchus obscurus		
Dusky Dolphin [43]		Species or species habitat may occur within area
Megaptera novaeangliae		
Humpback Whale [38]	Vulnerable	Congregation or aggregation known to occur within area
Natator depressus		
Flatback Turtle [59257]	Vulnerable	Foraging, feeding or

Name	Threatened	Type of Presence
		related behaviour known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area
Migratory Terrestrial Species		
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Migratory Wetlands Species		
Ardea alba Great Egret, White Egret [59541]		Breeding known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat likely to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [Resource Information]

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

Name
Commonwealth Land -
Defence - BUNBURY TRAINING DEPOT

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Anous tenuirostris melanops Australian Lesser Noddy [26000]	Vulnerable	Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Breeding known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat likely to occur within area
Catharacta skua Great Skua [59472]		Species or species habitat may occur within

Name	Threatened	Type of Presence
		area
Diomedea amsterdamensis Amsterdam Albatross [64405]	Endangered*	Species or species habitat may occur within area
Diomedea dabbenena Tristan Albatross [66471]	Endangered*	Species or species habitat may occur within area
Diomedea exulans (sensu lato) Wandering Albatross [1073]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Halobaena caerulea Blue Petrel [1059]	Vulnerable	Species or species habitat may occur within area
Macronectes giganteus Southern Giant-Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant-Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Species or species habitat may occur within area
Puffinus assimilis Little Shearwater [59363]		Foraging, feeding or related behaviour known to occur within area
Puffinus carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [1043]		Species or species habitat likely to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat may occur within area
Sterna anaethetus Bridled Tern [814]		Foraging, feeding or related behaviour likely to occur within area
Sterna caspia Caspian Tern [59467]		Foraging, feeding or related behaviour known to occur within area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Foraging, feeding or related behaviour may occur within area
Thalassarche cauta (sensu stricto) Shy Albatross, Tasmanian Shy Albatross [64697]	Vulnerable*	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area

Name	Threatened	Type of Presence
Fish		
Acentronura australe Southern Pygmy Pipehorse [66185]		Species or species habitat may occur within area
Campichthys galei Gale's Pipefish [66191]		Species or species habitat may occur within area
Heraldia nocturna Upside-down Pipefish, Eastern Upside-down Pipefish, Eastern Upside-down Pipefish [66227]		Species or species habitat may occur within area
Hippocampus angustus Western Spiny Seahorse, Narrow-bellied Seahorse [66234]		Species or species habitat may occur within area
Hippocampus breviceps Short-head Seahorse, Short-snouted Seahorse [66235]		Species or species habitat may occur within area
Hippocampus subelongatus West Australian Seahorse [66722]		Species or species habitat may occur within area
Histiogamphelus cristatus Rhino Pipefish, Macleay's Crested Pipefish, Ring-back Pipefish [66243]		Species or species habitat may occur within area
Lissocampus caudalis Australian Smooth Pipefish, Smooth Pipefish [66249]		Species or species habitat may occur within area
Lissocampus fatiloquus Prophet's Pipefish [66250]		Species or species habitat may occur within area
Lissocampus runa Javelin Pipefish [66251]		Species or species habitat may occur within area
Maroubra perserrata Sawtooth Pipefish [66252]		Species or species habitat may occur within area
Mitotichthys meraculus Western Crested Pipefish [66259]		Species or species habitat may occur within area
Nannocampus subosseus Bonyhead Pipefish, Bony-headed Pipefish [66264]		Species or species habitat may occur within area
Phycodurus eques Leafy Seadragon [66267]		Species or species habitat may occur within area
Phyllopteryx taeniolatus Common Seadragon, Weedy Seadragon [66268]		Species or species habitat may occur within area
Pugnaso curtirostris Pugnose Pipefish, Pug-nosed Pipefish [66269]		Species or species habitat may occur within area
Solegnathus lettiensis Gunther's Pipehorse, Indonesian Pipefish [66273]		Species or species habitat may occur within area
Stigmatopora argus Spotted Pipefish, Gulf Pipefish [66276]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Stigmatopora nigra		
Widebody Pipefish, Wide-bodied Pipefish, Black Pipefish [66277]		Species or species habitat may occur within area
Urocampus carinirostris		
Hairy Pipefish [66282]		Species or species habitat may occur within area
Vanacampus margaritifer		
Mother-of-pearl Pipefish [66283]		Species or species habitat may occur within area
Vanacampus phillipi		
Port Phillip Pipefish [66284]		Species or species habitat may occur within area
Vanacampus poecilolaemus		
Longsnout Pipefish, Australian Long-snout Pipefish, Long-snouted Pipefish [66285]		Species or species habitat may occur within area
Mammals		
Arctocephalus forsteri		
New Zealand Fur-seal [20]		Species or species habitat may occur within area
Neophoca cinerea		
Australian Sea-lion [22]	Vulnerable	Species or species habitat may occur within area
Reptiles		
Caretta caretta		
Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas		
Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea		
Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Natator depressus		
Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area

Whales and other Cetaceans [Resource Information]

Name	Status	Type of Presence
Mammals		
Balaenoptera acutorostrata		
Minke Whale [33]		Species or species habitat may occur within area
Balaenoptera edeni		
Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus		
Blue Whale [36]	Endangered	Congregation or aggregation known to occur within area
Caperea marginata		
Pygmy Right Whale [39]		Species or species habitat may occur within area
Delphinus delphis		
Common Dophin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Eubalaena australis		
Southern Right Whale [40]	Endangered	Breeding known to occur within area

Name	Status	Type of Presence
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Congregation or aggregation known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area

Extra Information

Places on the RNE [Resource Information]

Note that not all Indigenous sites may be listed.

Name	State	Status
Natural		
Dardanup Management Priority Area	WA	Indicative Place
Lower Brunswick, Collie and Wellesley Rivers	WA	Indicative Place
Rocky Point Basalt Formation	WA	Indicative Place
South West Irrigation Area	WA	Indicative Place
Historic		
Australind Memorial	WA	Indicative Place
Bunbury Timber Jetty	WA	Indicative Place
CBH Grain Silos	WA	Indicative Place
Commonwealth Bank Building (former)	WA	Indicative Place
Dardanup Park Homestead	WA	Indicative Place
Forrest House	WA	Indicative Place
Gibson Residence (former)	WA	Indicative Place
Henton Cottage	WA	Indicative Place
House	WA	Indicative Place
Lyric Theatre (former)	WA	Indicative Place
St Nicholas Anglican Church	WA	Indicative Place
The Bungalow Cottage	WA	Indicative Place
The Gordons (former)	WA	Indicative Place
Apex House	WA	Registered
Boarding House (former)	WA	Registered
Bunbury Boys School (former)	WA	Registered
Bunbury Post Office (former)	WA	Registered
Bunbury Railway Station (former)	WA	Registered
Burlington Hotel	WA	Registered
Convent of Mercy Group (former)	WA	Registered
Craigie Lee	WA	Registered
Cronshaws Store	WA	Registered
Eagle Towers	WA	Registered
House	WA	Registered
House	WA	Registered

Name	State	Status
House	WA	Registered
House	WA	Registered
House	WA	Registered
House	WA	Registered
House	WA	Registered
House	WA	Registered
House	WA	Registered
House (former)	WA	Registered
King Cottage	WA	Registered
Leschenault Homestead	WA	Registered
Lilydale	WA	Registered
Myrniong House	WA	Registered
Old Grand Central Hotel	WA	Registered
Old Picton Inn	WA	Registered
Prince of Wales Hotel	WA	Registered
Rose Hotel and former Sample Room	WA	Registered
St Marks Anglican Church and Graveyard (former)	WA	Registered
The Residency	WA	Registered
Tuart Street Group	WA	Registered
Turner Street Group	WA	Registered
Upton House	WA	Registered
WA Bank Building (former)	WA	Registered

State and Territory Reserves [Resource Information]

Name	State
Dardanup	WA
Leschenault Peninsula	WA
Morangarel	WA
Unnamed WA40552	WA
Unnamed WA46108	WA

Regional Forest Agreements [Resource Information]

Note that all areas with completed RFAs have been included.

Name	State
South West WA RFA	Western Australia

Invasive Species [Resource Information]

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

Name	Status	Type of Presence
Birds		
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Passer montanus Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Streptopelia senegalensis Laughing Turtle-dove, Laughing Dove [781]		Species or species habitat likely to occur within area
Mammals		

Name	Status	Type of Presence
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Anredera cordifolia Madeira Vine, Jalap, Lamb's-tail, Mignonette Vine, Anredera, Gulf Madeiravine, Heartleaf Madeiravine, Potato Vine [2643]		Species or species habitat likely to occur within area
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Asparagus declinatus Bridal Veil, Bridal Veil Creeper, Pale Berry Asparagus Fern, Asparagus Fern, South African Creeper [66908]		Species or species habitat likely to occur within area
Asparagus plumosus Climbing Asparagus-fern [48993]		Species or species habitat likely to occur within area
Brachiaria mutica Para Grass [5879]		Species or species habitat may occur within area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat may occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Genista linifolia Flax-leaved Broom, Mediterranean Broom, Flax Broom [2800]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Olea europaea Olive, Common Olive [9160]		Species or species habitat may occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Protasparagus plumosus Climbing Asparagus-fern, Ferny Asparagus [11747]		Species or species habitat likely to occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Solanum elaeagnifolium Silver Nightshade, Silver-leaved Nightshade, White Horse Nettle, Silver-leaf Nightshade, Tomato Weed, White Nightshade, Bull-nettle, Prairie-berry, Satansbos, Silver-leaf Bitter-apple, Silverleaf-nettle, Trompillo [12323]		Species or species habitat likely to occur within area

Coordinates

-33.352384 115.696497,-33.356496 115.692842,-33.371268 115.690253,-33.374618 115.690862,-33.371953 115.714771,-33.365405 115.719796,-33.362131 115.718502, -33.361521 115.712487,-33.35741 115.70434,-33.35246 115.696116

Caveat

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

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

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

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

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

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

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

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

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

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

Acknowledgements

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

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

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

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

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Appendix D – Flora data

Definitions for likelihood of occurrence assessment

Likelihood of occurrence assessment for conservation significant flora

Flora Species List

Quadrat Data

Table 19 Definitions for likelihood of occurrence assessment

Likelihood of occurrence	Definition
Known	Species definitely recorded within the Project site either from previous records or field survey results.
Possible	Species previously recorded within 5 km with suitable habitat occurring at the Project site. OR Species not previously recorded within 5 km, but suitable habitat occurs at the Project site.
Unlikely	Species previously recorded within 5 km but suitable habitat does not occur at the Project site.
Highly unlikely	Species not previously recorded within 5 km, suitable habitat does not occur at the Project site and/or Project site is outside the natural distribution of the species.

Table 20 Likelihood of occurrence assessment for conservation significant species identified as potentially occurring within the Study Area

Scientific name	Status		Source			Description	Habitat requirements and Range[1]	Likelihood of occurrence (see Table 19 for definitions)
	State	Federal	Nature-map search	EPBC PMST search	DPaW databases			
Acacia flagelliformis	P4		X		X	Rush-like, erect or sprawling shrub, 0.3-0.75(-1.6) m high. Fl. yellow, May to Sep.	Sandy soils. Winter-wet areas and along creeks. In closed scrub or heath within Jarrah-Marri Forest (Maslin, 2001).	Known. This species has been recorded within the study area.
Acacia semitrullata	P4		X		X	Slender, erect, pungent shrub, (0.1-)0.2-0.7(-1.5) m high. Fl. cream-white, May to Oct.	White/grey sand, sometimes over laterite, clay. Sandplains, swampy areas.	Possible. The study area contains suitable habitat for this species.
Andersonia gracilis	T	E		X		Slender erect or open straggly shrub, 0.1-0.5(-1) m high. Fl. white-pink-purple, Sep to Nov.	White/grey sand, sandy clay, gravelly loam. Winter-wet areas, near swamps.	Highly Unlikely. The study area is outside the known range of this species.
Angianthus drummondii	P3		X		X	Erect annual, herb, to 0.1 m high. Fl. yellow, Oct to Dec.	Grey or brown clay soils, ironstone. Seasonally wet flats.	Possible. The study area contains some limited habitat for this species.
Aponogeton hexatepalus	P4		X		X	Rhizomatous or cormous, aquatic perennial, herb, leaves floating. Fl. green-white, Jul to Oct.	Mud. Freshwater: ponds, rivers, claypans.	Possible. The study area contains suitable habitat for this species.
Austrostipa jacobsiana	P1		X		X	Unknown	Swan Coastal Plain	Possible. Limited habitat information available.
Banksia nivea subsp. *uliginosa*	T	E		X		Dense, erect, non-lignotuberous shrub, 0.2-1.5 m high. Fl. yellow-brown, Aug to Sep.	Sandy clay, gravel. Clay over laterite in thick scrub, in winter wet southern and Scott ironstones (Luu and Brown, 2008).	Unlikely. The species has restricted habitat requirements which are unlikely to occur within the study area.
Banksia squarrosa	T	E		X		Erect, open, non-lignotuberous shrub, 1.2-4	White/grey sand, gravelly clay or loam. Winter-wet flats, clay	Unlikely. The species has restricted habitat requirements

Scientific name	Status		Source			Description	Habitat requirements and Range[1]	Likelihood of occurrence (see Table 19 for definitions)
	State	Federal	Nature-map search	EPBC PMST search	DPaW databases			
subsp. *argillacea*						m high. Fl. yellow, Jun to Nov.	flats. This species occurs on winter-wet clay over ironstone in tall shrubland (Luu and English, 2004).	which are unlikely to occur within the study area.
Boronia humifusa	P1		X		X	Low-growing, wiry perennial, herb, 0.1-0.2 m high. Flowers pink/red, June or Sep.	Gravelly clay loam over laterite. Jarrah-Marri open forest.	Unlikely. The study area does not contain suitable habitat for this species.
Boronia tetragona	P3		X		X	Perennial, herb, 0.3-0.7 m high, leaves sessile, entire, with papillate margins, branches quadrangular, sepals ciliate. Fl. pink & red, Oct to Dec.	Black/white sand, laterite, brown sandy loam. Winter-wet flats, swamps, open woodland.	Possible. The study area contains suitable habitat for this species.
Brachyscias verecundus	T	CE		X		Annual (or ephemeral), herb, 0.012-0.022 m high, entirely glabrous. Fl. white/cream.	In a moss sward. On a granite outcrop. Occurs on the eastern side of the Swan Coastal Plain on ironstone (Meissner and English, 2005)	Unlikely. The species has restricted habitat requirements which are unlikely to occur within the study area.
Caladenia huegelii	T	E		X	X	Tuberous, perennial, herb, 0.25-0.6 m high. Fl. green & cream & red, Sep to Oct.	Grey or brown sand, clay loam.	Possible. The study area contains suitable habitat for this species.
Caladenia speciosa	P4		X		X	Tuberous, perennial, herb, 0.35-0.6 m high. Fl. white-pink, Sep to Oct.	White, grey or black sand.	Possible. The study area contains suitable habitat for this species.
Caladenia winfieldii	T	CE		X		Tuberous, perennial, herb, 0.3-0.6 m high.Fl. pink, Oct to Nov.	Grey-black sand, sandy loam. Winter-wet depressions, swamps	Highly Unlikely. This species' known range is restricted to an area near Manjimup, and the study area is not within its known range.

Scientific name	Status		Source			Description	Habitat requirements and Range[1]	Likelihood of occurrence (see Table 19 for definitions)
	State	Federal	Nature-map search	EPBC PMST search	DPaW databases			
Carex tereticaulis	P1		X		X	Monoecious, rhizomatous, tufted perennial, grass-like or herb (sedge), 0.7 m high. Flowers brown, Sep to Oct.	Black peaty sand	Possible. The study area contains suitable habitat for this species.
Centrolepis caespitosa	P4	E		X		Tufted annual, herb (forming a rounded cushion up to 25 mm across). Fl. Oct to Dec.	White sand, clay. Salt flats, wet areas.	Unlikely. This species has a highly disjunct range and has not been recorded within the vicinity of the study area.
Chamaescilla gibsonii	P3		X		X	Clumped tuberous, herb. Fl. blue, Sep.	Clay to sandy clay. Winter-wet flats, shallow water-filled claypans.	Possible. The study area contains suitable habitat for this species.
Chamelaucium sp. C Coastal Plain (R.D.Royce 4872)	T	V		X		Intricately branched spreading shrub, to 1.2 m, 0.6 m across. Fl. inconspicuous greenish-white. Young branches fawn to reddish.	Swamp margins, open Dryandra shrubland in winter-wet sandy clay sites on coastal plain, low woodlands of *Eucalyptus rudis, Melaleuca rhaphiophylla, Astartea fascicularis*, or Proteaceous heaths, heathland growing on sandy loams or loams over laterite hardpan at depths of less than 50 cm. The two main populations of Royce's Waxflower at Tutunup and Ruabon occur in a wet heathland (<2 m) or shrubland (>2 m).	Possible. The study area contains suitable habitat for this species.
Chamelaucium sp. Yoongarillup (G.J. Keighery 3635)	P4		X		X	Erect, compact perennial shrub 0.6—1 m high by 0.8 m wide. Fl. red. Gully, riverbank, ridge, open.	Dry, brown sand—loam, littered, white clayey sand, yellowish brown loam soils, laterite, yellow/brown soil, light sandy loam.	Possible. The study area contains suitable habitat for this species.

Scientific name	Status		Source			Description	Habitat requirements and Range[1]	Likelihood of occurrence (see Table 19 for definitions)
	State	Federal	Nature-map search	EPBC PMST search	DPaW databases			
Craspedia sp. Waterloo (G. J. Keigher 13724)	P2		X			Unknown	Unknown	Possible. Limited habitat information available.
Darwinia foetida	T	CE		X		Erect, or spreading, shrub to 0.7 m high, often using other shrubs for support. Young branches are slender, green-brown with prominent, decurrent leaf bases, becoming grey and woody. Fl. green, Oct to Nov.	Grey or white sand, swampy, seasonally wet sites.	Highly Unlikely. The study area is outside the known range of this species.
Darwinia whicherensis	T	E		X		Erect or sometimes spreading shrub, to 70 cm tall by 40 cm wide, and often uses other shrubs for support. Fl. enclosed by red and green bracts.	Known from three locations at the base of the Whicher Range, in a winter-wet area of shrubland over shallow red clay over ironstone.	Unlikely. The species has restricted habitat requirements which are unlikely to occur within the study area.
Diuris drummondii	T	V	X	X	X	Tuberous, perennial, herb, 0.5 – 1.05 m high. Flowers yellow, Nov to Dec or Jan.	Low-lying depressions, swamps	Known. Has been previously recorded within the study area. Was not recorded during the field survey, but this was conducted outside of its flowering season.
Diuris micrantha	T	V		X		Tuberous, perennial, herb, 0.3-0.6 m high. Fl. yellow & brown, Sep to Oct.	Brown loamy clay. Winter-wet swamps, in shallow water.	Highly Unlikely. This species is known from seven populations from east of Kwinana and south to the Frankland River area. The study area is not within its known range.

Scientific name	Status		Source			Description	Habitat requirements and Range[1]	Likelihood of occurrence (see Table 19 for definitions)
	State	Federal	Nature-map search	EPBC PMST search	DPaW databases			
Diuris purdiei	T	E		X		Tuberous, perennial, herb, 0.15-0.35 m high. Fl. yellow, Sep to Oct.	Grey-black sand, moist. Winter-wet swamps.	Highly Unlikely. This species' known range is restricted to an area near Perth. The study area is not within its known range.
Drakaea elastica	T	E	X	X	X	Tuberous, perennial, herb, 0.12-0.3 m high. Fl. red & green & yellow, Oct to Nov.	White or grey sand. Low-lying situations adjoining winter-wet swamps.	Possible. The study area contains suitable habitat for this species.
Drakaea micrantha	T	V	X	X	X	Tuberous, perennial, herb, 0.15-0.3 m high. Fl. red & yellow, Sep to Oct.	White-grey sand.	Possible. The study area contains suitable habitat for this species.
Eleocharis keigheryi	T	V	X	X	X	Rhizomatous, clumped perennial, grass-like or herb (sedge) to 0.4 m high. Flowers green, Aug to Nov.	Clay, sandy loam. Emergent in freshwater: creeks, claypans.	Possible. The study area contains suitable habitat for this species.
Eucalyptus rudis subsp. *cratyantha*	P4		X		X	Tree, 5-20 m high, bark rough, box-type. Fl. white, Jul to Sep.	Loam. Flats, hillsides.	Possible. The study area contains suitable habitat for this species.
Franklandia triaristata	P4		X		X	Erect, lignotuberous shrub, 0.2-1 m high. Fl. white-cream-yellow/brown-purple, Aug to Oct.	White or grey sand.	Possible. The study area contains suitable habitat for this species.
Gastrolobium sp. Yoongarillup (S.Dilkes s.n. 1/9/1969)	P1		X		X	Erect, perennial shrub; 0.5—1.10 m high, 0.8—1.0 m wide. Fl. yellow/orange.	Valley, state forest; white, dry sand, into open plain; rocky, red gravel.	Possible. The study area contains suitable habitat for this species.
Isopogon uncinatus	T	E		X		Tufted spreading or prostrate, non-lignotuberous shrub, 0.05-0.4 m high. Fl. yellow/cream, Oct to Nov.	Loam or sand on granite, peaty sand. Swampy depressions, hillslopes.	Highly Unlikely. This species is range is restricted to an area near Albany. The study area is not within its known range.

Scientific name	Status		Source			Description	Habitat requirements and Range[1]	Likelihood of occurrence (see Table 19 for definitions)
	State	Federal	Nature-map search	EPBC PMST search	DPaW databases			
Lambertia echinata subsp. *occidentalis*	T	E		X		Prickly, much-branched, non-lignotuberous shrub, to 3 m high. Fl. yellow, Feb or Apr or Dec.	White sandy soils over laterite, orange/brown-red clay over ironstone. Flats to foothills, winter-wet sites. Occurs on the eastern side of the Swan Coastal Plain along the base of the Whicher Scarp on ironstone (Meissner and English, 2005)	Unlikely. The species has restricted habitat requirements which are unlikely to occur within the study area.
Lasiopetalum membranaceum	P3		X		X	Multi-stemmed shrub, 0.2-1 m high. Fl. pink-blue-purple, Sep to Dec.	Sand over limestone. Generally occurs in Tuart/Peppermint woodland.	Unlikely. The study area does not contain optimal habitat for this species.
Leptomeria furtiva	P2		X		X	Lax, sprawling shrub, 0.2-0.45 m high. Fl. orange-brown, Aug to Oct.	Grey or black peaty sand. Winter-wet flats.	Possible. The study area contains suitable habitat for this species.
Leucopogon sp. Busselton (D. Cooper 243) PN	P2		X		X	Low sprawling/open erect shrub 0.4-1 m high, 0.2-0.7 m wide. Fl. white.	Grey sand, dark brown sandy clay, red sand. Low flat, dry-winter wet, wet flat, poor drainage, seasonal swamp, myrtaceous woodland.	Possible. The study area contains suitable habitat for this species.
Meeboldina decipiens subsp. *decipiens*	P3		X			Erect, open perennial, grass-like or herb (sedge), 0.6 m high. Flowers October.	Sand and sandy peat. Swamps	Possible. The study area contains suitable habitat for this species.
Mitreola minima	P3		X		X	Slender, erect annual, herb, 0.025-0.04 m high. Flowers white, Oct to Dec.	Grey sand. Peaty swampy areas.	Possible. The study area contains suitable habitat for this species.
Ornduffia submersa	P4		X		X	Emergent aquatic herb. Fl. white/cream.	Seasonal wetland. Yellow grey clayey sand, granite derived soil over limestone,	Possible. The study area contains suitable habitat for this species.

Scientific name	Status		Source			Description	Habitat requirements and Range[1]	Likelihood of occurrence (see Table 19 for definitions)
	State	Federal	Nature-map search	EPBC PMST search	DPaW databases			
							moist brown clay.	
Platysace ramosissima	P3		X		X	Perennial, herb, to 0.3 m high. Flowers white-cream, Oct to Nov.	Sandy soils.	Possible. The study area contains suitable habitat for this species.
Puccinellia vassica	P1		X		X	Caespitose annual or perennial, grass-like or herb, 0.41-0.55 m high.	Saline soils. On the outer margins of coastal saltmarshes.	Unlikely. The study area does not contain suitable habitat for this species.
Pultenaea skinneri	P4		X		X	Slender shrub, 1-2 m high. Flowers yellow/orange and red, July to Sep.	Sandy or clayey soils. Winter-wet depressions.	Possible. The study area contains suitable habitat for this species.
Schoenus benthamii	P3		X		X	Tufted perennial, grass-like or herb (sedge), 0.15-0.45 m high. Fl. brown, Oct to Nov.	White, grey sand, sandy clay. Winter-wet flats, swamps.	Possible. The study area contains suitable habitat for this species.
Schoenus capillifolius			X			Semi-aquatic tufted annual, grass-like or herb (sedge), 0.05 m high. Flowers green, Oct to Nov	Brown mud. Claypans	Possible. The study area contains suitable habitat for this species.
Schoenus loliaceus	P2		X		X	Annual, grass-like or herb (sedge), 0.03-0.06 m high. Flowers Aug to Nov.	Sandy soils. Winter-wet depressions	Possible. The study area contains suitable habitat for this species.
Stylidium longitubum	P3		X		X	Erect annual (ephemeral), herb, 0.05-0.12 m high. Fl. pink, Oct to Dec.	Sandy clay, clay. Seasonal wetlands.	Possible. The study area contains suitable habitat for this species.
Synaphea hians	P3		X			Prostrate or decumbent shrub, 0.15-0.6 m high, to 1 m wide. Fl. yellow, Jul or Sep to Nov.	Sandy soils. Rises.	Possible. The study area contains suitable habitat for this species.

Scientific name	Status		Source			Description	Habitat requirements and Range[1]	Likelihood of occurrence (see Table 19 for definitions)
	State	Federal	Nature-map search	EPBC PMST search	DPaW databases			
Synaphea odocoileops	P1		X		X	Tufted, compact shrub, 0.2-0.5 m high, Flowers yellow, Aug to Oct.	Brown-orange loam and sandy clay, granite. Swamps, winter-wet areas.	Possible. The study area contains suitable habitat for this species.
Synaphea sp. Serpentine (G.R. Brand 103)	P3				X	Unknown	Unknown	Possible. Limited habitat information available.
Synaphea sp. Fairbridge Farm (D. Papenfus 696)	T	CR		X		Dense, clumped shrub, to 0.3 m high, to 0.4 m wide. Flowers yellow, Oct.	Sandy with lateritic pebbles. Near winter-wet flats, in low woodland with weedy grasses.	Unlikely. The study area contains marginal habitat for this species.
Synaphea stenoloba	T	E		X		Caespitose shrub, 0.3-0.45 m high. Flowers yellow, Aug to Oct.	Sandy or sandy clay soils. Winter-wet flats, granite	Unlikely. The study area contains marginal habitat for this species.
Thelymitra variegata	P3				X	Tuberous, perennial, herb, 0.1-0.35 m high. Flowers orange, red, purple, pink, Jun to Sep.	Sandy clay, sand, laterite.	Possible. The study area contains marginally suitable habitat for this species.
Trichocline sp. Treeton (B.J. Keighery & N. Gibson 564)	P2		X			Tuberous, perennial, herb, to 1.6 m high.	Sand over limestone, sandy clay over ironstone. Seasonally wet flats.	Unlikely. The study area does not contain optimal habitat for this species.
Verticordia attenuata	P3		X		X	Shrub, 0.4-1 m high. Fl. pink, Dec or Jan to May.	White or grey sand. Winter-wet depressions.	Possible. The study area contains suitable habitat for this species.
Verticordia fimbrilepis subsp. *fimbrilepis*	T	E		X		Shrub, 0.3-0.7 m high. Flowers pink-white, Oct to Dec or Jan.	Gravelly sandy or clayey soils. Flats, road verges.	Highly Unlikely. This species is range is restricted to an area between Armadale and Kojonup. The study area is not within its known range.

Table 21 Flora species list recorded during the field survey

Family	Genus	Species	Status	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14
Amaranthaceae	*Alternanthera*	*nodiflora*															
Anarthriaceae	*Lyginia*	*imberbis*		X	X				X	X	X	X			X	X	X
Apiaceae	*Platysace*	*filiformis*										X	X				
Apocynaceae	*Gomphocarpus*	*fruticosus*	*DP - C3														
Asparagaceae	*Lomandra*	*nigricans*		X	X		X			X		X	X			X	
Asparagaceae	*Thysanotus*	sp. (insufficient material)					X			X				X	X	X	
Asteraceae	*Cotula*	*coronopifolia*	*														
Asteraceae	*Cotula*	*turbinata*	*														
Asteraceae	*Hypochaeris*	*glabra*	*					X	X	X	X	X	X		X		X
Asteraceae	*Lagenophora*	*huegelii*		X	X	X	X		X			X	X	X	X	X	
Asteraceae	*Senecio*	*diaschides*															
Asteraceae	*Ursinia*	*anthemoides*	*	X	X	X			X		X				X		
Brassicaceae	sp.		*														
Campanulaceae	*Lobelia*	*anceps*															
Caryophyllaceae	*Cerastium*	*glomeratum*	*			X											
Colchicaceae	*Burchardia*	*congesta*								X							
Cyperaceae	*Gahnia*	*trifida*															X
Cyperaceae	*Lepidosperma*	*?pubisquameum*		X			X			X		X					
Cyperaceae	*Lepidosperma*	*longitudinale*						X									
Cyperaceae	*Lepidosperma*	sp. (insufficient material)					X				X						
Cyperaceae	*Mesomelaena*	*tetragona*											X				
Dasypogonaceae	*Dasypogon*	*bromeliifolius*		X	X		X		X	X	X	X	X	X	X		
Dennstaedtiaceae	*Pteridium*	*esculentum*					X										
Dilleniaceae	*Hibbertia*	*hypericoides*		X	X	X			X	X		X				X	
Dilleniaceae	*Hibbertia*	*vaginata*							X				X				

Family	Genus	Species	Status	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14
Dilleniaceae	*Hibbertia*	*racemosa*		X	X				X			X	X	X	X	X	
Droseraceae	*Drosera*	*erythrorhiza*		X	X				X			X		X		X	
Droseraceae	*Drosera*	*glanduligera*														X	
Droseraceae	*Drosera*	*pallida*			X				X	X		X					
Droseraceae	*Drosera*	sp. (insufficient material)				X	X						X				
Ericaceae	*Conostephium*	*pendulum*								X							
Ericaceae	*Leucopogon*	*propinquus*								X						X	
Fabaceae	*?Isotropis*	*cuneifolia*															
Fabaceae	*Acacia*	*flagelliformis*	P4								X						
Fabaceae	*Acacia*	*pulchella*															
Fabaceae	*Acacia*	*pulchella* var. *glaberrima*															
Fabaceae	*Acacia*	*stenoptera*															
Fabaceae	*Bossiaea*	*eriocarpa*		X												X	
Fabaceae	*Daviesia*	*physodes*															
Fabaceae	*Hardenbergia*	*comptoniana*					X								X		
Fabaceae	*Hovea*	*trisperma*								X		X		X		X	
Fabaceae	*Jacksonia*	*furcellata*															
Fabaceae	*Jacksonia*	*sternbergiana*							X								
Fabaceae	*Kennedia*	*prostrata*		X													
Fabaceae	*Lupinus*	*cosentinii*	*														
Goodeniaceae	*Dampiera*	*linearis*					X										
Haemodoraceae	*Conostylis*	*aculeata*								X			X				
Haemodoraceae	*Haemodorum*	*spicatum*															
Iridaceae	*Patersonia*	sp. (insufficient material)								X	X						
Iridaceae	*Romulea*	*rosea*	*			X	X	X						X	X		
Iridaceae	*Watsonia*	*meriana var. bulbillifera*	*														
Juncaceae	*Juncus*	*microcephalus*															

Family	Genus	Species	Status	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14
Juncaceae	*Juncus*	*pallidus*															X
juvenile herbs														X			
Lamiaceae	*Hemiandra*	*pungens*															
Lauraceae	*Cassytha*	sp. (insufficient material)						X									X
Loranthaceae	*Nuytsia*	*floribunda*															
Menyanthaceae	*Ornduffia*	*albiflora*			X		X					X					
Myrtaceae	*Agonis*	*flexuosa*		X		X			X	X	X			X		X	
Myrtaceae	*Astartea*	*?scoparia*									X						
Myrtaceae	*Corymbia*	*calophylla*			X		X		X			X	X				
Myrtaceae	*Eucalyptus*	*marginata*		X					X	X		X	X	X		X	
Myrtaceae	*Eucalyptus*	*rudis*															
Myrtaceae	*Jacksonia*	*horrida*															
Myrtaceae	*Kunzea*	*glabrescens*			X	X			X		X	X	X	X	X	X	
Myrtaceae	*Melaleuca*	*preissiana*															
Myrtaceae	*Melaleuca*	*rhaphiophylla*						X									
Myrtaceae	*Melaleuca*	*teretifolia*						X									X
Myrtaceae	*Melaleuca*	*thymoides*															
Myrtaceae	*Melaleuca*	*viminea*						X									
Myrtaceae	*Melaleuca*	*viminea* subsp. *viminea*															X
Orchidaceae	*Caladenia*	*?flava*								X		X		X			
Orchidaceae	*Cryptostylis*	*ovata*					X										
Orchidaceae	*Leporella*	*fimbriata*		X						X							
Orchidaceae	*Pterostylis*	*?aspera*															
Orchidaceae	*Pterostylis*	*vittata*					X			X				X			
Orchidaceae	*Pyrorchis*	*nigricans*		X	X	X			X	X		X	X	X	X	X	
Orobanchaceae	*Orobanche*	*minor*	*				X										
Oxalidaceae	*Oxalis*	sp. (insufficient material)	*														

Family	Genus	Species	Status	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14
Poaceae	*Briza*	*maxima*	*	X	X	X	X	X	X	X		X	X	X	X	X	
Poaceae	*Ehrharta*	*longiflora*	*			X	X						X				
Poaceae	*Holcus*	*lanatus*	*					X									
Poaceae	*juvenile grasses*		*								X						X
Poaceae	*sp. (juvenile regrowth)*		*	X										X	X		
Polygonaceae	*Acetosella*	*vulgaris*	*														
Proteaceae	*Adenanthos*	*meisneri*															
Proteaceae	*Banksia*	*attenuata*		X	X	X			X	X		X	X	X	X	X	
Proteaceae	*Banksia*	*grandis*							X				X				
Proteaceae	*Banksia*	*ilicifolia*		X	X				X						X		
Proteaceae	*Persoonia*	*longifolia*															
Proteaceae	*Petrophile*	*linearis*			X												
Proteaceae	*Xylomelum*	*occidentale*		X	X							X	X		X	X	
Restionaceae	*Desmocladus*	*fasciculatus*			X	X			X	X		X	X	X	X	X	
Restionaceae	*Desmocladus*	*flexuosus*					X										
Restionaceae	*Hypolaena*	*exsulca*								X	X	X				X	
Restionaceae	*Leptocarpus*	*laxus*						X									
Rubiaceae	*Opercularia*	*hispidula*					X										
Solanaceae	*Solanum*	*linnaeanum*	*DP - C3														
Solanaceae	*Solanum*	*nigrum*	*														
Stylidiaceae	*Stylidium*	sp. (insufficient material)								X						X	X
Stylidiaceae	*Stylidium*	*carnosum*															
Stylidiaceae	*Stylidium*	*piliferum*							X	X				X			
Thymelaeaceae	*Pimelea*	*hispida*						X									
Xanthorrhoeaceae	*Xanthorrhoea*	*brunonis*		X	X		X		X	X		X	X	X			
Zamiaceae	*Macrozamia*	*riedlei*		X	X	X			X			X			X	X	

Quadrat Data

Site	Q01	Project	EVA Lot 5 Boyanup-Picton Rd
Type:	Quadrat	**Size:**	10 × 10 m
Date:	11/06/13	**Described by:**	MD & LZ
Co-ordinates:	MGA 50	380231 mE	6307012 mN
Location:	Southern section of site, west of powerline track		
Landform:	Slope – upper		
Drainage:	Good drainage		
Soil colour & type:	Yellow-grey sand		
Vegetation Condition:	Very Good (3)		
Fire age & intensity:	Old (>5 years), no damage		
Disturbances:	Weeds, clearing		
Bare ground (%):	10-30	**Logs (%):**	2-10
Twigs (%):	<2	**Leaves (%):**	10-30
Rocks <2 cm (%):	<2	**Rocks 2-30 cm (%):**	<2
Rocks >30 cm (%):	<2	**Veg. ground layer (%):**	30-70
Veg Description	*Agonis flexuosa, Banksia attenuata* and *Eucalyptus marginata* woodland over *Xylomelum occidentale* and *Banksia illicifolia* tall open shrubland over low shrubland of *Xanthorrhoea brunonis, Hibbertia racemosa* and *H. hypericoides* over open sedgeland of *Dasypogon bromeliifolius* and *Desmocladus fasciculatus*		

Quadrat Data

Quadrat 1 Species List

Family	Genus	Species	Status	Sub-stratum (NVIS)	Foliage Cover (%)	Average Height (m)
Myrtaceae	*Agonis*	*flexuosa*		U1	10-30	7
Proteaceae	*Banksia*	*attenuata*		U1	2-10	6
Myrtaceae	*Eucalyptus*	*marginata*		U1	<2	4
Xanthorrhoeaceae	*Xanthorrhoea*	*brunonis*		M2	10-30	0.9
Proteaceae	*Xylomelum*	*occidentale*		M2	<2	1.4
Dilleniaceae	*Hibbertia*	*racemosa*		M3	2-10	0.2
Dilleniaceae	*Hibbertia*	*hypericoides*		M3	<2	0.4
Zamiaceae	*Macrozamia*	*riedlei*		M3	<2	0.3
Fabaceae	*Bossiaea*	*eriocarpa*		M3	<2	0.1
Proteaceae	*Banksia*	*ilicifolia*		M1	<2	4
Proteaceae	*Xylomelum*	*occidentale*		M1	<2	2.3
Dasypogonaceae	*Dasypogon*	*bromeliifolius*		G1	10-30	0.1
Poaceae	sp. (juvenile regrowth)			G1	2-10	0.05
Cyperaceae	*Lepidosperma*	*?pubisquameum*		G1	<2	0.8
Anarthriaceae	*Lyginia*	*imberbis*		G1	<2	0.6
Poaceae	*Briza*	*maxima*	*	G1	<2	0.6
Asparagaceae	*Lomandra*	*nigricans*		G1	<2	0.3
Asteraceae	*Ursinia*	*anthemoides*	*	G2	2-10	0.1
Asteraceae	*Lagenophora*	*huegelii*		G2	<2	0.05
Droseraceae	*Drosera*	*erythrorhiza*		G2	<2	0.05
Fabaceae	*Kennedia*	*prostrata*		G2	<2	0.05
Orchidaceae	*Leporella*	*fimbriata*		G2	<2	0.05
Orchidaceae	*Pyrorchis*	*nigricans*		G2	<2	0.05

Quadrat Data

Site	Q02	Project	EVA Lot 5 Boyanup-Picton Rd
Type:	Quadrat	**Size:**	10 × 10 m
Date:	11/06/13	**Described by:**	MD & LZ
Co-ordinates:	MGA 50	379977 mE	6307263 mN
Location:	Centre of study area		
Landform:	Flat		
Drainage:	Good drainage		
Soil colour & type:	White--grey sand		
Vegetation Condition:	Excellent (2) - Very Good (3)		
Fire age & intensity:	Old (>5 years), no damage		
Disturbances:	Weeds, historical grazing		
Bare ground (%):	2-10	**Logs (%):**	2-10
Twigs (%):	<2	**Leaves (%):**	10-30
Rocks <2 cm (%):	<2	**Rocks 2-30 cm (%):**	<2
Rocks >30 cm (%):	<2	**Veg. ground layer (%):**	30-70
Veg Description	*Corymbia calophylla, Banksia attenuata* and *B. illicifolia* woodland over *Kunzea glabrescens* and *Xylomelum occidentale* tall open shrubland over low shrubland of *Xanthorrhoea brunonis, Macrozamia riedlei* and *Hibbertia racemosa* over sedgeland of *Dasypogon bromeliifolius, Lyginia imberbis* and *Desmocladus fasciculatus* over very open herbland of *Pyrorchis nigricans* and *Drosera erythrorhiza.*		

Quadrat Data

Quadrat 2 Flora Species List

Family	Genus	Species	Status	Sub-stratum (NVIS)	Foliage Cover (%)	Average Height (m)
Proteaceae	*Banksia*	*attenuata*		U1	10-30	5
Proteaceae	*Banksia*	*ilicifolia*		U1	10-30	4
Myrtaceae	*Corymbia*	*calophylla*		U1	2-10	5
Myrtaceae	*Kunzea*	*glabrescens*		M1	30-70	4.5
Proteaceae	*Xylomelum*	*occidentale*		M2	<2	1.3
Xanthorrhoeaceae	*Xanthorrhoea*	*brunonis*		M3	2-10	0.8
Zamiaceae	*Macrozamia*	*riedlei*		M3	<2	0.7
Dilleniaceae	*Hibbertia*	*racemosa*		M3	<2	0.2
Dilleniaceae	*Hibbertia*	*hypericoides*		M3	<2	0.1
Dasypogonaceae	*Dasypogon*	*bromeliifolius*		G1	30-70	0.2
Anarthriaceae	*Lyginia*	*imberbis*		G1	<2	0.5
Poaceae	*Briza*	*maxima*	*	G1	<2	0.4
Asparagaceae	*Lomandra*	*nigricans*		G1	<2	0.3
Restionaceae	*Desmocladus*	*fasciculatus*		G2	2-10	0.1
Droseraceae	*Drosera*	*pallida*		G2	<2	cl
Proteaceae	*Petrophile*	*linearis*		G2	<2	0.2
Asteraceae	*Ursinia*	*anthemoides*	*	G2	<2	0.05
Asteraceae	*Lagenophora*	*huegelii*		G2	<2	0.05
Droseraceae	*Drosera*	*erythrorhiza*		G2	<2	0.05
Orchidaceae	*Pyrorchis*	*nigricans*		G2	<2	0.05
Menyanthaceae	*Ornduffia*	*albiflora*		G2	<2	0.05

Quadrat Data

Site	Q03	Project	EVA Lot 5 Boyanup-Picton Rd
Type:	Quadrat	**Size:**	10 × 10 m
Date:	11/06/13	**Described by:**	MD & LZ
Co-ordinates:	MGA 50	379795 mE	6307126 mN
Location:	South-west of study area		
Landform:	Hill crest		
Drainage:	Good drainage		
Soil colour & type:	White--grey sand		
Vegetation Condition:	Very Good (3) – Good (4)		
Fire age & intensity:	Old (>5 years), no damage		
Disturbances:	Weeds, historical grazing and dieback		
Bare ground (%):	10-30	**Logs (%):**	2-10
Twigs (%):	2-10	**Leaves (%):**	30-70
Rocks <2 cm (%):	Nil	**Rocks 2-30 cm (%):**	Nil
Rocks >30 cm (%):	Nil	**Veg. ground layer (%):**	10-30
Veg Description	*Banksia attenuata* and *Agonis flexuosa* woodland over tall open shrubland of *Kunzea glabrescens* over low shrubland of *Macrozamia riedlei* over very open herbland of *Pyrorchis nigricans, Lagenophora huegelii* and **Ursinia anthemoides.*		

Quadrat Data

Quadrat 3 Flora Species List

Family	Genus	Species	Status	Sub-stratum (NVIS)	Foliage Cover (%)	Average Height (m)
Proteaceae	*Banksia*	*attenuata*		U1	30-70	5
Myrtaceae	*Agonis*	*flexuosa*		U1	2-10	4
Myrtaceae	*Kunzea*	*glabrescens*		M1	2-10	3.5
Zamiaceae	*Macrozamia*	*riedlei*		M3	<2	0.5
Dilleniaceae	*Hibbertia*	*hypericoides*		M3	<2	0.1
Poaceae	*Briza*	*maxima*	*	G1	<2	0.6
Droseraceae	*Drosera*	sp. (insufficient material)		G2	<2	cl
Poaceae	*Ehrharta*	*longiflora*	*	G2	<2	0.2
Asteraceae	*Ursinia*	*anthemoides*	*	G2	<2	0.1
Iridaceae	*Romulea*	*rosea*	*	G2	<2	0.1
Asteraceae	*Lagenophora*	*huegelii*		G2	<2	0.05
Orchidaceae	*Pyrorchis*	*nigricans*		G2	<2	0.05
Restionaceae	*Desmocladus*	*fasciculatus*		G2	<2	0.05
Caryophyllaceae	*Cerastium*	*glomeratum*	*	G2	<2	0.05

Quadrat Data

Site	Q04	Project	EVA Lot 5 Boyanup-Picton Rd
Type:	Quadrat	**Size:**	10 × 10 m
Date:	11/06/13	**Described by:**	MD & LZ
Co-ordinates:	MGA 50	379700 mE	6307085 mN
Location:	South-west of study area		
Landform:	Slope - middle		
Drainage:	Good drainage		
Soil colour & type:	Black-white silty-sand		
Vegetation Condition:	Excellent (2) - Very Good (3)		
Fire age & intensity:	Old (>5 years), no damage		
Disturbances:	Weeds, historical grazing		
Bare ground (%):	<2	**Logs (%):**	2-10
Twigs (%):	2-10	**Leaves (%):**	30-70
Rocks <2 cm (%):	Nil	**Rocks 2-30 cm (%):**	Nil
Rocks >30 cm (%):	Nil	**Veg. ground layer (%):**	30-70
Veg Description	*Corymbia calophylla* open forest over shrubland of tall open shrubland of *Xanthorrhoea brunonis* over low shrubland of *Pteridium esculentum, Opercularia hispidula* and *Hibbertia sp.* over sedgeland of *Dasypogon bromeliifolius* and open grassland of **Erhrarta longiflora* and **Briza maxima* over very open herbland of *Lagenophora huegelii.*		

Quadrat Data

Quadrat 4 Flora Species List

Family	Genus	Species	Status	Sub-stratum (NVIS)	Foliage Cover (%)	Average Height (m)
Myrtaceae	*Corymbia*	*calophylla*		U1	30-70	17
Xanthorrhoeaceae	*Xanthorrhoea*	*brunonis*		M1	2-10	1.5
Fabaceae	*Hardenbergia*	*comptoniana*		M1	<2	cl
Rubiaceae	*Opercularia*	*hispidula*		M2	10-30	0.6
Dennstaedtiaceae	*Pteridium*	*esculentum*		M2	<2	0.7
Goodeniaceae	*Dampiera*	*linearis*		M2	<2	0.3
Dasypogonaceae	*Dasypogon*	*bromeliifolius*		G1	30-70	0.6
Poaceae	*Ehrharta*	*longiflora*	*	G1	2-10	0.2
Asparagaceae	*Thysanotus*	sp. (insufficient material)		G1	<2	cl
Cyperaceae	*Lepidosperma*	sp. (insufficient material)		G1	<2	0.8
Cyperaceae	*Lepidosperma*	*?pubisquameum*		G1	<2	0.6
Poaceae	*Briza*	*maxima*	*	G1	<2	0.4
Droseraceae	*Drosera*	sp. (insufficient material)		G2	<2	0.3
Asparagaceae	*Lomandra*	*nigricans*		G2	<2	0.3
Orchidaceae	*Pterostylis*	*vittata*		G2	<2	0.2
Iridaceae	*Romulea*	*rosea*	*	G2	<2	0.1
Orchidaceae	*Cryptostylis*	*ovata*		G2	<2	0.1
Orobanchaceae	*Orobanche*	*minor*	*	G2	<2	0.1
Restionaceae	*Desmocladus*	*flexuosus*		G2	<2	0.1
Asteraceae	*Lagenophora*	*huegelii*		G2	<2	0.05
Menyanthaceae	*Ornduffia*	*albiflora*		G2	<2	0.05

Quadrat Data

Site	Q05	Project	EVA Lot 5 Boyanup-Picton Rd
Type:	Quadrat	**Size:**	10 × 10 m
Date:	11/06/13	**Described by:**	MD & LZ
Co-ordinates:	MGA 50	379416 mE	6307231 mN
Location:	South-west of study area		
Landform:	Swamp		
Drainage:	Seasonally wet		
Soil colour & type:	Brown clay		
Vegetation Condition:	Very Good (3)		
Fire age & intensity:	Old (>5 years), no damage		
Disturbances:	Weeds, historical grazing		
Bare ground (%):	<2	**Logs (%):**	2-10
Twigs (%):	2-10	**Leaves (%):**	30-70
Rocks <2 cm (%):	Nil	**Rocks 2-30 cm (%):**	Nil
Rocks >30 cm (%):	Nil	**Veg. ground layer (%):**	30-70
Veg Description	Tall Open Scrub of *Melaleuca rhaphiophylla* and *Melaleuca teretifolia* over sedgeland of *Leptocarpus laxus* and *Lepidosperma longitudinale* over open herbland of **Romulea rosea, *Hypochaeris glabra* and juvenile grasses.		

Quadrat Data

Quadrat 5 Flora Species List

Family	Genus	Species	Status	Sub-stratum (NVIS)	Foliage Cover (%)	Average Height (m)
Myrtaceae	*Melaleuca*	*rhaphiophylla*		U1	10-30	4
Myrtaceae	*Melaleuca*	*teretifolia*		U1	10-30	3.5
Myrtaceae	*Melaleuca*	*viminea*		U1	<2	2.7
Lauraceae	*Cassytha*	sp. (insufficient material)		M1	2-10	cl
Myrtaceae	*Melaleuca*	*teretifolia*		M1	2-10	2.5
Thymelaeaceae	*Pimelea*	*hispida*		M2	<2	1.2
Restionaceae	*Leptocarpus*	*laxus*		G1	10-30	1.6
Cyperaceae	*Lepidosperma*	*longitudinale*		G1	10-30	1.3
Poaceae	*Briza*	*maxima*	*	G1	<2	0.4
Poaceae	*Holcus*	*lanatus*	*	G1	<2	0.3
Iridaceae	*Romulea*	*rosea*	*	G2	10-30	0.05
Asteraceae	*Hypochaeris*	*glabra*	*	G2	2-10	0.05

Quadrat Data

Site	Q06	Project	EVA Lot 5 Boyanup-Picton Rd
Type:	Quadrat	**Size:**	10 × 10 m
Date:	11/06/13	**Described by:**	MD & LZ
Co-ordinates:	MGA 50	379969 mE	6307013 mN
Location:	South-west of study area		
Landform:	Slope - middle		
Drainage:	Good drainage		
Soil colour & type:	White-grey sand		
Vegetation Condition:	Very Good (3) – Good (4)		
Fire age & intensity:	Old (>5 years), no damage		
Disturbances:	Weeds, dieback		
Bare ground (%):	10-30	**Logs (%):**	2-10
Twigs (%):	2-10	**Leaves (%):**	30-70
Rocks <2 cm (%):	Nil	**Rocks 2-30 cm (%):**	Nil
Rocks >30 cm (%):	Nil	**Veg. ground layer (%):**	2-10
Veg Description	*Corymbia calophylla* open woodland woodland of *Banksia attenuata* and *Agonis flexuosa* over tall open shrubland of *Banksia illicifolia* and *Kunzea glabrescens* over low open shrubland of *Xanthorrhoea brunonis, Macrozamia riedlei* and *Hibbertia racemosa* over sedgeland of *Dasypogon bromeliifolius* and *Lyginis imberbis* and *Desmocladus fasciculatus* over very open herbland of *Pyrorchis nigricans* and *Drosera erythrorhiza.*		

Quadrat Data

Quadrat 6 Flora List

Family	Genus	Species	Status	Sub-stratum (NVIS)	Foliage Cover (%)	Average Height (m)
Myrtaceae	*Corymbia*	*calophylla*		U1	2-10	20
Myrtaceae	*Agonis*	*flexuosa*		U2	10-30	6
Proteaceae	*Banksia*	*attenuata*		U2	2-10	7
Myrtaceae	*Eucalyptus*	*marginata*		U2	<2	5
Proteaceae	*Banksia*	*grandis*		U2	<2	5
Myrtaceae	*Kunzea*	*glabrescens*		M1	2-10	4
Proteaceae	*Banksia*	*ilicifolia*		M1	<2	3
Xanthorrhoeaceae	*Xanthorrhoea*	*brunonis*		M2	2-10	0.9
Zamiaceae	*Macrozamia*	*riedlei*		M2	<2	0.4
Dilleniaceae	*Hibbertia*	*vaginata*		M2	<2	0.4
Fabaceae	*Jacksonia*	*sternbergiana*		M2	<2	0.4
Dilleniaceae	*Hibbertia*	*racemosa*		M2	<2	0.3
Dilleniaceae	*Hibbertia*	*hypericoides*		M2	<2	0.2
Dasypogonaceae	*Dasypogon*	*bromeliifolius*		G1	10-30	0.6
Poaceae	*Briza*	*maxima*	*	G1	<2	0.3
Anarthriaceae	*Lyginia*	*imberbis*		G1	<2	0.3
Droseraceae	*Drosera*	*pallida*		G1	<2	0.1
Restionaceae	*Desmocladus*	*fasciculatus*		G2	<2	0.2
Asteraceae	*Hypochaeris*	*glabra*	*	G2	<2	0.05
Asteraceae	*Lagenophora*	*huegelii*		G2	<2	0.05
Asteraceae	*Ursinia*	*anthemoides*	*	G2	<2	0.05
Orchidaceae	*Pyrorchis*	*nigricans*		G2	<2	0.05
Droseraceae	*Drosera*	*erythrorhiza*		G2	<2	0.05
Stylidiaceae	*Stylidium*	*piliferum*		G2	<2	0.05

Quadrat Data

Site	Q07	Project	EVA Lot 5 Boyanup-Picton Rd
Type:	Quadrat	**Size:**	10 × 10 m
Date:	12/06/13	**Described by:**	MD & LZ
Co-ordinates:	MGA 50	380421 mE	6306966 mN
Location:	South-east of study area, east of powerline		
Landform:	Slope - middle		
Drainage:	Good drainage		
Soil colour & type:	White-grey sand		
Vegetation Condition:	Excellent (2) - Very Good (3)		
Fire age & intensity:	Old (>5 years), no damage		
Disturbances:	Weeds, dieback		
Bare ground (%):	2-10	**Logs (%):**	2-10
Twigs (%):	<2	**Leaves (%):**	>70
Rocks <2 cm (%):	Nil	**Rocks 2-30 cm (%):**	Nil
Rocks >30 cm (%):	Nil	**Veg. ground layer (%):**	10-30
Veg Description	Open forest of *Eucalyptus marginata, Banksia attenuata* and *Agonis flexuosa* over low very open shrubland of *Xanthorrhoea brunonis* over sedgeland of *Dasypogon bromeliifolius, Hypolaena exsulca* and *Lomandra nigricans* over very open herbland of *Pyrorchis nigricans* and *Drosera* sp..		

Quadrat Data

Quadrat 7 Flora List

Family	Genus	Species	Status	Sub-stratum (NVIS)	Foliage Cover (%)	Average Height (m)
Myrtaceae	*Agonis*	*flexuosa*		U1	30-70	7
Proteaceae	*Banksia*	*attenuata*		U1	2-10	6
Myrtaceae	*Eucalyptus*	*marginata*		U1	2-10	6
Myrtaceae	*Agonis*	*flexuosa*		M1	2-10	2.6
Xanthorrhoeaceae	*Xanthorrhoea*	*brunonis*		M2	<2	0.6
Dilleniaceae	*Hibbertia*	*hypericoides*		M2	<2	0.6
Ericaceae	*Conostephium*	*pendulum*		M2	<2	0.2
Ericaceae	*Leucopogon*	*propinquus*		M2	<2	0.2
Dasypogonaceae	*Dasypogon*	*bromeliifolius*		G1	10-30	0.4
Restionaceae	*Hypolaena*	*exsulca*		G1	2-10	0.4
Cyperaceae	*Lepidosperma*	*?pubisquameum*		G1	<2	0.5
Anarthriaceae	*Lyginia*	*imberbis*		G1	<2	0.4
Orchidaceae	*Pterostylis*	*vittata*		G1	<2	0.4
Iridaceae	*Patersonia*	sp. (insufficient material)		G1	<2	0.4
Asparagaceae	*Lomandra*	*nigricans*		G1	<2	0.3
Poaceae	*Briza*	*maxima*	*	G1	<2	0.2
Droseraceae	*Drosera*	*pallida*		G1	<2	0.1
Asparagaceae	*Thysanotus*	sp. (insufficient material)		G1	<2	0.1
Colchicaceae	*Burchardia*	*congesta*		G2	<2	0.4
Restionaceae	*Desmocladus*	*fasciculatus*		G2	<2	0.1
Fabaceae	*Hovea*	*trisperma*		G2	<2	0.1
Haemodoraceae	*Conostylis*	*aculeata*		G2	<2	0.1
Stylidiaceae	*Stylidium*	sp. (insufficient material)		G2	<2	0.1
Asteraceae	*Hypochaeris*	*glabra*	*	G2	<2	0.05
Orchidaceae	*Pyrorchis*	*nigricans*		G2	<2	0.05
Stylidiaceae	*Stylidium*	*piliferum*		G2	<2	0.05
Orchidaceae	*Leporella*	*fimbriata*		G2	<2	0.05
Orchidaceae	*Caladenia*	*?flava*		G2	<2	0.05

Quadrat Data

Site	Q08	Project	EVA Lot 5 Boyanup-Picton Rd
Type:	Quadrat	**Size:**	10 × 10 m
Date:	12/06/13	**Described by:**	MD & LZ
Co-ordinates:	MGA 50	380470 mE	6307221 mN
Location:	On eastern boundary of study area ~centre of study area		
Landform:	Swamp/drainage depression		
Drainage:	Seasonally wet		
Soil colour & type:	White-grey sand		
Vegetation Condition:	Excellent (2)		
Fire age & intensity:	Old (>5 years), no damage		
Disturbances:			
Bare ground (%):	30-70	**Logs (%):**	nil
Twigs (%):	2-10	**Leaves (%):**	<2
Rocks <2 cm (%):	Nil	**Rocks 2-30 cm (%):**	Nil
Rocks >30 cm (%):	Nil	**Veg. ground layer (%):**	30-70
Veg Description	Closed Heath of *Astartea scoparia* with occasional emergent *Agonis flexuosa* and *Kunzea glabrescens* over sedgeland of *Leptocarpus laxus, Lepidosperma* sp. and *Patersonia* sp. over very open grassland of juvenile grasses and very open herbland of *Hypochaeris glabra*		

Quadrat Data

Quadrat 8 Flora List

Family	Genus	Species	Status	Sub-stratum (NVIS)	Foliage Cover (%)	Average Height (m)
Myrtaceae	*Agonis*	*flexuosa*		U1	2-10	5
Myrtaceae	*Astartea*	*scoparia*		M2	30-70	1.3
Myrtaceae	*Agonis*	*flexuosa*		M1	<2	2.5
Myrtaceae	*Kunzea*	*glabrescens*		M1	<2	2.1
Anarthriaceae	*Lyginia*	*imberbis*		G1	30-70	1.3
Iridaceae	*Patersonia*	sp. (insufficient material)		G1	<2	0.8
Dasypogonaceae	*Dasypogon*	*bromeliifolius*		G1	<2	0.4
Poaceae	juvenile grasses		*	G2	30-70	0.1
Asteraceae	*Ursinia*	*anthemoides*	*	G2	<2	0.1
Cyperaceae	*Lepidosperma*	sp. (insufficient material)		G2	2-10	0.6
Fabaceae	*Acacia*	*flagelliformis*	P4	G2	2-10	0.6
Asteraceae	*Hypochaeris*	*glabra*	*	G2	2-10	0.05
Restionaceae	*Hypolaena*	*exsulca*		G2	10-30	0.3

Quadrat Data

Site	Q09	Project	EVA Lot 5 Boyanup-Picton Rd
Type:	Quadrat	**Size:**	10 × 10 m
Date:	12/06/13	**Described by:**	MD & LZ
Co-ordinates:	MGA 50	380419 mE	6307714 mN
Location:	North-east of study area		
Landform:	Middle slope		
Drainage:	Good drainage		
Soil colour & type:	White-grey sand		
Vegetation Condition:	Excellent (2) – Very Good (3)		
Fire age & intensity:	Old (>5 years), no damage		
Disturbances:	Weeds, historical grazing		
Bare ground (%):	<2	**Logs (%):**	2-10
Twigs (%):	<2	**Leaves (%):**	30-70
Rocks <2 cm (%):	Nil	**Rocks 2-30 cm (%):**	Nil
Rocks >30 cm (%):	Nil	**Veg. ground layer (%):**	30-70
Veg Description	Open Woodland of *Corymbia calophylla* over woodland of *Eucalyptus marginata* and *Banksia attenuata* over tall open shrubland of *Xylomelum occidentale* and *Kunzea glabrescens* over *Xanth, Macrozamia riedlei* and *Hibbertia hypericoides* over sedgeland of *Dasypogon bromeliifolius, Hypolaena exsulca* and *Lyginis imberbis* over very open herbland of *Drosera erythrohiza* and *Pyrorchis nigricans.*		

Quadrat Data

Quadrat 9 Flora List

Family	Genus	Species	Status	Sub-stratum (NVIS)	Foliage Cover (%)	Average Height (m)
Myrtaceae	*Corymbia*	*calophylla*		U1	2-10	20
Proteaceae	*Banksia*	*attenuata*		U2	10-30	8
Myrtaceae	*Eucalyptus*	*marginata*		U2	<2	6
Proteaceae	*Xylomelum*	*occidentale*		M1	2-10	5
Myrtaceae	*Kunzea*	*glabrescens*		M1	<2	4
Xanthorrhoeaceae	*Xanthorrhoea*	*brunonis*		M2	10-30	0.8
Zamiaceae	*Macrozamia*	*riedlei*		M2	<2	0.6
Dilleniaceae	*Hibbertia*	*hypericoides*		M2	<2	0.4
Dilleniaceae	*Hibbertia*	*racemosa*		M2	<2	0.2
Fabaceae	*Hovea*	*trisperma*		M2	<2	0.1
Dasypogonaceae	*Dasypogon*	*bromeliifolius*		G1	30-70	0.4
Droseraceae	*Drosera*	*pallida*		G1	<2	cl
Cyperaceae	*Lepidosperma*	*?pubisquameum*		G1	<2	0.7
Asparagaceae	*Lomandra*	*nigricans*		G1	<2	0.7
Apiaceae	*Platysace*	*filiformis*		G1	<2	0.4
Poaceae	*Briza*	*maxima*	*	G1	<2	0.3
Anarthriaceae	*Lyginia*	*imberbis*		G2	2-10	0.7
Restionaceae	*Hypolaena*	*exsulca*		G2	2-10	0.2
Restionaceae	*Desmocladus*	*fasciculatus*		G2	<2	0.1
Asteraceae	*Hypochaeris*	*glabra*	*	G2	<2	0.05
Orchidaceae	*Pyrorchis*	*nigricans*		G2	<2	0.05
Orchidaceae	*Caladenia*	*?flava*		G2	<2	0.05
Asteraceae	*Lagenophora*	*huegelii*		G2	<2	0.05
Droseraceae	*Drosera*	*erythrorhiza*		G2	<2	0.05
Menyanthaceae	*Ornduffia*	*albiflora*		G2	<2	0.05

Quadrat Data

Site	Q10	Project	EVA Lot 5 Boyanup-Picton Rd
Type:	Quadrat	**Size:**	10 × 10 m
Date:	12/06/13	**Described by:**	MD & LZ
Co-ordinates:	MGA 50	380145 mE	6307787 mN
Location:	North-centre of study area		
Landform:	Flat		
Drainage:	Good drainage		
Soil colour & type:	White-grey silty-sand		
Vegetation Condition:	Very Good (3)		
Fire age & intensity:	Old (>5 years), no damage		
Disturbances:	Weeds, historical grazing		
Bare ground (%):	10-30	**Logs (%):**	2-10
Twigs (%):	2-10	**Leaves (%):**	10-30
Rocks <2 cm (%):	Nil	**Rocks 2-30 cm (%):**	Nil
Rocks >30 cm (%):	Nil	**Veg. ground layer (%):**	30-70
Veg Description	Open Woodland of *Corymbia calophylla* over woodland of *Eucalyptus marginata, Banksia attenuata* and *B. grandis* over tall open shrubland of *Xylomelum occidentale* and *Kunzea glabrescens* over *Xanth, Hibbertia racemosa* and *Hibbertia vaginata* over sedgeland of *Mesomelaena tetragona, Lomandra nigricans* and *Desmocladus flexuosa* over very open herbland of **Hypochaeris* sp., *Lagenophora huegelii* and *Pyrorchis nigricans.*		

Quadrat Data

Quadrat 10 Flora List

Family	Genus	Species	Status	Sub-stratum (NVIS)	Foliage Cover (%)	Average Height (m)
Myrtaceae	*Corymbia*	*calophylla*		U1	2-10	14
Myrtaceae	*Eucalyptus*	*marginata*		U2	<2	6
Proteaceae	*Banksia*	*grandis*		U2	2-10	4
Proteaceae	*Banksia*	*attenuata*		U2	10-30	9
Proteaceae	*Xylomelum*	*occidentale*		M1	10-30	4
Myrtaceae	*Kunzea*	*glabrescens*		M1	2-10	4
Xanthorrhoeaceae	*Xanthorrhoea*	*brunonis*		M2	2-10	0.8
Dilleniaceae	*Hibbertia*	*racemosa*		M3	<2	0.2
Dilleniaceae	*Hibbertia*	*vaginata*		M3	<2	0.2
Cyperaceae	*Mesomelaena*	*tetragona*		G1	2-10	0.8
Asparagaceae	*Lomandra*	*nigricans*		G1	2-10	0.5
Droseraceae	*Drosera*	sp. (insufficient material)		G1	<2	cl
Dasypogonaceae	*Dasypogon*	*bromeliifolius*		G1	<2	0.4
Apiaceae	*Platysace*	*filiformis*		G1	<2	0.3
Poaceae	*Briza*	*maxima*	*	G1	<2	0.3
Poaceae	*Ehrharta*	*longiflora*	*	G1	<2	0.3
Haemodoraceae	*Conostylis*	*aculeata*		G1	<2	0.2
Restionaceae	*Desmocladus*	*fasciculatus*		G2	2-10	0.1
Asteraceae	*Hypochaeris*	*glabra*	*	G2	<2	0.05
Orchidaceae	*Pyrorchis*	*nigricans*		G2	<2	0.05
Asteraceae	*Lagenophora*	*huegelii*		G2	<2	0.05

Quadrat Data

Site	Q11	Project	EVA Lot 5 Boyanup-Picton Rd
Type:	Quadrat	**Size:**	10 × 10 m
Date:	12/06/13	**Described by:**	MD & LZ
Co-ordinates:	MGA 50	380145 mE	6307787 mN
Location:	North-west of study area		
Landform:	Flat		
Drainage:	Good drainage		
Soil colour & type:	White-grey silty-sand		
Vegetation Condition:	Very Good (3)		
Fire age & intensity:	Old (>5 years), no damage		
Disturbances:	Weeds, historical grazing		
Bare ground (%):	10-30	**Logs (%):**	2-10
Twigs (%):	<2	**Leaves (%):**	30-70
Rocks <2 cm (%):	Nil	**Rocks 2-30 cm (%):**	Nil
Rocks >30 cm (%):	Nil	**Veg. ground layer (%):**	10-30
Veg Description	Open forest *Eucalyptus marginata, Banksia attenuata* and *Agonis flexuosa* over tall open shrubland of *Kunzea glabrescens* and *Xanth* over low shrubland of *Hibbertia racemosa* over very open grassland of **Briza maxima* and juvenile grasses very open herbland of *Lagenophora huegelii.*		

Quadrat Data

Quadrat 11 Flora List

Family	Genus	Species	Status	Sub-stratum (NVIS)	Foliage Cover (%)	Average Height (m)
Myrtaceae	*Agonis*	*flexuosa*		U1	30-70	10
Proteaceae	*Banksia*	*attenuata*		U1	10-30	7
Myrtaceae	*Eucalyptus*	*marginata*		U1	<2	6
Myrtaceae	*Kunzea*	*glabrescens*		M1	2-10	7
Myrtaceae	*Agonis*	*flexuosa*		M1	2-10	4
Xanthorrhoeaceae	*Xanthorrhoea*	*brunonis*		M2	2-10	0.8
Dilleniaceae	*Hibbertia*	*racemosa*		M3	<2	0.2
Asparagaceae	*Thysanotus*	sp. (insufficient material)		G1	<2	cl
Dasypogonaceae	*Dasypogon*	*bromeliifolius*		G1	<2	0.2
Poaceae	sp. (juvenile regrowth)		*	G2	2-10	0.2
juvenile herbs				G2	2-10	0.05
Poaceae	*Briza*	*maxima*	*	G2	<2	0.4
Restionaceae	*Desmocladus*	*fasciculatus*		G2	<2	0.2
Fabaceae	*Hovea*	*trisperma*		G2	<2	0.1
Orchidaceae	*Caladenia*	*?flava*		G2	<2	0.1
Orchidaceae	*Pterostylis*	*vittata*		G2	<2	0.1
Iridaceae	*Romulea*	*rosea*	*	G2	<2	0.1
Orchidaceae	*Pyrorchis*	*nigricans*		G2	<2	0.05
Asteraceae	*Lagenophora*	*huegelii*		G2	<2	0.05
Droseraceae	*Drosera*	*erythrorhiza*		G2	<2	0.05
Stylidiaceae	*Stylidium*	*piliferum*		G2	<2	0.05

Quadrat Data

Site	Q12	Project	EVA Lot 5 Boyanup-Picton Rd
Type:	Quadrat	**Size:**	10 × 10 m
Date:	12/06/13	**Described by:**	MD & LZ
Co-ordinates:	MGA 50	380003 mE	6307481 mN
Location:	Centre of study area, west of powerlines		
Landform:	Flat		
Drainage:	Good drainage		
Soil colour & type:	White-grey silty-sand		
Vegetation Condition:	Very Good (3)		
Fire age & intensity:	Old (>5 years), no damage		
Disturbances:	Weeds, historical grazing, dieback		
Bare ground (%):	10-30	**Logs (%):**	2-10
Twigs (%):	<2	**Leaves (%):**	30-70
Rocks <2 cm (%):	Nil	**Rocks 2-30 cm (%):**	Nil
Rocks >30 cm (%):	Nil	**Veg. ground layer (%):**	30-70
Veg Description	Open forest of *Banksia attenuata, B. illicifolia* and *Xylomelum occidentale* over tall open shrubland of *Kunzea glabrescens* over low shrubland of *Macrozamia riedlei* and *Hibbertia racemosa* over very open sedgeland of *Dasypogon bromeliifolius* and *Desmocladus fasciculatus* over very open herbland of *Hardenbergia comptoniana, Lagenophora huegelii* and *Pyrorchis nigricans.*		

Quadrat Data

Quadrat 12 Flora List

Family	Genus	Species	Status	Sub-stratum (NVIS)	Foliage Cover (%)	Average Height (m)
Proteaceae	*Banksia*	*attenuata*		U1	10-30	8
Proteaceae	*Xylomelum*	*occidentale*		U1	10-30	7
Proteaceae	*Banksia*	*ilicifolia*		U1	2-10	6
Myrtaceae	*Kunzea*	*glabrescens*		M1	2-10	1.3
Fabaceae	*Hardenbergia*	*comptoniana*		M1	<2	cl
Zamiaceae	*Macrozamia*	*riedlei*		M2	<2	0.5
Dilleniaceae	*Hibbertia*	*racemosa*		M2	<2	0.2
Dasypogonaceae	*Dasypogon*	*bromeliifolius*		G1	10-30	0.2
Anarthriaceae	*Lyginia*	*imberbis*		G1	<2	0.8
Asparagaceae	*Thysanotus*	sp. (insufficient material)		G1	<2	0.6
Poaceae	*Briza*	*maxima*	*	G1	<2	0.3
Restionaceae	*Desmocladus*	*fasciculatus*		G1	<2	0.1
Poaceae	sp. (juvenile regrowth)		*	G2	10-30	0.1
Iridaceae	*Romulea*	*rosea*	*	G2	<2	0.1
Asteraceae	*Ursinia*	*anthemoides*	*	G2	<2	0.1
Orchidaceae	*Pyrorchis*	*nigricans*		G2	<2	0.05
Asteraceae	*Lagenophora*	*huegelii*		G2	<2	0.05
Asteraceae	*Hypochaeris*	*glabra*	*	G2	<2	0.05

Quadrat Data

Site	Q13	Project	EVA Lot 5 Boyanup-Picton Rd
Type:	Quadrat	**Size:**	10 × 10 m
Date:	12/06/13	**Described by:**	MD & LZ
Co-ordinates:	MGA 50	380003 mE	6307481 mN
Location:	Centre of study area, west of powerlines		
Landform:	Slope - middle		
Drainage:	Good drainage		
Soil colour & type:	White-grey silty-sand		
Vegetation Condition:	Very Good (3)		
Fire age & intensity:	Old (>5 years), no damage		
Disturbances:	Weeds, historical grazing		
Bare ground (%):	2-10	**Logs (%):**	2-10
Twigs (%):	<2	**Leaves (%):**	>70
Rocks <2 cm (%):	Nil	**Rocks 2-30 cm (%):**	Nil
Rocks >30 cm (%):	Nil	**Veg. ground layer (%):**	10-30
Veg Description	Open forest of *Eucalyptus marginata, Banksia attenuata* and *Agonis flexuosa* over tall open shrubland of *Xylomelum occidentale* and *Kunzea glabrescens* over low shrubland of *Macrozamia riedlei, Hibbertia racemosa* and *H. hypericoides* over very open sedgeland of *Tricostularia neesii* and *Desmocladus fasciculatus* over very open herbland of *Drosera glanduligera, Lagenophora huegelii* and *Pyrorchis nigricans.*		

Quadrat Data

Quadrat 13 Flora Species List

Family	Genus	Species	Status	Sub-stratum (NVIS)	Foliage Cover (%)	Average Height (m)
Myrtaceae	*Eucalyptus*	*marginata*		U1	2-10	12
Proteaceae	*Banksia*	*attenuata*		U2	10-30	8
Myrtaceae	*Agonis*	*flexuosa*		U2	10-30	7
Myrtaceae	*Kunzea*	*glabrescens*		M1	2-10	4
Proteaceae	*Xylomelum*	*occidentale*		M2	<2	1.3
Zamiaceae	*Macrozamia*	*riedlei*		M3	<2	0.5
Dilleniaceae	*Hibbertia*	*racemosa*		M3	<2	0.3
Dilleniaceae	*Hibbertia*	*hypericoides*		M3	<2	0.1
Ericaceae	*Leucopogon*	*propinquus*		M3	<2	0.1
Anarthriaceae	*Lyginia*	*imberbis*		G1	2-10	0.6
Asparagaceae	*Lomandra*	*nigricans*		G1	<2	0.4
Asparagaceae	*Thysanotus*	sp. (insufficient material)		G1	<2	0.2
Poaceae	*Briza*	*maxima*	*	G1	<2	0.2
Restionaceae	*Hypolaena*	*exsulca*		G1	<2	0.2
Restionaceae	*Desmocladus*	*fasciculatus*		G1	<2	0.1
Fabaceae	*Hovea*	*trisperma*		G1	<2	0.1
Fabaceae	*Bossiaea*	*eriocarpa*		G2	<2	0.2
Orchidaceae	*Pyrorchis*	*nigricans*		G2	<2	0.05
Asteraceae	*Lagenophora*	*huegelii*		G2	<2	0.05
Droseraceae	*Drosera*	*erythrorhiza*		G2	<2	0.05
Stylidiaceae	*Stylidium*	sp. (insufficient material)		G2	<2	0.05
Droseraceae	*Drosera*	*glanduligera*		G2	<2	0.05

Quadrat Data

Site	Q14	Project	EVA Lot 5 Boyanup-Picton Rd
Type:	Quadrat	**Size:**	10 × 10 m
Date:	12/06/13	**Described by:**	MD & LZ
Co-ordinates:	MGA 50	379384 mE	6307286 mN
Location:	South-west of study area		
Landform:	Swamp		
Drainage:	Seasonally wet		
Soil colour & type:	Black clay		
Vegetation Condition:	Very Good (3)		
Fire age & intensity:	Old (>5 years), no damage		
Disturbances:	Weeds, historical grazing		
Bare ground (%):	2-10	**Logs (%):**	2-10
Twigs (%):	10-30	**Leaves (%):**	2-10
Rocks <2 cm (%):	Nil	**Rocks 2-30 cm (%):**	Nil
Rocks >30 cm (%):	Nil	**Veg. ground layer (%):**	>70
Veg Description	Tall Open Scrub of *Melaleuca teretifolia* and *Melaleuca viminea* over sedgeland of *Leptocarpus laxus, Gahnia trifida* and *Juncus pallidus* over open herbland of **Hypochaeris glabra* and juvenile grasses.		

Quadrat Data

Quadrat 14 Flora List

Family	Genus	Species	Status	Sub-stratum (NVIS)	Foliage Cover (%)	Average Height (m)
Myrtaceae	*Melaleuca*	*viminea* subsp. *viminea*		M1	30-70	4
Lauraceae	*Cassytha*	sp. (insufficient material)		M1	10-30	cl
Myrtaceae	*Melaleuca*	*teretifolia*		M1	2-10	3
Cyperaceae	*Gahnia*	*trifida*		G1	2-10	1.7
Anarthriaceae	*Lyginia*	*imberbis*		G1	2-10	1.2
Juncaceae	*Juncus*	*pallidus*		G1	2-10	1.1
Poaceae	juvenile grasses		*	G2	30-70	0.1
Stylidiaceae	*Stylidium*	sp. (insufficient material)		G2	<2	0.1
Asteraceae	*Hypochaeris*	*glabra*	*	G2	<2	0.05

Appendix E - Fauna data

Fauna species recorded during the field survey

Likelihood of occurrence – fauna species

Fauna species recorded during the field survey

Family	Taxon	Common Name	Status			Introduced	Observation
			EPBC Act	WC Act	DPaW		
Birds							
Acanthizidae	*Acanthiza apicalis*	Inland Thornbill					Sighting
Acanthizidae	*Acanthiza chrysorrhoa*	Yellow-rumped Thornbill					Sighting
Acanthizidae	*Acanthiza inornata*	Western Thornbill					Sighting
Acanthizidae	*Gerygone fusca*	Western Gerygone					Sighting
Acanthizidae	*Sericornis frontalis*	White-browed Scrubwren					Sighting
Acanthizidae	*Smicrornis brevirostris occidentalis*	Weebill					Sighting
Accipitridae	*Haliastur sphenurus*	Whistling Kite					Sighting, Heard
Acrocephalidae	*Acrocephalus australis*	Australian Reed-Warbler					Sighting
Artamidae	*Artamus personatus*	Masked Woodswallow					Sighting
Cacatuidae	*Calyptorhynchus banksii naso*	Forest Red-tailed Black Cockatoo	Vulnerable	Threatened			Sighting, Foraging evidence, Call heard
Cacatuidae	*Calyptorhynchus baudinii*	Baudin's Black Cockatoo	Vulnerable	Threatened			Sighting, Foraging evidence, Call heard
Cacatuidae	*Calyptorhynchus latirostris*	Carnaby's Black Cockatoo	Endangered	Threatened			Sighting, Foraging evidence, Call heard
Cacatuidae	*Eolophus roseicapilla*	Galah					Sighting
Campephagidae	*Coracina novaehollandiae*	Black-faced Cuckoo-shrike					Sighting
Columbidae	*Phaps chalcoptera*	Common Bronzewing					Sighting
Columbidae	*Streptopelia senegalensis*	Laughing Dove					Sighting
Corvidae	*Corvus coronoides perplexus*	Australian Raven					Sighting

Family	Taxon	Common Name	Status			Introduced	Observation
			EPBC Act	WC Act	DPaW		
Cracticidae	*Cracticus nigrogularis*	Pied Butcherbird					Sighting
Cracticidae	*Cracticus tiibicen dorsalis*	Australian Magpie					Sighting
Dicruridae	*Grallina cyanoleuca*	Magpie-lark					Sighting
Dicruridae	*Rhipidura fuliginosa*	Grey Fantail					Sighting
Dicruridae	*Rhipidura leucophrys leucophrys*	Willie Wagtail					Sighting
Falconidae	*Falco cenchroides cenchroides*	Nankeen Kestrel					Sighting
Halcyonidae	*Dacelo novaequineae*	Laughing Kookaburra				x	Sighting
Halcyonidae	*Todiramphus sanctus*	Sacred Kingfisher					Sighting
Hirundinidae	*Hirundo neoxena*	Welcome Swallow					Sighting
Hirundinidae	*Petrochelidon nigricans*	Tree Martin					Sighting
Maluridae	*Malurus elegans*	Red-winged Fairy-wren					Sighting
Maluridae	*Malurus splendens*	Splendid Fairy-wren					Sighting
Megaluridae	*Megalurus gramineus*	Little Grassbird					Sighting
Meliphagidae	*Anthochaera carunculata*	Red Wattlebird					Sighting
Meliphagidae	*Lichenostomus virescens virescens*	Singing Honeyeater					Sighting
Meliphagidae	*Lichmera indistincta*	Brown Honeyeater					Sighting
Meliphagidae	*Melithreptus lunatus*	White-naped Honeyeater					Sighting
Meliphagidae	*Phylidonyris niger*	White-cheeked Honeyeater					Sighting
Meliphagidae	*Phylidonyris novaehollandiae*	New Holland Honeyeater					Sighting
Motacillidae	*Anthus novaeseelandiae*	Richards Pipit					Sighting
Pachycephalidae	*Colluricincla harmonica*	Grey Shrike-thrush					Sighting
Pachycephalidae	*Pachycephala pectoralis*	Golden Whistler					Sighting
Pachycephalidae	*Pachycephala rufiventris*	Rufous Whistler					Sighting
Pardalotidae	*Pardalotus striatus*	Striated Pardelote					Sighting
Petroicidae	*Eopsaltria griseogularis*	Western Yellow Robin					Sighting

Family	Taxon	Common Name	Status			Introduced	Observation
			EPBC Act	WC Act	DPaW		
Petroicidae	*Microeca fascinans*	Jacky Winter					Sighting
Petroicidae	*Petroica boodang*	Scarlet Robin					Sighting
Podargidae	*Podargus strigoides*	Tawny Frogmouth					Sighting (Diurnal and Nocturnal)
Psittacidae	*Platycercus icterotis*	Western Rosella					Sighting
Psittacidae	*Platycercus zonarius semitorquatus*	Twenty-eight Parrot					Sighting
Psittacidae	*Purpureicephalus spurius*	Red Capped Parrot					Sighting
Psittacidae	*Trichoglossus haematodus*	Rainbow Lorikeet				x	Sighting
Strigidae	*Ninox novaeseelandiae*	Boobook Owl					Sighting, Heard
Threskiornithidae	*Threskiornis molucca*	White Ibis					Sighting
Timaliidae	*Zosterops lateralis*	Silvereye					Sighting
Amphibians							
Myobatrachidae	*Crinia glauerti*	Clicking Froglet					Heard
Myobatrachidae	*Crinia insignifera*	Squelching Froglet					Sighting
Myobatrachidae	*Geocrinia leai*	Ticking Frog					Heard
Myobatrachidae	*Crinia georgiana*	Quacking Frog					Heard
Reptiles							
Scincidae	*Tiliqua rugosa rugosa*	Bobtail					Sighting

Family	Taxon	Common Name	Status			Introduced	Observation
			EPBC Act	WC Act	DPaW		
Mammals							
Bovidae	*Bos taurus*	Domestic Cow				x	Sighting
Canidae	*Vulpes vulpes*	Red Fox				x	Tracks, Scats, Den
Canidae	*Canis lupus*	Domestic Dog				x	Sighting, Scats
Equidae	*Equus caballus*	Horse				x	Sighting
Leporidae	*Oryctolagus cuniculus*	European Rabbit				x	Scats
Macropodidae	*Macropus fuliginosus*	Western Grey Kangaroo					Sighting, Scats
Peramelidae	*Isoodon obesulus fusciventer*	Southern Brown Bandicoot				Priority 5	Signs
Phalangeridae	*Trichosurus vulpecula*	Common Brushtail Possum					Sighting, Scats
Pseudocheiridae	*Pseudocheirus occidentalis*	Western Ringtail Possum	Vulnerable	Threatened			Sighting, Scats

Fauna likelihood of occurrence

Scientific name	Common name	Status			Source		Description & habitat requirements	Likelihood of occurrence
		WC Act	EPBC Act	DPaW	Nature-map search	EPBC PMST search		
Birds								
Anous tenuirostris melanops	Australian Lesser Noddy	T	V		X	X	The Australian Lesser Noddy is usually found only around its breeding islands in the Houtman Abrolhos Islands in Western Australia. There are also some records north of the breeding islands, for example at the Wallabi Group of islands, in the northern Houtman Abrolhos Islands, on Barrow Island, and at Webb Island. The species usually occupies coral-limestone islands that are densely fringed with White Mangrove *Avicennia marina*. It occasionally occurs on shingle or sandy beaches. The Australian Lesser Noddy roosts mainly in mangroves, especially at night but may sometimes rest on beaches (DSEWPaC 2013).	Unlikely - There is no suitable habitat for the Noddy within the Study Area, and the closest record of the species is near the Leschenault Estuary.
Botaurus poiciloptilus	Australasian Bittern	T	E			X	The Australasian Bittern occurs mainly in densely vegetated freshwater wetlands and, rarely, in estuaries or tidal wetlands. The species favours foraging in tall, dense vegetation in shallow permanent or seasonal fresh water. In the southwest of Western Australia the Bittern is now largely confined to coastal areas especially along the south coast where it is found in beds of tall rush mixed with or near short fine sedge or open pools. It also occurs around swamps, lakes, pools, rivers and channels fringed with lignum *Muehlenbeckia*, canegrass *Eragrostis* or other dense vegetation . It occasionally ventures into areas of open water or onto banks (DSEWPaC 2013).	Possible - Australasian Bittern is likely to migrate to optimal wetlands at different times of the year. It is possible that the species may temporarily use these wetland areas within the Study Area.

Scientific name	Common name	Status			Source		Description & habitat requirements	Likelihood of occurrence
		WC Act	EPBC Act	DPaW	Nature-map search	EPBC PMST search		
Burhinus grallarius	Bush Stone-curlew			P4	X		The Bush-stone Curlew inhabits dry open woodlands, lightly timbered country, mallee and mulga; anywhere with groundcover of small sparse shrubs, grass or litter of twigs. It avoids dense forest and closed canopy habitats. In southern Australia, they persist most often where there is often with a well-structured litter layer and fallen timber debris (Morcombe 2004).	Unlikely - There is no suitable habitat for the Bush Stone-curlew within the Study Area, and the closest record of the species is near Bunbury in 1939.
Calyptorhynchus banksii naso	Forest Red-tailed Black-Cockatoo	T			X	X	Forest Red-tailed Black Cockatoo typically occurs in dense Jarrah (*Eucalyptus marginata*), Karri (*E. diversicolor*) and Marri (*Corymbia calophylla*) forests, however the species also occurs in a range of other forest and woodland types, including Blackbutt (*E. patens*), Wandoo (*E. wandoo*), Tuart (*E. gomphocephala*), Albany Blackbutt, Yate (*E. cornuta*), and Flooded Gum (*E. rudis*) (DSEWPaC, 2012). Habitats also tend to have an understorey of *Banksia* spp., *Persoonia* spp., *Allocasuarina* spp. The Forest red-tailed Black Cockatoo generally nests in hollows in live or dead trees of Marri, Karri, Wandoo, Bullich, Blackbutt, Tuart and Jarrah (DSEWPaC 2012).	Known - The Forest Red-tailed Black Cockatoo was recorded foraging in the Study Area during the field survey. There is suitable foraging, roosting and potential breeding habitat for the species.

Scientific name	Common name	Status			Source		Description & habitat requirements	Likelihood of occurrence
		WC Act	EPBC Act	DPaW	Nature-map search	EPBC PMST search		
Calyptorhynchus baudinii	Baudin's Cockatoo	T			X	X	Baudin's Black Cockatoo occurs in high-rainfall areas, usually at sites that are heavily forested and dominated by Marri (*Corymbia calophylla*) and Eucalyptus species, especially Karri (*E. diversicolor*) and Jarrah (*E. marginata*). The species also occurs in woodlands of Wandoo (*E. wandoo*), Blackbutt (*E. patens*), Flooded Gum (*E. rudis*), and Yate (*E. cornuta*) . Baudin's Black Cockatoo breeds in the Jarrah, Marri and Karri forests of the deep south-west in areas averaging more than 750 mm of rainfall annually. The range of the species extends from Albany northward to Gidgegannup and Mundaring (east of Perth), and inland to the Stirling Ranges and near Boyup Brook. Preferred roosts are in areas with a dense canopy close to permanent sources of water, that provide the birds with protection from weather conditions (DSEWPaC, 2012).	Known - Baudin's Black Cockatoo was recorded foraging in the Study Area during the field survey. There is suitable foraging, roosting and potential breeding habitat for the species.
Calyptorhynchus latirostris	Carnaby's Cockatoo	T			X	X	Carnaby's Cockatoo mainly occurs in uncleared or remnant native eucalypt woodlands and in shrubland or kwongan heathland dominated by Hakea, Dryandra, Banksia and Grevillea species. The species also occurs in forests containing Marri (*Corymbia calophylla*), Jarrah (*Eucalyptus marginata*) or Karri (*E. diversicolor*). 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. Feeds on the seeds of a variety of native plants, including Allocasuarina, Banksia, Dryandra, Eucalyptus, Grevillea and Hakea, and some introduced plants (DSEWPaC, 2012).	Known - Carnaby's Cockatoo was recorded foraging in the Study Area during the field survey. There is suitable foraging, roosting and potential breeding habitat for the species.

Scientific name	Common name	Status			Source		Description & habitat requirements	Likelihood of occurrence
		WC Act	EPBC Act	DPaW	Nature-map search	EPBC PMST search		
Falco peregrinus macropus	Peregrine Falcon			S	X		The Peregrine Falcon is seen occasionally anywhere in the south-west of Western Australia. It is found everywhere from woodlands to open grasslands and coastal cliffs - though less frequently in desert regions. The species nests primarily on ledges of cliffs, shallow tree hollows, and ledges of building in cities. (Morcombe, 2004).	Possible - The Peregrine Falcon is known to occur in the greater Bunbury Region, and may be an occaisional visitor to the Study Area. The Study Area does not occur in or around any cliff or potential breeding areas for this species.
Ixobrychus flavicollis subsp. australis	Australian Black Bittern			P3	X		The Black Bittern inhabits both terrestrial and estuarine wetlands, generally in areas of permanent water and dense vegetation. Where permanent water is present, this species may occur in flooded grassland, forest, woodland, rainforest and mangroves (Marchant & Higgins 1990).	Possible - The Australian Black Bittern is likely to migrate to optimal wetlands at different times of the year. It is possible that the species may temporarily use these wetland areas within the Study Area.
Ixobrychus minutus subsp. dubius	Australian Little Bittern			P4	X		The species is most common in freshwater marshes with beds of bulrushes *Typha* spp., reeds *Phragmites* spp. (Hockey et al. 2005) or other dense aquatic vegetation, preferably also with deciduous bushes and trees. It may also occupy the margins of lakes, pools and reservoirs, wooded and marshy banks of streams and rivers (del Hoyo et al. 1992).	Possible - The Australian Little Bittern is likely to migrate to optimal wetlands at different times of the year. It is possible that the species may temporarily use these wetland areas within the Study Area.

Scientific name	Common name	Status			Source		Description & habitat requirements	Likelihood of occurrence
		WC Act	EPBC Act	DPaW	Nature-map search	EPBC PMST search		
Leipoa ocellata	Malleefowl	T	V, Mi			X	The Malleefowl generally occurs in semi-arid areas of Western Australia, from Carnarvon to south east of the Eyre Bird Observatory (south-east Western Australia). It occupies shrublands and low woodlands that are dominated by mallee vegetation, as well as native pine *Callitris* woodlands, *Acacia* shrublands, Broombush *Melaleuca uncinata* vegetation or coastal heathlands. The nest is a large mound of sand or soil and organic matter (Jones and Goth 2008; Morcombe, 2004).	Unlikely - There is not suitable habitat for the Malleefowl in the Study Area, and the species is not known to occur in the Bunbury region.
Psophodes nigrogularis nigrogularis	Western Whipbird (western heath subspecies)	T	E		X		The western heath subspecies of the Western Whipbird is known only to occur in one small population in south Western Australia, in the Two-Peoples Bay- Mt Manypeaks region. The population at Two Peoples Bay-Mt Manypeaks region is estimated as less than 100 pairs and occurs in dense coastal heath (Simpson and Day, 2004). The preferred habitat is thicket, a two to three metre high formation of varied floristic composition. Other vegetation associations are used infrequently, although all nests are usually found in dense heath adjacent to areas of thicket.	Unlikely - The western heath subspecies of the Western Whipbird is restricted to the dense coastal heath in the Two-Peoples Bay- Mt Manypeaks region, approximately 300 km south-east of the Study Area. The closest record to the Study Area is a historical record from 1898. Therefore this species is unlikely to occur in the Study Area.

Scientific name	Common name	Status			Source		Description & habitat requirements	Likelihood of occurrence
		WC Act	EPBC Act	DPaW	Nature-map search	EPBC PMST search		
Rostratula benghalensis australis	Australian Painted Snipe		E, Mi			X	The Australian Painted Snipe generally inhabits shallow terrestrial freshwater (occasionally brackish) wetlands, including temporary and permanent lakes, swamps and claypans. Australian Painted Snipe breeding habitat requirements may be quite specific: shallow wetlands with areas of bare wet mud and both upper and canopy cover nearby. The species rarely occurs in south-western Australia, where it was once more common (DSEWPaC 2013).	Unlikely - While there is suitable wetland habitat for this species within the Study Area, it is considered to be rare in south-western Australia and has not been recorded within 10 km. The closest record of this species is approximately 85 km north of the Study Area near Pinjarra (date: 1905). Therefore this species is unlikely to occur.
Sterna nereis nereis	Australian Fairy Tern		V			X	Within Australia, the Fairy Tern occurs along the coasts of Victoria, Tasmania, South Australia and Western Australia; occurring as far north as the Dampier Archipelago near Karratha. The Fairy Tern (Australian) nests on sheltered sandy beaches, spits and banks above the high tide line and below vegetation. The subspecies has been found in embayments of a variety of habitats including offshore, estuarine or lacustrine (lake) islands, wetlands and mainland coastline. The bird roosts on beaches at night (DSEWPaC 2013).	Unlikely - This species predominantly occurs along coastal areas, and has not been recorded within 10 km of the Study Area. The closest record of this species is approximately 90 km north of the Study Area near Mandurah in 1999. Therefore this species is unlikely to occur.
Migratory birds								

Scientific name	Common name	Status			Source		Description & habitat requirements	Likelihood of occurrence
		WC Act	EPBC Act	DPaW	Nature-map search	EPBC PMST search		
Ardea ibis	Cattle Egret	IA	Mi		X	X	The Cattle Egret is a common and widespread species. Typical habitat includes tropical and temperate grasslands, wooded lands and terrestrial wetlands. It often forages away from water on low lying grasslands, improved pastures and croplands and roosts in trees, or amongst ground vegetation in or near lakes and swamps (DSEWPaC 2013).	Likely - There is suitable swamp habitat for the Cattle Egret within the Study Area, and the species has recently been recorded in the Bunbury region. The species is most likely an occaisional visitor to the Study Area.
Ardea modesta	Eastern Great Egret	IA	Mi		X	X	The Eastern Great Egret is widespread in Australia. They have been reported in a wide range of wetland habitats, include swamps and marshes; margins of rivers and lakes; damp or flooded grasslands, pasture or agricultural lands; reservoirs; sewerage treatment ponds; drainage channels; salt pans; salt marshes; mangrove, and a range of coastal/marine habitats (DSEWPaC 2013).	Likely - There is suitable swamp habitat for the Eastern Great Egret within the Study Area, and the species has recently been recorded in the Bunbury region. The species is most likely an occaisional visitor to the Study Area.
Haliaeetus leucogaster	White-bellied Sea-Eagle	IA	Mi		X	X	The White-bellied Sea-Eagle occurs in coastal habitats (especially those close to the sea-shore as well as any habitat characterized by the presence of large areas of open water (larger rivers, swamps, lakes, the sea). It also occurs in the vicinity of estuaries, mangroves, swamps, lagoons and floodplains, often far inland along major rivers (Morcombe, 2004).	Unlikely - There is very limited suitable habitat for the White-bellied Sea-Eagle within the Study Area, as there an absence of large areas of open water.

Scientific name	Common name	Status			Source		Description & habitat requirements	Likelihood of occurrence
		WC Act	EPBC Act	DPaW	Nature-map search	EPBC PMST search		
Merops ornatus	Rainbow Bee-eater	IA	Mi		X	X	Open forests and woodlands, shrublands, and in various cleared or semi-cleared habitats, including farmland and areas of human habitation. It also inhabits sand dune systems in coastal areas and at inland sites that are in close proximity to water (DSEWPaC 2013).	Known - Rainbow Bee-eaters have been recorded within the Study Area during previous surveys (GHD 2009b, GHD 2011a). Observations were made of three pairs of bee-eaters nesting just east of the wetland area in the Study Area. Rainbow Bee-eaters were also observed along the eastern boundary of the Study Area.
Mammals								
Dasyurus geoffroii	Chuditch	T	V		X	X	The Chuditch inhabits eucalypt forest (especially Jarrah, *Eucalyptus marginata*), dry woodland and mallee shrublands . In Jarrah forest, Chuditch populations occur in both moist, densely vegetated, steeply sloping forest and drier, open, gently sloping forest. Most diurnal resting sites in sclerophyll forest consist of hollow logs or earth burrows The species can travel large distances, has a large home range and is sparsely populated through a large portion of its range (Van Dyke & Strahan, 2008).	Possible - There is suitable habitat for the Chuditch within the Study Area, and the species is known to occur between Collie and Bunbury. However due to habitat loss surrounding Bunbury, the likelihood of the species occurrence has reduced. Given the considerable size of the Study Area, it is possible that the species occurs in low numbers.

Scientific name	Common name	Status			Source		Description & habitat requirements	Likelihood of occurrence
		WC Act	EPBC Act	DPaW	Nature-map search	EPBC PMST search		
Hydromys chrysogaster	Water-rat			P4	X		Water-rats live primarily in a wide variety of freshwater habitats, from sub-alpine streams and other inland waterways to lakes, swamps, farm dams and irrigation channels and are thought to be one of the few native species to have at least partially benefited from human encroachment (Van Dyke & Strahan, 2008).	Unlikley - There is no suitable habitat for the Water-rat within the Study Area, due to the lack of permanent waters areas. The species may potentially occur with the Preston and Ferguson Rivers, however the nearest records of the species are in Bunbury and most likely historical anecdotal records.
Isoodon obesulus fusciventer	Quenda			P5	X		The Quenda prefers dense scrubby, often swampy, vegetation with dense cover up to one metre high. However, it also occurs in woodlands, and may use less ideal habitat where this habitat occurs adjacent to the thicker, more desirable vegetation. The species often feeds in adjacent forest and woodland that is burnt on a regular basis and in areas of pasture and cropland lying close to dense cover (Van Dyck and Strahan, 2008).	Known - Quenda diggings were recorded within the Study Area during the field survey, and the species has previously been recorded within the Study Area (GHD 2009b, GHD 2011a). There are areas of densely vegetated habitat within the Study Area which would provide ideal habitat for the Quenda.

Scientific name	Common name	Status			Source		Description & habitat requirements	Likelihood of occurrence
		WC Act	EPBC Act	DPaW	Nature-map search	EPBC PMST search		
Macropus irma	Western Brush Wallaby			P4	X		The Western Brush Wallaby is a grazer found primarily in open forest or woodland,particularly favouring open, seasonally wet flats with low grasses and open scrubby thickets. It is also found in some areas of mallee and heathland, and is uncommon in karri forest. This species was once very common in the south-west of Western Australia but has undergone a reduction in range and a significant decline in abundance in its current habitat. (Van Dyke & Strahan, 2008).	Likely - There is suitable woodland with larger open areas, which would provide suitable habitat for the Western Brush Wallaby. The species has also been recorded with the Bunbury region and on the Swan Coastal Plain. Given the considerable size of the Study Area, it is possible that the species occurs in low numbers.
Phascogale tapoatafa tapoatafa	Southern Brush-tailed Phascogale	T			X		Brush-tailed Phascogales are one of the most arboreal dasyurids and seldom feed on the ground. They occur in dry sclerophyll forests and open woodlands with a generally sparse ground-storey, which contain suitable nesting resources such as tree hollows, rotted stumps and tree cavities (Van Dyck and Strahan 2008).	Known - While the Southern Brush-tailed Phascogale was not recorded during nocturnal spotlighing in the current survey, the species has previously been recorded as part of a study by Hunter (2012) within the Study Area. Five individuals were captured and radio collared as part of this study. There is suitable habitat for this species within the Study Area, including tree hollows, rotted stumps and tree cavities.

Scientific name	Common name	Status			Source		Description & habitat requirements	Likelihood of occurrence
		WC Act	EPBC Act	DPaW	Nature-map search	EPBC PMST search		
Pseudocheirus occidentalis	Western Ringtail Possum	T	V		X	X	The Western Ringtail Possum occurs in and near coastal Peppermint Tree (*Agonis flexuosa*) forest and Tuart (*Eucalyptus gomphocephala*) dominated forest with a Peppermint Tree understorey from Bunbury to Albany. Also occurs in Jarrah (*Eucalyptus marginata*) forest and Jarrah-Marri (*Corymbia calophylla*) forest associated with Peppermint Tree (Van Dyck and Strahan, 2008).	Known - Western Ringtail Possums were recorded during the current survey, including sightings, dreys and scat records. The species has also previously been recorded in the Study Area, and individuals have been radio collared and tracked during a study by Hunter (2012). The Study Area contains significant habitat for the species, and supports a considerable population.
Setonix brachyurus	Quokka	T	V		X	X	Dense forests and thickets, streamside vegetation, heaths and shrublands *Agonis linearifolia*-dominated swamps in the Jarrah (*Eucalyptus marginata*) forest. The northern extent of the current distribution on the mainland is in the Jarrah forest immediately south-east of the Perth metropolitan area, from where it extends southward through the southern Jarrah, Marri and Karri forests to the south coast, but largely confined throughout to areas receiving an annual rainfall of 1,000 millimetres or more (Van Dyck and Strahan, 2008).	Unlikely - There is not suitable habitat for the Quokka within the Study Area, and the species has expereicned considerable decline in recent years. The closest record of the Quokka is located approximately 10 km south of the Study Area. Therefore, it is unlikely that the Quokka occurs.
Reptiles								

Scientific name	Common name	Status			Source		Description & habitat requirements	Likelihood of occurrence
		WC Act	EPBC Act	DPaW	Nature-map search	EPBC PMST search		
Ctenotus ora	Coastal Plains Skink			P1	X		This species has been newly described and separated from *Ctenotus labillardieri* by Kay & Keogh (2012). The Coastal plains skink is locally restricted the sandy regions of the Swan Coastal Plain south of Perth.	Likely - There is suitable sandy soil habitat for the Coastal Plains Skink within the Study Area, and the species has been reocorded less than 1 km north of the Study area, near the intersection of Boyanup-Picton Road and South-Western Highway.
Fish								
Geotria australis	Pouched Lamprey			P1	X		This species utilises freshwater streams in the south west (Perth to Albany) to breed and grow before migrating to the ocean to mature (Allen *et al.* 2002). Dams and weirs are the main obstacles for the species. Sporadic records exist throughout the South West Coast Drainage Division between Perth and Albany including the Swan, Canning, Serpentine, Margaret, Donnelly, Warren and Goodga rivers.	Unlikely - There is no suitable freshwater habitat for the Pouched Lamprey within the Study Area, and the nearest record of the species is approximately 4 km east.
Nannatherina balstoni	Balston's Pygmy Perch	T	V			X	Balston's Pygmy Perch inhabits acidic, tannin-stained freshwater pools, streams and lakes in peat flats within 30 km of the coast of south-west Western Australia, preferring shallow water, and commonly associated with tall sedge thickets and inundated riparian vegetation (Allen *et al.* 2002).	Unlikely - Balston's Pygmy Perch is not known to occur in the Bunbury region and there is no suitable freshwater habitat for the species within the Study Area.
Invertebrates								

Scientific name	Common name	Status			Source		Description & habitat requirements	Likelihood of occurrence
		WC Act	EPBC Act	DPaW	Nature-map search	EPBC PMST search		
Idiosoma nigrum	Shield-backed Trapdoor Spider	T	V			X	Endemic to Western Australia. The species is known from three locations. One location consists of a number of severely fragmented populations in the central and northern wheatbelt. The second and third locations are at Jack Hills and Weld Range, two isolated populations approximately 200 km further north, in more arid areas (DSEWPaC 2013).	Unlikely - There is no suitable habitat for the Shield-backed Trapdoor Spider within the Study Area, and the species is not known to occur in the Bunbury region.

Conservation codes are provided in Appendix B.

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Appendix F – Information from previous surveys

Figure reproduced from GHD (2009b) – 'Figure 3' BORR Wallrodt Rd North and South Fauna Locations

Figure reproduced from GHD (2011a) – 'Figure 6' BPAR Stage 2 Fauna Survey Observations

Figure reproduced from GHD (2011a) – 'Figure 7a' BPAR Known Possum Habitat and Impact

Figure reproduced from GHD (2011a) – 'Figure 7b' BPAR Cockatoo Foraging Habitat and Impact

379,500 380,000 380,500

6,308,000 6,307,500 6,307,000 6,306,500

WALLRODT RD

MOORE RD

Locality Map

BUNBURY EATON GELORUP

Figure 2 Figure 3 Figure 4 Figure 5 Figure 6 Figure 7 Figure 8

LEGEND

- Proposed Bunbury Outer Ring Roads
- Roads

Field Data

- Rainbow Bee Eater
- Cockatoo Habitat Area
- Black Faced Cuckoo Shrike
- Cockatoo Feeding Area
- Live Possum Sighting
- Possum Drey - Active
- Possum Drey - Undetermined
- Possum Drey - Old
- Possum Droppings

1:5,000 (at A3)

0 25 50 100 150 200

Metres

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

N

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Main Roads WA - ETS
Bunbury Outer Ring Road Rare Fauna Survey

Job Number 61-23472
Revision 0
Date 19 MAR 2009

Bunbury Outer Ring Road Study Area
Wallrodt Rd North and South Fauna Locations

Figure 3

G:\61\23472\GIS\MXDS\6123472-G007.mxd

GHD House, 239 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

Data Source: Landgate: Bunbury Mar 2006 Mosaic - Mar 2006; GHD: Field Data - 20090306, Proposed Bunbury Outer Ring Roads - 20090216; MRWA: Roads - 20080708. Created by: kdiralu, wdavis

379,000 380,500

6,309,000 6,307,500 6,306,000 6,304,500

DAVIE ST
YOOKSON RD
THE AVENUE
SOUTH WESTERN HWY
HARRIS RD
PEDRETTI RD
MARTIN PELUSEY RD
BOYANUP-PICTON RD
RESTA RD
PORT ACCESS ROAD (Stage 2)
WALLRODT RD
BUNBURY OUTER RING ROAD (Stage 1)
BUSHER RD
TIMBER MILL PL
MOORE RD
QUEELUP RD

Locality Map
MANDURAH
HARVEY
BUNBURY
COLLIE
DUNSBOROUGH
BUSSELTON

LEGEND

Feeding Habitat
- Cockatoo Feeding Areas

Cockatoos
- Live Baudin Black Cockatoo Sighting
- Live Carnaby Black Cockatoo Sighting

Western Ringtail Possum
- Live Western Ringtail Possum Sighting
- Possum Drey - Active
- Possum Drey - Old
- Possum Drey - Undetermined

- Native Fish Sample Points

Habitat Areas
- Cockatoo Habitat Area

Western Ringtail Possum Droppings
- Droppings

Animal Sighting
- Live Brushtail Possum
- Bandicoot
- Bee Eater

- Bunbury Port Access Project Stage 2

1:15,000 (at A3)
0 75 150 300 450 600 750
Meters

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

N

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Main Roads WA
Bunbury Port Access Project Stage 2

Fauna Survey Observations

Job Number 61-24038
Revision 0
Date 22 NOV 2010

Figure 6

G:\61\24038\GIS\Maps\MXD\612403800_G001_Fig6_Rev0.mxd
239 Adelaide Terrace Perth WA 6004 Australia T 61 8 6222 8222 F 61 8 6222 8555 E permail@ghd.com.au W www.ghd.com.au

Data Source: Landgate: Bunbury Mosaic - Jan 2008; GHD: Field Data, Cockatoo & Possum Sightings - 20090803; MRWA: Alignments - 20101021. Created by: wdavis, tgoad

379,000 380,500

6,309,000 6,307,500 6,306,000 6,304,500

YOOKSON RD
THE AVENUE
DAVIE ST
POAT ST
SOUTH WESTERN HWY
HARRIS RD
PEDRETTI RD
COLEMAN TURN
MARTIN-PELUSEY RD
COPPLESTONE RD
BOYANUP-PICTON RD
RESTA RD
RAWLING RD
PORT ACCESS ROAD (Stage 2)
WALLRODT RD
SOUTH WESTERN HWY
BUNBURY OUTER RING ROAD (Stage 1)
BUSHER RD
TIMBER MILL PL
QUEELUP RD
MOORE RD

Locality Map
MANDURAH
HARVEY
BUNBURY
COLLIE
DUNSBOROUGH
BUSSELTON

LEGEND

Bunbury Port Access Project Stage 2
3m Road Extents Buffer
Known Western Ringtail Possum Habitat

Vegetation Type

Corymbia calophylla/ Agonis flexuosa open woodland
Eucalyptus rudis woodland
Melaleuca rhaphiophylla wetland
Paddock/Cleared

1:15,000 (at A3)
0 75 150 300 450 600 750
Meters

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

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Main Roads WA
Bunbury Port Access Project Stage 2

Known Possum Habitat and Impact

Job Number 61-24038
Revision 0
Date 22 NOV 2010

Figure 7a

G:\61\24038\GIS\Maps\MXD\612403800_G001_Fig7a_Rev0.mxd

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

Data Source: GHD: Vegetation Type - 20100727, Possum Habitat - 20100831; MRWA: Alignment, 3m Buffer Extent - 201021; Landgate: Bunbury 2008 Mosaic - 200801. Created by: jhchen, KDIRALU, slee2, tgoad

379,000 380,500

6,309,000 6,307,500 6,306,000 6,304,500

DAVIE ST
YOOKSON RD
POAT ST
THE AVENUE
SOUTH WESTERN HWY
HARRIS RD
PEDRETTI RD
COLEMAN TURN
RAWLING RD
MARTIN PELUSEY RD
COPPLESTONE RD
BOYANUP PICTON RD
PORT ACCESS ROAD (Stage 2)
SOUTH WESTERN HWY
WALLRODT RD
RESTA RD
BUNBURY OUTER RING ROAD (Stage 1)
BUSHER RD
TIMBER MILL PL
QUEELUP RD
MOORE RD

Locality Map
MANDURAH
HARVEY
BUNBURY
COLLIE
DUNSBOROUGH
BUSSELTON

LEGEND

- Bunbury Port Access Project Stage 2
- 3m Road Extents Buffer
- Known Cockatoo Feeding Habitat

Vegetation Type

- *Corymbia calophylla/ Agonis flexuosa* open woodland
- *Eucalyptus rudis* woodland
- *Melaleuca rhaphiophylla* wetland
- Paddock/Cleared

1:15,000 (at A3)
0 75 150 300 450 600 750
Meters

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

N

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Main Roads WA
Bunbury Port Access Project Stage 2

Job Number 61-24038
Revision 0
Date 22 NOV 2010

Cockatoo Foraging Habitat and Impact

Figure 7b

G:\61\24038\GIS\Maps\MXD\612403800_G001_Fig7b_Rev0.mxd

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

Data Source: GHD: Vegetation Type - 20100727, Cockatoo Habitat - 20100831; MRWA: Alignmen, 3m Buffer Extent - 201021; Landgate: Bunbury 2008 Mosaic - 200801. Created by: jhchen, KDIRALU, slee2, tgoad

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Document Status

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0	M Longman L Zimmermann M Dilly	F Hannon	Fionnuala Hannon	F Hannon	Fionnuala Hannon	2.4.2014

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Appendix H

Revegetation Implementation Plan

REVISED REVEGETATION IMPLMENTATION PLAN
Bunbury Port Access Project Stage 2
October 2015

Printed copies are uncontrolled unless marked otherwise

TRIM Document Number	B15#38562
Project Manager	Gerry Zoetelief

Report Compilation and Review	Name and Position	Document Revision	Date
Author:	N McCarthy Project Environment Manager	Draft	05/08/15
Reviewer:	A Grist Project Manager	Draft	05/08/15
Author:	N McCarthy Project Environment Manager	Rev 0	06/0815
Author:	N McCarthy Project Environment Manager	Rev 1	28/10/15
Reviewer:	A Grist Project Manager	Rev 1	28/10/15
Author:	N McCarthy Project Environment Manager	Rev 2	29/10/15

1 Background

Main Roads completed construction of the Bunbury Access Project Stage 2 (the Project) as shown at Figure 1 in mid-2013. Environmental offsets are required as a consequence of approval conditions under the *Environment Protection and Biodiversity Act 1999*, (EPBC 2010/5768), and under Main Roads Clearing Permit CPS 818.

In 2012 Main Roads submitted an Environmental Offset Plan (EOP), which included a Revegetation Implementation Plan, to the Commonwealth Department of Sustainability, Environment, Water, Population and Communities (now Department of the Environment (DotE)) for the project and this was subsequently approved by the Department of the Environment (DotE) in November 2012.

In April 2015 Main Roads submitted a revised EOP to DotE and the WA Department of Environment Regulation (DER) based on the actual project clearing and a revised EOP. The April 2015 EOP has been updated in October 2015 (Rev 2) to address some minor discrepancies in the earlier plan and this Revegetation Implementation Plan (RIP) has been prepared to support the revised EOP.

2 Introduction

This Plan has been prepared by Main Roads WA to document the implementation of revegetation and other works proposed as a component of the environmental offsets for the Bunbury Port Access Project Stage 2. Revegetation works are focused on 13.2 ha of Lot 111 Moore Road, Davenport which is located as shown at Figure 2.

This report details:

- The objectives of the revegetation works
- The location of the rehabilitation site
- Revegetation plant species
- Revegetation and rehabilitation works
- Revegetation completion criteria
- Contingency and management actions

This report forms a component of the November 2015 Environmental Offset Plan (EOP) prepared for the Project and should be read in conjunction with the EOP as appropriate.

It should be noted that revegetation and management actions detailed in the RIP have been undertaken since 2013. Main Roads will prepare and submit a revegetation monitoring report in late 2017 to detail actions undertaken and the success of the revegetation works.

3 Objective

The objective of the offset plan is to replace and enhance ecological values to offset those lost through clearing required for the construction of the Project by undertaking rehabilitation and fencing works on offset properties.

This implementation plan is proposed to document impact mitigation measures offsets required to address Commonwealth and West Australian environmental legislation to offset the impacts on the listed threatened species:

- Western Ringtail Possum
- Carnaby's Black Cockatoo

- Baudin's Black Cockatoo

4 Offset Site

The proposed environmental offset site as detailed in the EOP is Lot 111 (formerly Lot 102) Moore Road, Davenport. Main Roads has purchased Lot 111 Moore Road which is traversed by the Project.

The area of Lot 111 to be incorporated into the environmental offset comprises existing native vegetation (26.7 ha) and revegetation (13.2 ha). The site provides habitat values for Black Cockatoo and Western Ringtail Possum. The property is located as shown at Figure 2.

5 Revegetation Plant Species

The following list outlines the flora species used in revegetation of the Lot 111.

Table 1 Revegetation Plant Species

Genus	Species	Form	Cockatoo / Possum Habitat
Acacia	*extensa*	Shrub	
Acacia	*pulchella*	Shrub	
Agonis	*flexuosa*	Tree	Yes
Allocasuarina	*fraseriana*	Tree	Yes
Banksia	*attenuata*	Tree	Yes
Banksia	*grandis*	Tree	Yes
Banksia	*littoralis*	Tree	Yes
Billardiera	*heterophylla*	Shrub	
Conostylis	*candicans*	Herb	
Corymbia	*Calophylla*	Tree	Yes
Dryandra	*sessilis*	Shrub	Yes
Eucalyptus	*marginata*	Tree	Yes
Eucalyptus	*rudis*	Tree	Yes
Grevillea	*crithmifoliai*	Shrub	Yes
Grevillea	*vestita*	Shrub	Yes
Hakea	*Prostrate*	Shrub	Yes
Hardenbergia	*comptoniana*	Shrub	
Jacksonia	*furcellata*	Shrub	Yes
Kennedia	*prostrata*	Shrub	
Kunzea	*ericfolia*	Shrub	
Melaleuca	*huegelii*	Shrub	

Melaleuca	*incana*	Shrub
Melaleuca	*preissiana*	Tree
Melaleuca	*rhaphiophylla*	Tree
Melaleuca	*systena*	Shrub
Melaleuca	*viminea*	Shrub
Olearia	*axillaris*	Shrub
Patersonia	*occidentalis*	Herb
Regelia	*ciliate*	Shrub
Xylomelum	*occidentale*	Tree

6 Proposed Rehabilitation and Revegetation Works

The rehabilitation of degraded area's within Lot 111 is primarily aimed at replicating the ecological values of the adjacent Banksia/Jarrah/Peppermint woodland within the property by revegetating the currently cleared areas which will enhance the existing remnant vegetation.

The revegetation works will be conducted using proven methodologies developed by Main Roads as described at Appendix A. Table 1 below details the proposed revegetation works and the status of the action.

Table 2 Lot 111 Moore Road Proposed Actions and Timing

Topic	Action	Timing	Status
Weed control	Determine appropriate method and timing of weed control	March 2012	Complete
	Conduct initial weed spraying 1-2 times prior to initial earthworks	June / August 2012	Complete
	Implement additional weed control work as required to achieve completion criteria	Ongoing	In progress
Earthworks	Remove rubbish and declared weeds	March 2012	In progress
	Re-contour landform to blend with surrounding contours	March 2012	Complete
Access	Install 1.8 m chain mesh fencing of the road reserve to exclude public access	June 2013	Complete
Revegetation	Define plant propagation requirements for seedling planting	November 2011	Complete
	Undertake seed collection from surrounding vegetation	November 2011	Complete
	Undertake seedling propagation using collected seed	November 2011	In progress

	Complete soil analysis and define soil nutrient status. Implement soil improvement as required based on nutrient status.	March 2012	Complete
	Undertake seeding and seedling planting as per the MRWA Revegetation Planning and Techniques 6707/031.	June 2012	In progress
	Undertake infill seedling planting as per the MRWA Revegetation Planning and Techniques 6707/031 if required.	June 2013	In progress
Pest and other fauna control	Implement pest control program to minimise damage from grasshoppers and other insects if required based on monitoring.	As required	In progress
	Install tree guards for seedlings if required.	As required	Complete
	Monitor progress of rehabilitation success and implement contingency actions as required	October 2015	In progress
	Informal monitoring undertaken to October 2017	October 2016 October 2017	
	Handover management of site to DEC on achievement of completion criteria	December 2017	In progress
Reporting	Completion criteria compliance reporting to Department of Environment Regulation and Department of the Environment.	December 2017	In progress

7 Revegetation Monitoring and Completion Criteria

7.1 Program

Assessment of the revegetation works within the Site will be undertaken annually in November against the Revegetation Completion Criteria once Main Roads is confident that the criteria is near to being achieved.

Rapid Assessment (RA) plots, 100m long x 10m wide, will be established at the rehabilitation site, with an additional RA plot in remnant vegetation to act as control site. Within each RA plot, two quadrats, referred to as Q1 and Q2, each 2.5 m x 2.5 m, will be established at random locations.

The RA plots will be monitored against the completion criteria.

- Species density
- Species diversity
- Structure
- Species composition
- Weed coverage
- vegetation health and survival (including signs of disease and pests)

Monitoring will be undertaken for three years after initial planting commencing in November 2015. Maintenance activities will continue until completion criteria are met.

7.2 Completion Criteria

Main Roads will provide a report assessing the revegetation works against the completion criteria once it is considered that the completion criteria has been achieved – expected to be November 2017. This report will be used as the basis of concluding successful rehabilitation.

Acceptance of the works at the end of the Vegetation Establishment Period shall be subject to:

1. Landscaping and revegetation works meeting the completion criteria for final completion based on two or more randomly selected representative plots (10 m x 2 m or equal area) per nominated planting zone within the project area.
2. Satisfactory completion of all additional maintenance and remedial works by Main Roads
3. Satisfactory submission of completion criteria report to DotE and DER

Table 3 Revegetation Completion Criteria

Criteria	Completion Criteria
Survival rate of seedlings planted	75 % (2 200/ha)
Species diversity	Minimum of five (5) different native plant species per 10m x 10m quadrat
Structure	10-30% understorey 40-70% midstorey 5-20% upper storey
Weed coverage	Less than 15% weed cover ($15m^2$ per $100m^2$)

8 Contingency and Management Actions

Contingency actions shall be implemented if monitoring during the establishment period indicates that completion criteria are not being met or are unlikely to be achieved. MRWA Project Manager has responsibility for implementing any actions, should they be required.

Table 4 Contingency actions for the rehabilitation sites

Trigger	Action
Insufficient provenance seed volumes or plants collected and propagated from current seed collection areas.	Discuss with DPaW the potential to extend seed collection areas or obtain additional seed and plants from other seed collectors and native nurseries. Prioritise areas for planting and/or direct seeding, potentially postponing some of the planned works.
Inadequate native flora	1. Identify cause.

Trigger	Action
species richness and/or cover to achieve completion criteria.	2. Implement approach to remedy cause, which could include: ◗ collecting additional seed for direct seeding or plant propagation to compensate for the insufficient native plant species richness and/or cover ◗ undertaking of infill seedling planting or additional direct seeding ◗ application of fertilisers or wetting agents etc to improve soil. 3. Monitor success of remedy.
Significant changes to native flora species diversity, richness and/or cover between monitoring periods	1. Identify cause, which could include: ◗ favoured species is potentially invasive or a pioneer species ◗ spatial and seasonal variation is attributing to succession within plant communities ◗ limiting factors restricting the development of species (e.g. infiltration rates, groundwater level, soil surface features, diseases). 2. Implement approach to remedy cause, which could include: ◗ application of fertilisers and wetting agents ◗ removal of potentially invasive species 3. Monitor success of remedy.
Unacceptable weed infestations as per completion criteria.	1. Identify cause. 2. Identify the weeds, their location and coverage and obtain quotations from contractors to control them. 3. Employ a contractor to control the weeds. 4. Monitor success of weed control.
Erosion occurring.	1. Identify cause. 2. Implement remedy (may involve consulting an expert to determine the appropriate remedy). 3. Monitor success of remedy.

9 Reporting

Main Roads will report to the Department of the Environment and the Department of Environment Regulation once the revegetation works have achieved the completion criteria as detailed in this Revegetation Implementation Plan.

References

GHD. 2011. Bunbury Port Access Project Stage 2 – Revegetation Implementation Plan. Unpublished Report prepared for Main Roads Western Australia. Document 61/26518/13532.

Figure 1
Locality Plan
Bunbury Port Access Stage 2

DESCRIPTION:
Figure 1
Locality Plan
Bunbury Port Access Stage 2

LEGEND

KEY MAP

AUTHOR: DOMAIN01\c3721
DATE: 29-October-2015
CREATED BY INTEGRATED MAPPING SYSTEM
GEOCENTRIC DATUM OF AUSTRALIA

0 2 4 km

mainroads WESTERN AUSTRALIA

Figure 2
Bunbury Port Access Stage 2
Lot 111 Offset Site

DESCRIPTION:
Figure 2
Bunbury Port Access Stage 2
Lot 111 Offset Site

LEGEND

- PAR_Lot_102_Offset
- Cadastre

KEY MAP

AUTHOR: DOMAIN01\c3721
DATE: 29-October-2015
CREATED BY INTEGRATED MAPPING SYSTEM
GEOCENTRIC DATUM OF AUSTRALIA

0 0.2 0.4 km

mainroads WESTERN AUSTRALIA

Appendix A

Revegetation Methodology

1 Dieback Management

All rehabilitation areas are “not able to be assessed” for dieback due to a lack of dieback susceptible indicator species (e.g. cleared areas including pastoral lands and heavily disturbed scattered parkland vegetation). These areas may have been infected by *P. cinnamomi* through past disturbance and usage. To minimise the risk of spreading dieback, areas that are “not able to be assessed” for dieback (i.e. uninterpretable areas) are treated with the same care as dieback infected areas. Dieback management measures include:

- hygiene training will be included in an induction program to ensure all personnel are aware of the requirements to prevent the spread of weeds and diseases
- Prior to arrival on site all plant, machinery, equipment and tools are to be cleaned of soil and plant material
- Prior to departure from the project site all Plant, machinery, equipment and tools are to be cleaned.

2 Revegetation Methodology

Planting methods will follow the Revegetation Planning and Techniques Doc. No. 6707/031 (MRWA 2004). All seed and seedlings will be attempted to be sourced within the South West Botanical Province and where practicable, sourced from as close to the site as possible to ensure that the indigenous features of the local species are maintained.

3 Species Lists

The revegetation species lists, planting densities and completion criteria have been developed based upon known propagation successes of the species and several botanical surveys of species known to occur throughout the alignment including the following:

Government of Western Australia 2000, *Bush Forever Volume 2, Directory of Bush Forever Sites*, Department of Environmental Protection.

Gibson N, Keighery B, Keighery G, Burbidge A and Lyons A 1994, *A Floristic Survey of the Southern Swan Coastal Plain*, unpublished Report for the Australian Heritage Commission prepared by Department of Conservation and Land Management and the Conservation Council of Western Australia.

The individual site physical, chemical, biological and other parameters has been considered in species selection to assist to achieve successful establishment of the new vegetation.

4 Seedling sources

All seedlings required for the project are sourced from nurseries accredited under the Nursery Industry Accreditation Scheme of Australia. The nurseries are required to comply with the pottery mix requirements of AS 7343 and to use industry approved containers for the seedlings. To ensure appropriate root development all seedlings are to be propagated in native tubes (50 mm square x 120 mm deep). All containers are sterilised prior to any material being placed in them to avoid the introduction or spread of soil borne pathogens. Only suitably mature tube stock with well developed roots, 10-15 cm high foliage that has been hardened off and is of a generally good health condition is accepted. Seedlings are ordered on an annual basis (November) to allow sufficient time for seed collection and plant propagation.

5 Planting

Planting is undertaken during the winter season when the soil moisture is suitable for seedling establishment, usually between May and July. Depending upon the site conditions planting is undertaken using the rip mound plant, furrow and rip plant or infill individual augur planting methods. Weed control is undertaken over the previous year (e.g. herbicide application), when it is most suitable to eradicate the species present and anytime after seedling planting, when required to control annual grass. All seedlings are to be planted with an industry standard, 20g slow release native fertiliser tablet approximately 200 mm deep and 200 mm from the roots.

Rip Mound Planting

This method involves an initial herbicide application followed by rotary hoeing of the areas to be ripped and mounded to remove large soil aggregates and improve soil friability. This is followed by the ripping of soil to a minimum depth of 500 mm and the mounding of the soil into rows approximately 500 mm high (soil will settle to approximately 300 mm high). All mounds are then to be treated with a pre-emergent herbicide. Mulch is then spread over the mounds to an optimal depth of 70 mm and seedlings are planted on the top of these mounds.

In waterlogged soil conditions this method provides the advantage of creating a zone of aerated soil for root development. Additional advantages of creating this rip mound plant area are the definition of a maintenance zone for weed control. Mounded rows should traverse any slopes to discourage water movement and soil erosion.

Furrow and Rip Planting

This method involves an initial herbicide application followed by scalping of the weedy topsoil to create a furrow approximately 100mm deep. This is then followed by the ripping of soil in the centre of the furrow line to a minimum depth of 500 mm into rows. All furrowed areas are then treated with a pre-emergent herbicide. Mulch is then spread along the furrows to an optimal depth of 70 mm and seedlings are planted along the rip lines.

In drier conditions or in non-wetting soils grey sands the inverted furrows also need to following existing contours to promote localised areas for water infiltration and avoid scour problems.

Auger Planting

This method is used in situations where creating a mound is undesirable for soil erosion reasons or when site access is too restrictive or the area is relatively small. After weed control measures are undertaken, holes are augured to a minimum depth of 500 mm with a CSIRO tree auger or equivalent. Seedlings are planted into these holes and mulch is placed around the seedling for approximately 1 m^2 and 70 mm deep.

6 Weed Control

Weed control shall be conducted prior to any new planting works as failure to control weeds will result in unsuccessful revegetation. Control of weeds will be undertaken in accordance with the *Agriculture and Related Resources Act 1976* and under industry best practise for Weed control. If weed control is required near wetlands, Roundup Bioactive® will be used. Weed control will continue for up to three years after planting. Spot spraying of Declared plants will also be undertaken on Land Acquisition sites prior to transfer of land to DEC.

7 Pest control

New planting sites that are likely to be damaged by local fauna will have tree guards placed around seedlings as required to minimise damage from rabbits and kangaroos.

Control methods for rabbits may need to be implemented prior to any revegetation works and during the establishment period. Monitoring of this threat is to be undertaken on a regular basis to ensure the extent of infestations is known and the appropriate management is implemented.