COTERRA ENVIRONMENT

Native Vegetation Clearing Permit Application Supporting Information

Lot 9010 Warton Road, Piara Waters

Revision 0 May 2020

CALIBRE | COMMITMENT | COLLABORATION

This report was prepared by: Coterra Pty Ltd trading as COTERRA ENVIRONMENT
ABN: ABN: 92 143 411 456
Our Ref: WASWSP02
Author(s): K. Watts
Reviewer: S. Harley
Report Version: Revision 0
Date: May 2020

This report was prepared for:
Department of Education
C/- With_Architecture Studio
346 William Street
Perth WA 6000

COTERRA ENVIRONMENT

Contents

Tables

Figures

Appendices

1 Permit Application Details

1.1 Background

Lot 9010 Warton Road, Piara Waters is located within the City of Armadale, approximately 25 km south of the Perth CBD (Figure 1). Historically the site has been used for sand extraction and the remaining topographic contours reflect this land use. The site was also used for turf production. Most of the vegetation present onsite has been cleared to facilitate these land uses (Figure 2).

The Department of Education is progressing plans and approvals to construct a Secondary School campus at the site. The project has been assigned a high priority by the Department of Education given the existing need in this location.

1.2 Proposal Details

A concept plan is being prepared for the proposed school development which will be subject to further refinement. In general, it is proposed to locate the school buildings within the eastern end of the site, with ovals and a playing field located in the west, adjacent to Warton Road.

A copy of the current Stage 1 Concept Plan is provided in Appendix 1.

1.3 Planning Instruments

An amendment to the Metropolitan Region Scheme (MRS) was initiated in March 2020 to rezone the site from 'Rural – Water Protection' to 'Public Purposes – High School'. Following referral of the amendment to the Environmental Protection Authority (EPA) this proposal was determined as 'Scheme Amendment Not to be Assessed Under Part IV of the EP Act. Advice Given. (Not Appealable)'. The EPA advice included the recommendation that an updated flora and vegetation survey be undertaken to inform future planning and approval stages. A copy of the EPA's decision and advice is provided in Appendix 2.

The site is currently zoned General Rural under the City of Armadale Town Planning Scheme. This zone is compatible with a school land use. As such a local scheme amendment will not be required.

Approval for the construction of the school site will be progressed under a Development Application (DA) submitted to the City of Armadale. It is proposed that two separate DA's will be progressed as follows:

- DA No. 1 – Seek approval for fill placement and preliminary earthworks which do not involve impacts to native vegetation. Anticipated to be lodged in May 2020.
- DA No. 2 – Seek approval for vegetation clearing and civil works to construct the school. Anticipated to be lodged in July 2020 as further design work is required before this DA can be finalised

The above approach is proposed to minimise the construction timeframes, by allowing some preliminary, low impact, works to commence while the detailed design is refined and final approvals for these items are sought.

Following on from the DA approvals, building permits will be required for construction of the school buildings.

1.4 Proposed Clearing Extent

Vegetation clearing is proposed to be undertaken to facilitate the earthworks required to achieve the development levels for the school building, access and other school land use (e.g. sporting fields) requirements.

The total size of the proposed clearing extent for Stage 1 is 1.23ha as shown on Figure 3. This footprint will be reflected in DA No. 2 as discussed above.

1.5 Alternatives Considered / Actions to Minimise Clearing and Impacts

The design of the site focuses on provision of the school buildings at the southern and eastern ends of the lot, away from the main areas of native vegetation. The north western and south western boundaries of the site (adjacent to Warton Road) contain areas where vegetation can be retained both temporarily (until later stages of the school infrastructure is developed) and permanently (see proposed Retained Vegetation areas shown in Appendix 1). Any future clearing proposed would also look to minimise the clearing footprint, where possible.

Future landscape working onsite will include planting of local native flora species to facilitate the ongoing representation of local flora in this area.

A Vegetation Management Plan is being prepared as part of the Development Application documentation package. This plan will identify protection measures for areas of vegetation which will be retained onsite during construction works.

2 Site Description

2.1 Topography, Soils and Geology

Topographic elevation across the site ranges from 28 to 33 metres Australian Height Datum (mAHD) (Figure 4).

Regional geology mapping (Jordan, 1986) indicates that the site contains the following soils (Figure 4):

- Bassendean Sands (S8): white to pale grey at surface, yellow at depth, fine to medium-grained, moderately sorted, subangular to sub-rounded, minor heavy minerals, of eolian origin.
- Bassendean Sands over Guildford Formation (S10): Sands as described above occur over sandy clay to clayey sand of the Guildford Formation, of eolian origin.

These soils are identified as having a Moderate to Low Acid Sulfate Soil risk (Landgate, 2020).

2.2 Hydrology

Regional groundwater mapping obtained from the DWER Perth Groundwater Map, indicates that Maximum Groundwater Level at the site range from 26mAHD to 28mAHD (Figure 5). This equates to a separation distance of between 0m and 7m below ground level. The groundwater flow direction is generally towards the east (DWER, 2019).

There are no mapped wetland present within the site (Landgate, 2020).

The site lies within the Jandakot Groundwater Protection Area as defined by the Statement of Planning Policy No 6 – Jandakot Groundwater Protection Policy. It is classified as a Priority 2 (P2) Catchment Area under the Public Drinking Water Source Areas (PDWSA).

Urban development is typically not supported within a P2 water protection zone, however with certain controls in place urban development is compatible with a P3* classification. Based upon DWER advice, the site can be reclassified from P2 to P3* if the MRS amendment process concludes that it is acceptable to rezone the land.

DWER advice on land-uses for protecting water quality within P3* areas identifies that future land-uses should be consistent with the region and local planning schemes, pose no unacceptable contamination risk to water quality and best interests of the community (DWER, 2018).

2.3 Vegetation and Flora

2.3.1 Vegetation Complex

The site occurs in the Bassendean dunes which support the Southern River vegetation complex. This is described as predominantly an open woodland of *Corymbia calophylla – Eucalyptus marginata – Banksia* spp. with fringing woodland of *Eucalyptus rudis – Melaleuca rhaphiophylla* along creek beds (Heddle *et al*., 1980). DBCA (Government of Western Australia, 2018) South-West Vegetation Complex Statistics Report indicates that there is 18% of the original area of the Southern River complex remaining vegetated within the Swan Coastal Plain.

2.3.2 Flora and Vegetation Surveys

The flora and vegetation onsite were assessed by Dr Eleanor Bennett in 2011. This assessment was completed in accordance with the Level 2 vegetation survey requirements as outlined within the EPA *Guidance for the Assessment of Environmental Factors, Terrestrial flora and vegetation surveys for*

environmental impact assessment in Western Australia (EPA, 2004). The survey involved field assessment undertaken on the 10th and 11th October 2011. A copy of the survey report is provided in Appendix 3 (Appendix A of FVC report).

An updated flora and vegetation reconnaissance level assessment was undertaken by Focused Vision Consulting (FVC) in 2020 to supplement the original survey work. The field work for this survey was completed on 25th March 2020. The scope of this assessment included:

- Undertake a revised DBCA database search for Threated and Priority flora potentially supported by the site
- Review the previous study report (Bennett Environmental Consulting, 2011)
- Undertake a site inspection to verify the vegetation type, condition, provide advice on the potential presence of vegetation representing the Banksia Woodlands of the Swan Coastal Plain Threatened Ecological Community (TEC) and verify habitats potentially provided for significance flora.

A copy of the FVC survey report is provided in Appendix 3.

The results of the two surveys are discussed further below.

2.3.3 Vegetation Type

The native vegetation units that were mapped onsite during the 2020 FVC assessment are listed in Table 2-1. The location and extent of these units are shown on Figure 6.

Table 2-1: Vegetation Units

Vegetation Unit and Description	Area
Native Vegetation	
EmBaLW Low Woodland A of *Eucalyptus marginata* subsp. *marginata* over *Banksia attenuata*, *Banksia menziesii, Allocasuarina fraseriana* and *Nuytsia floribunda* and Low Scrub B dominated by *Xanthorrhoea preissii* or Dwarf Scrub C dominated by *Hibbertia hypericoides* over Tall Grass dominated by **Avena barbata* and **Ehrharta calycina* in grey sand.	0.340 ha
BaEtLW Low Woodland A of *Banksia attenuata, Banksia menziesii, Allocasuarina fraseriana, Nuytsia floribunda* and *Eucalyptus todtiana* over Heath B of mixed taxa dominated by *Xanthorrhoea preissii* over Open Tall Grass dominated by **Ehrharta calycina* over Open Herbs dominated by *Dasypogon bromeliifolius* or *Phlebocarya ciliata* in grey sand.	0.225 ha
EmBaLW(-B) Low Woodland A of *Eucalyptus marginata subsp. marginata* over *Allocasuarina fraseriana, Nuytsia floribunda* and *Melaleuca preissiana* over Dense Thicket of *Kunzea glabrescens* over Low Scrub B dominated by *Xanthorrhoea preissii* or Dwarf Scrub C dominated by *Hibbertia hypericoides* over Tall Grass dominated by **Avena barbata* and **Ehrharta calycina* in grey sand.	0.832 ha
BaEtLW(-B) Low Woodland A of *Eucalyptus todtiana, Allocasuarina fraseriana* and *Nuytsia floribunda* over Thicket of *Kunzea glabrescens* over Low Scrub B dominated by *Xanthorrhoea preissii* over Open Tall Grass dominated by **Ehrharta calycina* over Open Herbs dominated by *Dasypogon bromeliifolius* in grey sand.	0.597 ha
MpOLW Open Low Woodland A of *Melaleuca preissiana* over Dense Tall Grass of **Ehrharta calycina*, **Eragrostis curvula* and **Ehrharta longiflora* in low lying grey sand over Open Herbs dominated	0.045 ha

Vegetation Unit and Description	Area
by **Arctotheca calendula* in low lying grey sand.	
AcOS Open Scrub of *Adenanthos cygnorum* regrowth over scattered sparse mixed shrubs and herbs.	0.138 ha
Sub-Total (Native Vegetation)	***2.177 ha***
Planted and Cleared Areas	
Planted Introduced tree species	1.061 ha
Cleared Cleared areas for commercial operations, tracks.	9.467 ha
Sub-Total (Planted and Cleared Areas)	***10.528 ha***
TOTAL	**12.705 ha**

Vegetation unit mapping by Dr Eleanor Bennett identified the same broad vegetation types at a coarser scale (Appendix 3).

2.3.4 Vegetation Condition

The vegetation condition onsite was assessed by FVC to vary from 'Good' to 'Completely Degraded'. The location of the vegetation condition extents is shown on Figure 7 with areas summarised on Table 2-2.

Table 2-2: Vegetation Condition Summary

Vegetation Condition	Area
Good	0.665 ha
Degraded – Good	0.782 ha
Degraded	0.571 ha
Degraded – Completely Degraded	1.218 ha
Completely Degraded	9.467 ha
TOTAL	**12.705 ha**

Differences have been observed in vegetation condition in comparison to the 2011 survey (Appendix 3), with some areas improving and some areas declining. These differences may be attributed to temporal changes and possibly from regrowth and vegetation improvement or increased distances over the period of time between the studies (FVC, 2020).

2.3.5 Conservation Significant Flora

No Threatened flora species were recorded within the study area by either FVC or Dr Eleanor Bennett.

One possible Priority flora species according to the DBCA, *Jacksonia ?gracillima* (P3), was recorded by FVC (2020) within the study area, although the timing of the survey was noted to be sub-optimal to confirm the identification of this species. Dr Eleanor Bennett identified a non-priority Jacksonia species (*Jacksonia furcellata*) within Lot 9010 during the spring 2011 survey. This was within the flowering period for both *J. graciliama* (October and November; DBCA, 2020) and *J. furcellata* (October to December; DBCA, 2020).

The Environmental Protection Authority (EPA) identified that *Caladenia huegelii* and other threatened orchids may not have been able to have been observed in the 2011 survey (Appendix 2). The Threatened Flora species which are identified by FVC as possibly occurring onsite are:

- *Austrostipa jacobsiana* (Critically Endangered)
- *Caladenia huegelii* (Critically Endangered)
- *Diuris purdiei* (Endangered)
- *Drakaea elastica* (Critically Endangered)
- *Drakea micrantha* (Endangered)

The potential for these species to be present onsite is summarised below.

Table 2-3: Threatened Flora Species Review

Species	Flowering	Comments (FVC, 2020)
Austrostipa jacobsiana	Flowering October through November (DotEE, 2018)	Vegetation units EmBaLW(-B) and BaEtLW(-B)) are somewhat low-lying, supporting *Melaleuca preissiana* and *Kunzea glabrescens*, which may provide suitable habitat. There is a more pronounced (small) low-lying area in the eastern part of the study area, however this area is significantly degraded, with an understorey consisting of weedy grasses. It is therefore considered possible that this species could occur within the study area. However, if present, it is also considered likely that it would have been observed during the March field assessment.
Caladenia huegelii (Grand Spider Orchid)	Flowers green and cream and red, September to October (DBCA, 2020)	This species occurs in areas of mixed *Eucalyptus marginata* and *Banksia attenuata* and *B. menziesii* woodland with scattered *Allocasuarina fraseriana* over *Hibbertia hypericoides* and *Xanthorrhoea preissii* on deep grey-white sand (Department of Environment and Conservation (DEC) 2009a), consistent with vegetation unit EmBmLW.
Diuris purdiei (Purdie's Donkey Orchid)	Flowers yellow, September to October (DBCA, 2020)	Soils and vegetation of the study area may be suitable for this species, however, *Diuris purdiei* also relies on relatively recent fire, which is not apparent in the study area. Furthermore, the study area lacks the sedges and dense heath preferred by the species. Therefore, it is unlikely this species would occur within the study area.
Drakaea elastica (Glossy-leafed hammer orchid)	Flowers red & green & yellow, October to November (DBCA, 2020)	It is possible that either Drakaea species could occur within the study area. However, given the lack of bare sand lenses throughput the study area, the likelihood of occurrence of both species is considered reduced.
Drakaea micrantha (Drarf hammer orchid)	Produces distinct flower with red and yellow parts from September to October (DBCA, 2020)	

The 2011 survey was within the flowering period for all of the above flora species (i.e. survey dates were 10th and 11th October 2011) and did not find any to be present onsite.

The FVC review of habitat suitable for these species concluded that on a site-specific level, the actual micro-habitat suitability of the study area is low and therefore, the likelihood of occurrence of the Threatened flora species focused on is also low (FVC, 2020).

2.3.6 Conservation Significant Ecological Communities

None of the vegetation onsite met the diagnostic criterial to be classed as the Banksia Woodland of the Swan Coastal Plain Threatened Ecological Community as the areas containing Banksia trees in 'Good' or better condition did not meet the minimum patch size thresholds.

2.4 Fauna and Habitat

A Level 1 fauna assessment (desktop review and site inspection) was completed for the site and surrounds in 2018 (Harewood, 2018). The objectives of the investigation were to identify fauna values, review impacting processes with respect to these values and the proposed development, and to provide recommendations to mitigate these impacts. A copy of this report is provided in Appendix 4, with a summary of the findings relevant to Lot 9010 provided below.

2.4.1 Fauna Habitats

Lot 9010 was mapped as containing the following fauna habitat types:

- Low Woodland/Open Low Woodland of Banksia, Sheoak, *Nuytsia floribunda* and Coastal Blackbutt or Jarrah over Dwarf Scrub, Heath, Grass and/or Herbs
- Dense Low Forest/Low Woodland of Paperbark (occasional Flooded Gum in some areas) over Scrub/Dense Thicket of Kunzea over Herbs/Dense Scrub and Tall Sedges.

Overall fauna habitat values of the survey area were found to have been severely compromised by the removal of most of the original native vegetation and the degradation of remnant patches. Most areas lack any natural attributes and are now only utilised by generally common and widespread fauna species with non-specific requirements which allow them to persist in disturbed/highly disturbed habitats. As a consequence, the fauna diversity of the subject site is well below levels present prior to historical disturbances having occurred (Harewood, 2018).

2.4.2 Fauna Observations

A total of 29 native fauna species were observed (or positively identified from foraging evidence, scats, tracks, skeletons or calls) within the survey area (i.e. including additional landholdings to Lot 9010) during the survey period. Five introduced species (horse, red fox, rabbit, laughing turtle dove, rainbow lorikeet) were also recorded. Most of the fauna species recorded were common, widespread bird species. Only one fauna species of conservation significance was recorded during the survey period (the forest red-tailed black cockatoo – foraging evidence). (Harewood, 2018).

2.4.3 Black Cockatoo Habitat

Lot 9010 was identified as containing 21 potential black cockatoo habitat trees which comprise:

- 17 planted non-endemic eucalypts
- 2 coastal blackbutt (*Eucalyptus todtiana*)
- 3 dead jarrah (*Eucalyptus marginata*)
- 1 flooded gum (*Eucalyptus rudis*)

The location of these trees is shown on Figure 8.

No trees were identified as potentially containing hollows of any size. No black cockatoo roosting activity within the subject site was noted during the survey period (Harewood, 2018).

The foraging habitat present within the survey area was largely patchy, fragment vegetation of variable quality (Harewood, 2018). The vegetation onsite which provides foraging habitat opportunities based on

the FVC survey data extends over approximately 2ha and comprises the EmBaLW, BaEtLW, EmBaLW(-B), BaEtLW(-B) vegetation units (Figure 6).

Based on available vegetation mapping it is estimated that there is approximately 11,500 ha of native vegetation within 12 km the subject site (~22% of total area) much of which is likely to represent black cockatoo habitat of some type. Bush forever sites make up about 75% of this area of remnant vegetation (Harewood, 2018).

2.5 Heritage

A search of the Department of Planning, Lands and Heritage (DPLH) Aboriginal Heritage Enquiry System (Western Australia) was undertaken which identified that there are no registered sites located within or adjacent to the landholdings (DPLH, 2019).

A search was undertaken of the State Heritage database (2018), administered by the State Heritage Office of Western Australia. No areas of European heritage significance have been recorded within the site.

3 Assessment Against Clearing Principles

3.1 Native vegetation should not be cleared if it comprises a high level of biological diversity

The values of the proposed clearing and remaining vegetation areas are summarised as follows:

Table 3-1: Native Vegetation Areas

Feature	Vegetation to be Cleared	Remaining Vegetation
Vegetation Units		
EmBaLW	0.26 ha	0.08 ha
BaEtLW	0.01 ha	0.22 ha
EmBaLW(-B)	0.36 ha	0.48 ha
BaEtLW(-B)	0.48 ha	0.11 ha
MpOLW	0.04 ha	0
AcOS	0.08 ha	0.06 ha
Total	**1.23 ha**	**0.95 ha**
Vegetation Condition		
Good	0.13 ha	0.53 ha
Degraded – Good	0.63 ha	0.16 ha
Degraded	0.37 ha	0.20 ha
Degraded – Completely Degraded	0.10 ha	0.06 ha
Total	**1.23 ha**	**0.95 ha**

As can be seen from the above most of the vegetation to be cleared is in a 'Degraded-Good' or lower condition with reduced biological diversity.

3.2 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

The fauna assessment of the site and surrounds concluded that fauna habitat values of the survey area have been severely compromised by the removal of most of the original native vegetation and the degradation of remnant patches. Most areas lack any natural attributes and are now only utilised by generally common and widespread fauna species with non-specific requirements which allow them to persist in disturbed/highly disturbed habitats.

Of the 1.23ha of vegetation to be cleared (see Table 3-1), this includes approximately 1.11ha of potential black cockatoo foraging habitat comprising vegetation units EmBaLW, BaEtLW, EmBaLW(-B) and BaEtLW(-B)) and 21 potential black cockatoo habitat trees. Two of the dead Jarrah habitat trees are located in areas of remaining vegetation which are not proposed to be cleared as part of this application. Given habitat values have been severely compromised in this location, the area to be cleared is not considered to provide significant fauna habitat opportunities.

3.3 Native vegetation should not be cleared if it includes, or is necessary for the continued existence of, rare flora

No Declared Rare Flora were found onsite during the Level 2 botanical assessment conducted by Bennett Environmental Consulting (2011) or the reconnaissance survey undertaken by FVC (2020). FVC also identified that based on review of habitat suitable for identified Threatened flora species it was concluded that on a site-specific level, the actual micro-habitat suitability of the study area is low and therefore, the likelihood of occurrence of the identified Threatened flora species is also low (FVC, 2020).

3.4 Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a threatened ecological community

No vegetation representing a Threatened Ecological Community is present onsite.

3.5 Native vegetation should not be cleared if it is significant as a remnant of native vegetation in an area that has been extensively cleared

DBCA 2017 vegetation complex statistics indicate that approximately 25% of the Southern River vegetation complex is remaining within the City of Armadale and approximately 18% is remaining within the Swan Coastal Plain (Government of Western Australia, 2018). As such, the remaining extent of the complex meets the EPA minimum 10% target for constrained areas.

The City of Armadale Local Biodiversity Strategy also states that 76% of the original extent of remnant vegetation remains with the City of Armadale (CoA, 2009).

The vegetation present onsite was found to be generally in poor condition (over 88% of the site contained vegetation in 'Degraded' or lower condition) and fragmented and as such it is not considered a significant remnant patch.

3.6 Native vegetation should not be cleared if it is growing in, or in association with, and environment associated with a watercourse or a wetland

The site is not identified as containing any wetland areas as mapped by the DBCA within the Geomorphic Wetlands of the Swan Coastal Plain database (Landgate, 2020).

3.7 Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation

Following clearing, soils onsite will be stabilised through construction or buildings, landscaping or placement of mulch / hydro-mulch over these areas. These actions will prevent soils movement which could lead to land degradation.

3.8 Native vegetation should not be cleared if the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation areas

The site is not physically connected to any conservation areas. The closest conservation area is Bush Forever Site 390, which is located west of Warton Road, and south of the site. It is noted that this Bush Forever Site is over 75m from the clearing area boundary and that is it not hydrologically downgradient.

Based on these factors clearing of vegetation onsite is not considered likely to have an impact on this conservation area.

3.9 Native vegetation should not be cleared if the clearing of the vegetation is likely to cause deterioration in the quality of the surface or underground water

There are no surface water flow paths between the site and nearby wetland areas which could facilitate an impact to wetland surface water quality. The nearest Resource Enhancement or Conservation category wetland parallel or hydrologically downgradient of the site is over 500m to the south (UFI 13342 – Resource Enhancement). A Conservation category wetland (UFI 7169) is located approximately 120m west of the site, which is hydrologically up-gradient as seen in the groundwater contours presented on Figure 5.

A District Water Management Strategy (JDA, 2020) has been prepared for the MRS amendment area to address how development of Lot 9010 and surrounding sites will not cause any unacceptable impacts to the groundwater resource. This DWMS must be approved by DWER prior to site development being able to be undertaken.

In addition, an Urban Water Management Plan is being prepared for the school site by Water Technology, which will be lodged with the City of Armadale for assessment and approval. This report will provide further information and commitments to demonstrate how groundwater protection is being achieved.

These management plans will ensure required groundwater protection is achieved.

3.10 Native vegetation should not be cleared if clearing the vegetation is likely to cause, or exacerbate, the incidence or intensity of flooding

The site is predominantly Bassendean Sand (S8) which is characterised as white to pale grey at the surface, yellow at depth, fine to medium-grained, moderately sorted, sub-angular to sub-rounded, minor heavy minerals of eolian origin. Some portions of the site are mapped as Sand (S10) which is as per S8 as a relatively thin veneer over strong, blocky, brown silts and clays. Both S8 and S10 are well draining soil types. As such clearing is not anticipated to increase the incidence or intensity of flooding.

4 Conclusions

The key features of the proposed clearing onsite are summarised as:

- Clearing of 1.23ha of vegetation of the 2.177 ha of native vegetation present onsite is proposed
- No Threatened Flora or Threatened Ecological Communities were found or are likely to occur onsite
- The vegetation onsite is not identified as providing valuable fauna habitat opportunities, including for black cockatoos

Based on the above it is concluded that the clearing proposed will not cause unacceptable environmental impacts and does not appear to be at variance to the clearing principles.

5 References

Bennett Environmental Consulting Pty Ltd (2011) *Botanical Assessment of Selected Lots Along Warton Road, Armadale Road and Wright Road, Forrestdale*. Prepared for Coterra Environment.

City of Armadale (CoA) (2009) *Local Biodiversity Strategy – Complete Report*. Adopted by Council 23 November 2009. Ironbark Environmental and EcoLogical Australia.

Department of Biodiversity, Conservation and Attractions. (2020) *Florabase*. https://florabase.dpaw.wa.gov.au/

Department of Planning, Lands, and Heritage (DPLH) (2019) *Aboriginal Heritage Enquiry System*. Accessed 15 October 2019.

Department of the Environment and Energy (DotEE) (2018). *Conservation Advice – Austrostipa jacobsiana*. Approved by the Minister and effective from 15/2/2018.

Department of Water and Environmental Regulation (DWER) (2018) *Priority 3* (P3*) areas.* Water Quality Protection Note No. 38. DWER, Perth.

Department of Water and Environmental Regulation (DWER) (2019) *Perth Groundwater Map*. https://maps.water.wa.gov.au/#/webmap/gwm

Environmental Protection Authority (EPA) (2004) *Guidance for the Assessment of Environmental Factors: Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia*. EPA Guidance Statement No. 51. EPA, Perth

Environmental Protection Authority (EPA) (2016) *Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment*. December 2016. EPA, Perth.

Focused Vision Consulting. (2020) *Flora and Vegetation Review – Lot 9103 Warton Road, PIara Waters*. Report prepared for Coterra Environment.

Government of Western Australia. (2018). *2017 South West Vegetation Complex Statistics Report, current as of October 2017.* WA Department of Biodiversity, Conservation and Attractions, Perth. https://catalogue.data.wa.gov.au/dataset/dbca

Harewood, G. (2018) *Fauna Assessment West Piara Waters, Forrestdale*. Report Prepared for Coterra Environment.

Heddle, E.M., Loneragan, O.W. and Havel, J.J. (1980) *Atlas of Natural Resources*. Western Australia Department of Conservation and Environment.

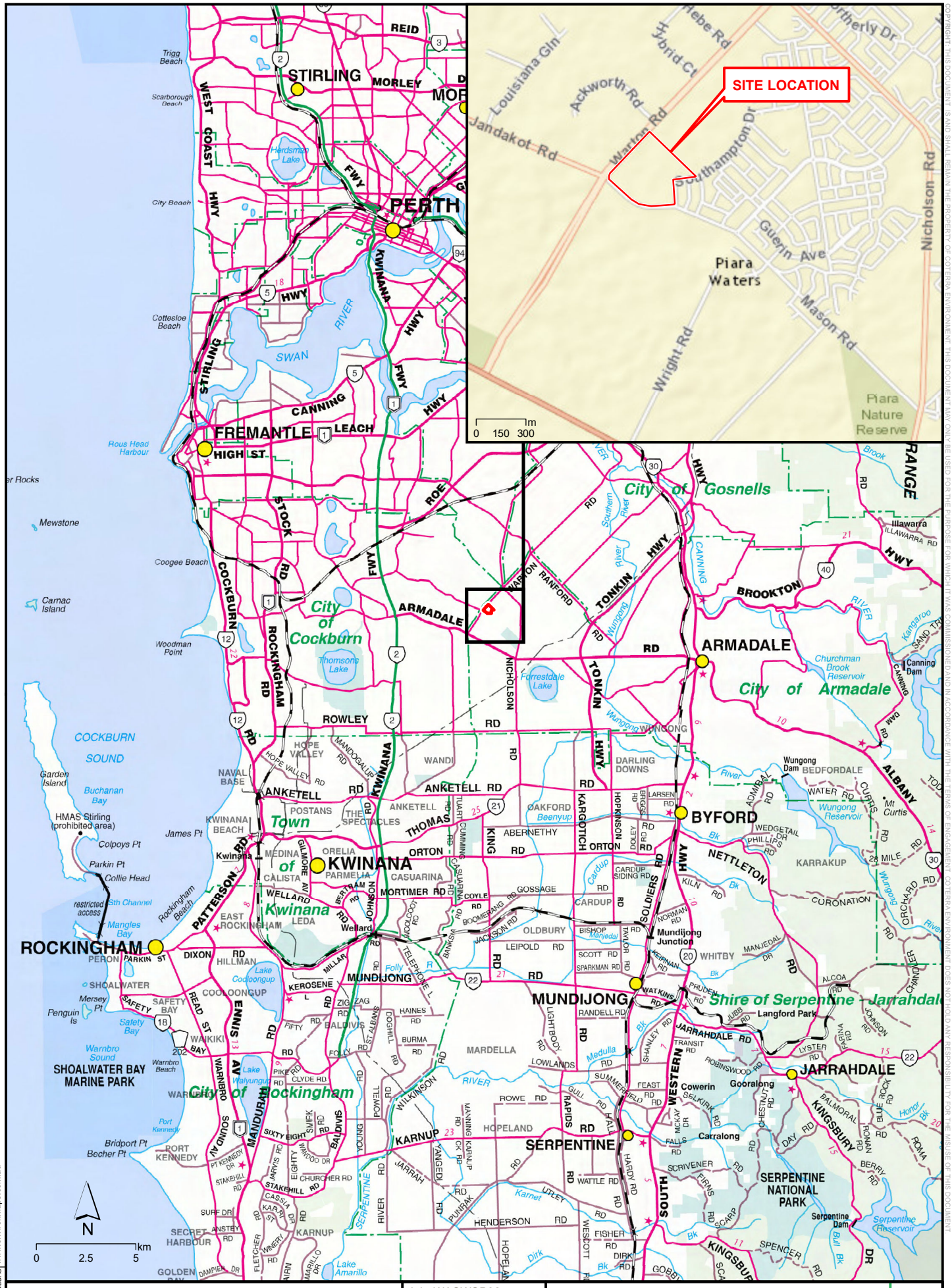
JDA Consulting Hydrologists (2020) *Piara Waters West District Water Management Strategy* (DWMS).. Report prepared for West Piara Landowners Group.

Jordan J.E. (1986). *Armadale Sheet part of Sheets 2033 I and 2133 IV.* Environmental Geology Series. Geological Survey of Western Australia, Department of Minerals and Energy, Perth, Western Australia.

Landgate (2019 & 2020) *Shared Land Information Platform – Locate V5*. https://maps.slip.wa.gov.au/landgate/locate/

State Heritage Office (2018) *Inherit Database* [Online] available at http://register.heritage.wa.gov.au/Public

Figures



ENVIRONMAPS | t: 0406 590 006 | Environmental Mapping Solutions | www.environmaps.com.au

C:\GIS\Jobs\CoTerra\WASWSP02 - Lot 9103 Warton Road, Piara Waters, NVCPA\Figures\WASWSP02_F01 Site Location_200403.mxd

COTERRA ENVIRONMENT

Job: WASWSP02
Doc: 001
Date: 3/04/2020
Ph: (08) 9381 5513
Fax: (08) 9381 5514
E: info@coterra.com.au

With_Architecture Studio
NATIVE VEGETATION CLEARING PERMIT APPLICATION
LOT 9103 WARTON ROAD, PIARA WATERS

SITE LOCATION

Figure 1

LEGEND

Site Boundary

Cadastre

N

0 12.5 25 50 75 100 m

Scale: 1:2,000 @ A3
GDA 1994 MGA Zone 50

Warton Rd

Warton Rd

Jandakot Rd

LOT 9103

9101

1001

Mason Rd

Bordeaux Pde

Salerno App

Delft L

Southampton Dr

Napoli Av

Essen Link

Padua Rd

Mannheim Cr

Brescia L

Source: Cadastre - Landgate, 2019
Orthophoto - NearMaps, 03.03.20

ENVIRONMAPS | t: 0406 590 006 | Environmental Mapping Solutions | www.environmaps.com.au

COTERRA ENVIRONMENT

Job: WASWSP02
Doc: 002
Date: 3/04/2020
Ph: (08) 9381 5513
Fax: (08) 9381 5514
E: info@coterra.com.au

With_Architecture Studio
NATIVE VEGETATION CLEARING PERMIT APPLICATION
LOT 9103 WARTON ROAD, PIARA WATERS

AERIAL PHOTOGRAPH

Figure 2

C:\GIS\Jobs\CoTerra\WASWSP02 - Lot 9103 Warton Road, Piara Waters, NVCPA\Figures\WASWSP02_F02 Aerial Photograph_200403.mxd

LEGEND

- Site Boundary
- Cadastre
- Proposed Development
- Extent of Earthworks
- Native Vegetation Extent
- Potential Retained Vegetation Area

N

0 12.5 25 50 75 100 m

Scale: 1:2,000 @ A3
GDA 1994 MGA Zone 50

9101

1001

Warton Rd

Jandakot Rd

Mason Rd

Bordeaux Pde

Salerno App

Delft L

Southampton Dr

Napoli Av

Padua Rd

Essen Link

Mannhein Cr

Brescia L

Source: Cadastre - Landgate, 2019
Orthophoto - NearMaps, 03.03.20
Vegetation Types - FVC, 2020
Proposed Development - with_architecture studio SD1.01_B 06.04.20

ENVIRONMAPS | t: 0406 590 006
Environmental Mapping Solutions | www.environmaps.com.au

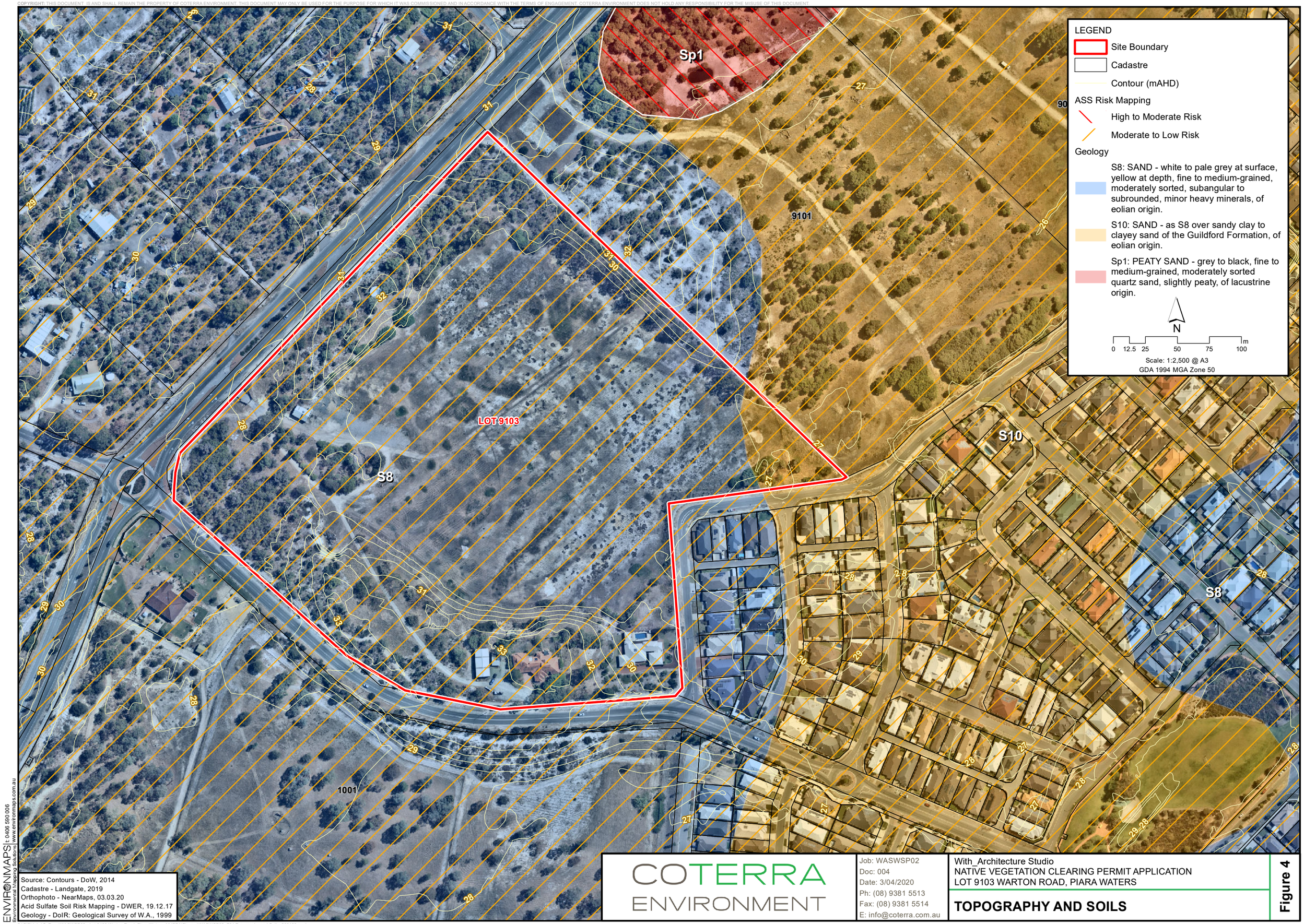
COTERRA ENVIRONMENT
Job: WASWSP02
Doc: 003
Date: 6/05/2020
Ph: (08) 9381 5513
Fax: (08) 9381 5514
E: info@coterra.com.au

With_Architecture Studio
NATIVE VEGETATION CLEARING PERMIT APPLICATION
LOT 9103 WARTON ROAD, PIARA WATERS

CLEARING EXTENT PLAN

Figure 3

C:\GIS\Jobs\CoTerra\WASWSP02 - Lot 9103 Warton Road, Piara Waters, NVCPA\Figures\WASWSP02_F03 Clearing Extent Plan_200506.mxd



Source: Contours - DoW, 2014
Cadastre - Landgate, 2019
Orthophoto - NearMaps, 03.03.20
Acid Sulfate Soil Risk Mapping - DWER, 19.12.17
Geology - DoIR: Geological Survey of W.A., 1999

ENVIRONMAPS | t: 0406 590 006
Environmental Mapping Solutions | www.environmaps.com.au

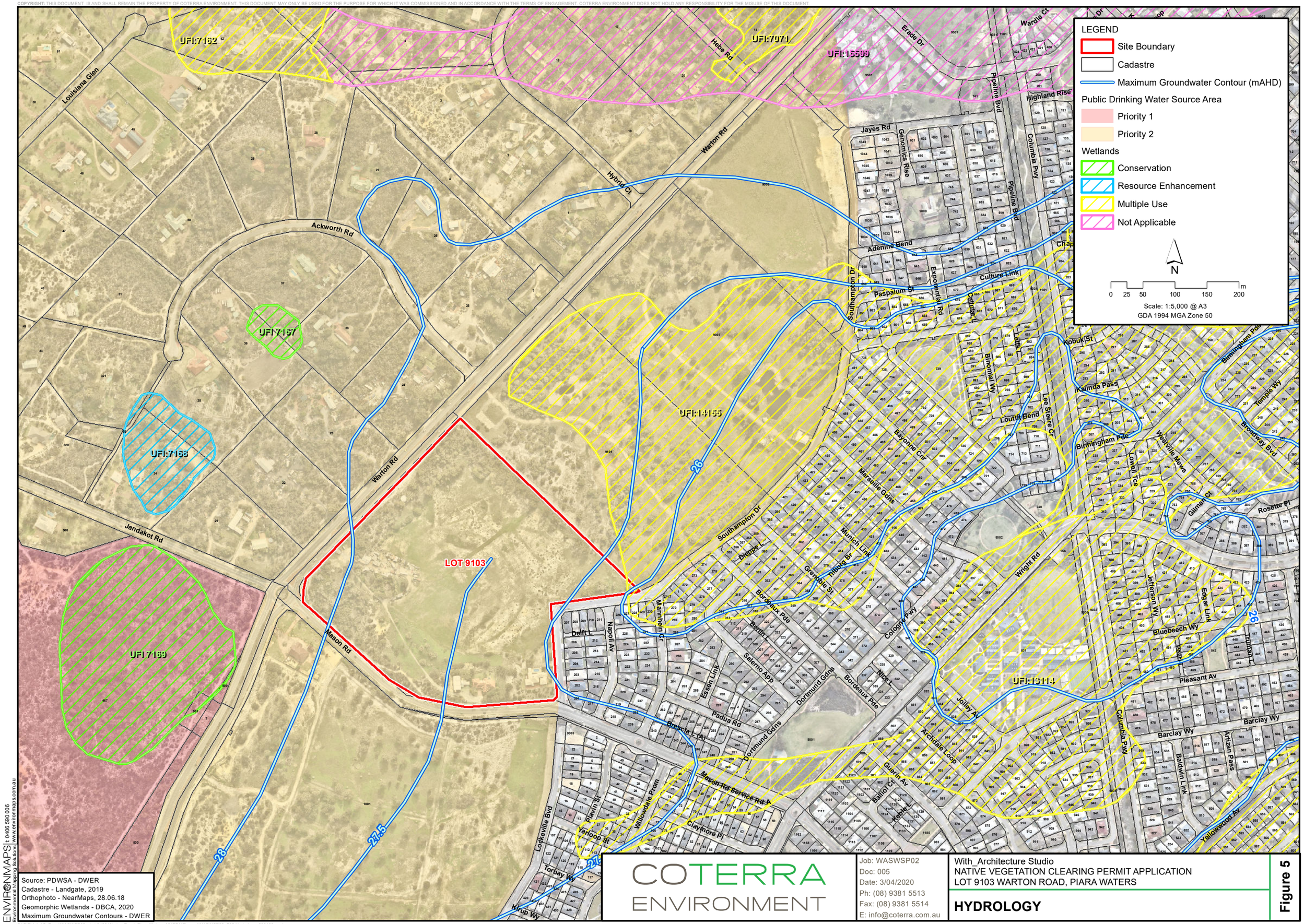
C:\GIS\Jobs\CoTerra\WASWSP02 - Lot 9103 Warton Road, Piara Waters, NVCPA\Figures\WASWSP02_F04 Topography and Soils_200403.mxd

COTERRA ENVIRONMENT
Job: WASWSP02
Doc: 004
Date: 3/04/2020
Ph: (08) 9381 5513
Fax: (08) 9381 5514
E: info@coterra.com.au

With_Architecture Studio
NATIVE VEGETATION CLEARING PERMIT APPLICATION
LOT 9103 WARTON ROAD, PIARA WATERS

TOPOGRAPHY AND SOILS

Figure 4



Source: PDWSA - DWER
Cadastre - Landgate, 2019
Orthophoto - NearMaps, 28.06.18
Geomorphic Wetlands - DBCA, 2020
Maximum Groundwater Contours - DWER

ENVIRONMAPS | t: 0406 590 006
Environmental Mapping Solutions | www.environmaps.com.au

C:\GIS\Jobs\CoTerra\WASWSP02 - Lot 9103 Warton Road, Piara Waters, NVCPA\Figures\WASWSP02_F05 Hydrology_200403.mxd

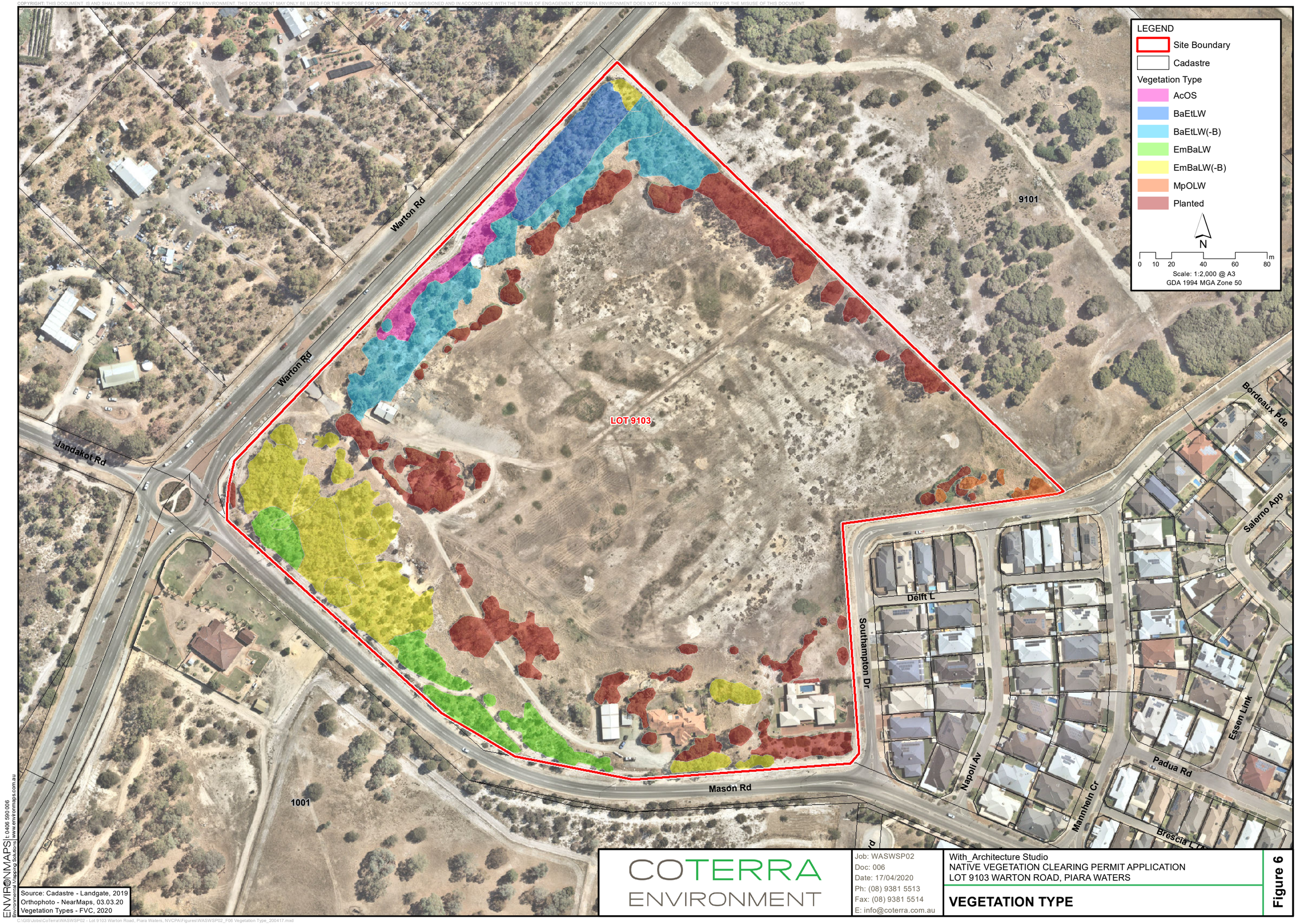
COTERRA ENVIRONMENT

Job: WASWSP02
Doc: 005
Date: 3/04/2020
Ph: (08) 9381 5513
Fax: (08) 9381 5514
E: info@coterra.com.au

With_Architecture Studio
NATIVE VEGETATION CLEARING PERMIT APPLICATION
LOT 9103 WARTON ROAD, PIARA WATERS

HYDROLOGY

Figure 5



Source: Cadastre - Landgate, 2019
Orthophoto - NearMaps, 03.03.20
Vegetation Types - FVC, 2020

ENVIRONMAPS | t: 0406 590 006 | Environmental Mapping Solutions | www.environmaps.com.au

C:\GIS\Jobs\CoTerra\WASWSP02 - Lot 9103 Warton Road, Piara Waters, NVCPA\Figures\WASWSP02_F06 Vegetation Type_200417.mxd

COTERRA ENVIRONMENT
Job: WASWSP02
Doc: 006
Date: 17/04/2020
Ph: (08) 9381 5513
Fax: (08) 9381 5514
E: info@coterra.com.au

With_Architecture Studio
NATIVE VEGETATION CLEARING PERMIT APPLICATION
LOT 9103 WARTON ROAD, PIARA WATERS

VEGETATION TYPE

Figure 6

LEGEND

- Site Boundary
- Cadastre

Vegetation Type

- G: Good
- D-G: Degraded to Good
- D: Degraded
- D-CD: Degraded to Completely Degraded

N

0 12.5 25 50 75 100 m

Scale: 1:2,000 @ A3

GDA 1994 MGA Zone 50

LOT 9103

9101

1001

Source: Cadastre - Landgate, 2019
Orthophoto - NearMaps, 03.03.20
Vegetation Condition - FVC, 2020

ENVIRONMAPS | t: 0406 590 006 | Environmental Mapping Solutions | www.environmaps.com.au

C:\GIS\Jobs\CoTerra\WASWSP02 - Lot 9103 Warton Road, Piara Waters, NVCPA\Figures\WASWSP02_F07 Vegetation Condition_200417.mxd

COTERRA ENVIRONMENT

Job: WASWSP02
Doc: 007
Date: 17/04/2020
Ph: (08) 9381 5513
Fax: (08) 9381 5514
E: info@coterra.com.au

With_Architecture Studio
NATIVE VEGETATION CLEARING PERMIT APPLICATION
LOT 9103 WARTON ROAD, PIARA WATERS

VEGETATION CONDITION

Figure 7

LEGEND

- Site Boundary
- Cadastre

Habitat Tree Location

- Coastal Blackbutt
- Dead Jarrah
- Flooded Gum
- Unknown Planted Non-endemic Eucalyptus

Fauna Habitat

- Low Woodland of Banksia
- Low Woodland of *Melaleuca preissiana*

N

0 12.5 25 50 75 100 m

Scale: 1:2,000 @ A3
GDA 1994 MGA Zone 50

Warton Rd
Warton Rd
Jandakot Rd
LOT 9103
9101
1001
Mason Rd
Bordeaux Pde
Salerno App
Delft L
Southampton Dr
Napoli Av
Mannhein Cr
Padua Rd
Essen Link
Brescia L

Source: Cadastre - Landgate, 2019
Orthophoto - NearMaps, 03.03.20

ENVIRONMAPS | t: 0406 590 006
Environmental Mapping Solutions | www.environmaps.com.au

C:\GIS\Jobs\CoTerra\WASWSP02 - Lot 9103 Warton Road, Piara Waters, NVCPA\Figures\WASWSP02_F08 Fauna Habitat_200422.mxd

COTERRA ENVIRONMENT

Job: WASWSP02
Doc: 008
Date: 22/04/2020
Ph: (08) 9381 5513
Fax: (08) 9381 5514
E: info@coterra.com.au

With_Architecture Studio
NATIVE VEGETATION CLEARING PERMIT APPLICATION
LOT 9103 WARTON ROAD, PIARA WATERS

FAUNA HABITAT

Figure 8

Appendix 1 Preliminary Concept Plan

BUILT FORM LEGEND

STAGE 1

PARKING LEGEND

STAGE 1

FENCE LEGEND

SITE BOUNDARY
PERIMETER FENCE
OVAL FENCE

BUILDING LEGEND

A ADMINISTRATION / MEDICAL CENTRE STUDENT SERVICES
COMMUNITY 1 - HASS LEARNING AREA (1ST FLOOR)

B CAFETERIA
SCIENCE (1ST FLOOR)

C INFORMATION RESOURCE CENTRE / STAFF ROOM

D TECHNOLOGIES LEARNING AREA

E PHYSICAL EDUCATION

F EDUCATION SUPPORT

GENERAL LEGEND

1. AFL OVAL / CRICKET (135m x 115m) - STAGE 1
2. HOCKEY / SOCCER - STAGE 2
3. MULTIPURPOSE COURTS (BASKETBALL & TENNIS)
4. MULTIPURPOSE COURTS (NETBALL & TENNIS)
5. RETAINED VEGETATION
6. BIO RETENTION SWALE
7. FIRE HYDRANT BOOSTER
8. PUMPS & TANKS
9. GAS METER
10. TRANSFORMER
11. TRANSPORTABLES
12. COURTYARDS
13. BIKE RACKS
14. BUS SHED
15. BIN COMPOUND

PARKING BAY INFORMATION STAGE 1

STREET PARKING	**: 54**
ON SITE	**: 130**
CARPARK 1	: 19
CARPARK 2	: 15
CARPARK 6	: 40
CARPARK 7	: 56
DROP OFF BAYS	**: 32**
CARPARK 1	: 6
CARPARK 2	: 4
CARPARK 3	: 8
CARPARK 4	: 10
CARPARK 5	: 4
TOTAL PARKING BAYS	
OFF-SITE	: 54
ON-SITE	: 130
DROP OFF	: 32
BUS BAYS	
OFF-SITE	: 7
ON-SITE	: 3

REQUIRED PARKING BAYS : 183
PROVIDED PARKING BAYS : 184 + (32 DROP OFF BAYS)

TOTAL PARKING BAYS STAGE 1 : 216

NEW SECONDARY SCHOOL SCHEMATIC DESIGN BMW	MASTERPLAN STAGE 1	JOB №: 2001 DWG №: SD1.01_E DATE: 20/04/20	SCALE: 1 : 2000@ A3 N	With_Architecture Studio 346 William Street, Perth Western Australia 6000	Ph 08 9328 4475 info@withstudio.com.au www.withstudio.com.au

with_ architecture studio

Appendix 2 EPA Advice on MRS Amendment

GOVERNMENT OF WESTERN AUSTRALIA

Environmental Protection Authority

S48A Referrals

Title: Metropolitan Region Scheme Amendment 1370/57 – West Piara High School Site

Location: West Piara

Description: The Western Australian Planning Commission proposes to rezone approximately 13 hectares of land in Piara Waters from the 'Rural-Water Protection' zone to the 'Public Purposes – High School' reservation. The amendment will facilitate the future construction of a new high school.

Ref ID: CMS17787

Date Received: 5/3/2020 **Date Sufficient Information Received:** 5/3/2020

Responsible Authority: Western Australian Planning Commission

Contact: Brett Pye

Preliminary Environmental Factors: Flora and Vegetation, Terrestrial Fauna, Inland Waters and Social Surroundings

Potential Significant Effects: Clearing of low represented vegetation and fauna habitat. Impacts to the Jandakot Underground Water Pollution Control Area, and drinking water production bores. Noise impacts from nearby existing dog kennels.

Management: Potential impacts to the above environmental factors can be managed through implementation of the EPA's advice and through future planning processes, including a local planning scheme amendment to be referred to the EPA.

Determination: **Referral Examined, Preliminary Investigations and Inquiries Conducted. Scheme Amendment Not to be Assessed Under Part IV of EP Act. Advice Given. (Not Appealable)**

The EPA has carried out some investigations and inquiries before deciding not to assess this scheme. In deciding not to formally assess schemes, the EPA has determined that no further assessment is required by the EPA.

This Determination is not appealable.

Chairman's Initials:

Date: 25 March 2020

GOVERNMENT OF WESTERN AUSTRALIA

Environmental Protection Authority

Ms Sam Fagan
The Secretary
Western Australian Planning Commission
Locked Bag 2506
PERTH WA 6001

Our Ref: *CMS17787*
Enquiries: *Steve Pavey, 6364 7600*
Email: *Steve.Pavey@dwer.wa.gov.au*

Dear Ms Fagan

DECISION UNDER SECTION 48A(1)(a)
Environmental Protection Act 1986

SCHEME:	**Metropolitan Region Scheme Amendment 1370/57 – West Piara High School Site**
LOCATION:	**West Piara**
RESPONSIBLE AUTHORITY:	**Western Australian Planning Commission**
DECISION:	**Referral Examined, Preliminary Investigations and Inquiries Conducted. Scheme Amendment Not to be Assessed Under Part IV of EP Act. Advice Given. (Not Appealable)**

Thank you for referring the above proposed scheme to the Environmental Protection Authority (EPA).

After consideration of the information provided by you, the EPA considers that the proposed scheme should not be assessed under Part IV Division 3 of the *Environmental Protection Act 1986* (EP Act) but nevertheless provides the attached advice and recommendations. I have also attached a copy of the Chairman's determination of the scheme.

Prime House, 8 Davidson Terrace, Joondalup, Western Australia 6027
Telephone 08 6364 7600 I Email info.epa@dwer.wa.gov.au

Locked Bag 10, Joondalup DC WA 6919

www.epa.wa.gov.au

Please note the following:

- For the purposes of Part IV of the EP Act, the scheme is defined as an assessed scheme. In relation to the implementation of the scheme, please note the requirements of Part IV Division 4 of the EP Act.

- There is no appeal right in respect of the EPA's decision to not assess the scheme.

A copy of the Chairman's determination, this letter and the attached advice and recommendations will be made available to the public via the EPA website.

Yours sincerely

A Sutton

Anthony Sutton
Delegate of the Environmental Protection Authority
Executive Director
EPA Services

27 March 2020

Encl. Scheme Advice and Recommendations
Chairman's Determination

ADVICE UNDER SECTION 48A(1)(a)
ENVIRONMENTAL PROTECTION ACT 1986

Metropolitan Region Scheme Amendment 1370/57 - West Piara High School Site

Location: **West Piara**

Determination: **Scheme Not Assessed – Advice Given (not appealable)**

Determination Published: 30 March 2020

Summary

The Western Australian Planning Commission (WAPC) proposes to reserve approximately 13 hectares (ha) of land in Piara Waters as 'Public Purposes – High School' to facilitate the future construction of a high school. The land is currently zoned 'Rural-Water Protection'.

The Environmental Protection Authority (EPA) has considered Metropolitan Region Scheme Amendment 1370/57 (MRS 1370/57) in accordance with the requirements of the *Environmental Protection Act 1986* (EP Act). The EPA has based its decision on the documentation provided by the WAPC and having considered this matter, the following advice is provided.

1. Environmental Factors

The EPA has identified the following preliminary environmental factors relevant to MRS 1370/57:

- Inland Waters;
- Flora and Vegetation;
- Terrestrial Fauna; and
- Social Surroundings.

2. Advice and Recommendations regarding Environmental Factors

The EPA considers MRS 1370/57 is unlikely to have a significant effect on the environment and does not warrant formal assessment under Part IV of the EP Act. However there are a number of environmental issues which require resolution prior to the initiation and referral of future local planning amendments to the EPA. The following advice is provided in this regard:

Inland Waters

The amendment area is within a Priority 2 Drinking Water Source Protection Area, the Jandakot Underground Water Pollution Control Area and partially within two drinking water wellhead protection zones.

The District Water Management Strategy (DWMS) submitted to the Department of Water and Environmental Regulation (DWER) for approval requires changes to sufficiently address the impacts, risks and management of urban development for surface water and groundwater resources.

The EPA recommends approval of the DWMS by the DWER prior to finalisation of MRS1370/57.

Flora and Vegetation, Terrestrial Fauna

The amendment area contains poorly represented remnant vegetation (Southern River complex - 14% remaining) and threatened species of black cockatoo habitat. The amendment area may also contain threatened flora known to occur within the local area.

Updated flora and vegetation and fauna surveys are required to inform future local planning scheme amendments. Since the provided October 2011 Bennett Environmental Consulting survey, several threatened and priority taxa are now known to occur in the local area (within 10km). The survey was also likely to have been too late to identify any *Caladenia huegelii* and possibly other threatened orchids. The EPA recommends that future surveys are undertaken consistent with EPA technical guidance.

The EPA does not support a concurrent amendment to the City of Armadale local planning scheme for West Piara when MRS 1370/57 is finalised. The EPA recommends future local planning scheme amendments be referred to the EPA which contain scheme map and/or text provisions which demonstrate avoidance and management of impacts to the environmental values, informed by the surveys required above.

Social Surroundings

The EPA notes there are several existing dog kennels to the north-west of the amendment area with potential for impacts on future residents. The EPA's GS 3 recommends a separation distance of 500 metres due to potential noise and odour impacts, unless site specific studies inform a reduced separation distance.

Conclusion

The EPA concludes the scheme amendment can be managed to meet the EPA's environmental objectives through existing planning controls. The EPA further recommends future City of Armadale local planning scheme amendment should contain specific scheme provisions, informed by surveys, to demonstrate how impacts to these values will be avoided and/or managed.

Appendix 3 Reconnaissance Level Flora and Vegetation Survey (Focused Vision Consulting, 2020)

FLORA AND VEGETATION REVIEW
LOT 9103 WARTON ROAD, PIARA WATERS

COTERRA ENVIRONMENT

MAY 2020

Focused Vision Consulting Pty Ltd
ABN 25 605 804 500

Please direct all enquiries to:
Focused Vision Consulting Pty Ltd
8/83 Mell Road, SPEARWOOD WA 6163
P: 08 6179 4111
E: admin@focusedvision.com.au

Document History

Rev.	Author	Reviewed	Approved	Date
A	Adrian Barrett Botanist/Ecologist	Kellie Bauer-Simpson Principal Ecologist		06/04/2020
B	Adrian Barrett Botanist/Ecologist	Kellie Bauer-Simpson Principal Ecologist	Kellie Bauer-Simpson Principal Ecologist	07/04/2020
0	Adrian Barrett Botanist/Ecologist Lisa Chappell Senior Botanist/ Environmental Scientist	Kellie Bauer-Simpson Principal Ecologist	Kellie Bauer-Simpson Principal Ecologist	18/04/2020
1	Adrian Barrett Botanist/Ecologist Lisa Chappell Senior Botanist/ Environmental Scientist	Kellie Bauer-Simpson Principal Ecologist	Kellie Bauer-Simpson Principal Ecologist	07/05/2020

TABLE OF CONTENTS

FIGURES

TABLES

EXECUTIVE SUMMARY

Coterra Environment (Coterra) is assisting a client with the proposed development of Lot 9103 Warton Road, Piara Waters. The site is proposed to be developed as a school and a native vegetation clearing permit (NVCP) will be required.

To facilitate the NVCP application, Focused Vision Consulting Pty Ltd (FVC) was commissioned to undertake an overview site inspection for flora and vegetation values of the study area and report on the outcomes, as a supplement to a previous study completed by Bennett Environmental Consulting Pty Ltd (Bennett) (2011).

The scope of study was to:

- request and review a revised Department of Biodiversity, Conservation and Attractions (DBCA) database search, to determine Threatened and Priority flora potentially supported by the site
- review the previous study report by Bennett (2011) as pertinent to the study area
- undertake an overview site inspection, aimed at verifying the vegetation type and condition mapping of Bennett (2011), with a focus on Banksia woodland, in an effort to provide conclusions as to the likely existence, condition and extent of the Banksia Woodlands of the Swan Coastal Plain ecological community (Banksia Woodlands Threatened Ecological Community (TEC)) at the site, plus verification of habitats potentially provided for Threatened flora (focused on *Austrostipa jacobsiana, Caladenia huegelii, Drakaea elastica* and *Diuris purdiei*)
- prepare a report, to supplement the Bennett (2011) report and accompany the NVCP application that includes:
    - revised (as applicable) vegetation unit mapping
    - revised (as applicable) vegetation condition mapping
    - commentary and preliminary conclusions regarding the existence, condition and extent of the Banksia woodland TEC at the site
    - commentary and preliminary conclusions regarding the provision of suitable habitat for and likelihood of occurrence of conservation significant flora, particularly *Austrostipa jacobsiana, Caladenia huegelii, Drakaea elastica* and *Diuris purdiei*
    - recommendations for further in-fill survey work that may be carried out in spring 2020.

The key findings arising from the flora and vegetation review of the study area were as follows:

- No Threatened flora listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) or *Biodiversity Conservation Act 2016* (BC Act) were recorded.
- One possible Priority flora species, *Jacksonia* ?*gracillima* (P3), was recorded within vegetation unit EmBaLW.
- The survey timing (late March) was not optimal for the identification of flowering flora, annual and ephemeral species and therefore, it is unlikely all species relevant to the study area were recorded.
- The timing of the field assessment could have also limited the accuracy of vegetation unit and condition mapping, since not all flora species naturally occurring during spring would have been observable. However, given the degraded nature of the majority of the study area, this is unlikely to have represented a major limitation.
- Of the four Threatened flora species given particular focus; *Austrostipa jacobsiana*, *Caladenia huegelii, Diuris purdiei* and *Drakaea elastica*, it is considered that all could possibly occur. However, specific habitat suitability for all species besides *Caladenia huegelii* is low to negligible. *Caladenia huegelii* could occur within vegetation units EmBaLW or BaEtLW.

- It is also considered possible for a fifth Threatened flora species, *Drakaea micrantha,* to occur, however, specific micro-habitats (bare sand lenses) were not observed within the study area and therefore, the actual likelihood if this species occurrence is also considered unlikely.
- Six vegetation units, plus 'planted' and 'cleared' areas were recorded within the study area, with two of the recorded units representing remnant vegetation with areas in 'Good' or better condition.
- Of the recorded vegetation units, two represent Banksia woodland, which both meet diagnostic criteria to be considered representative of the Banksia Woodlands TEC. However, the size of the areas of these woodlands do not meet minimum condition thresholds, even when considered in the context of regional adjacent Banksia woodland vegetation and therefore are not eligible for inclusion as a Matter of National Environmental Significance (MNES) protectable under the EPBC Act

Based on the findings of the study, it is recommended that suitably timed targeted flora surveys be carried out, focused on *Caladenia huegelii* and *Jacksonia gracillima,* and also addressing other relevant species arising from the desktop assessment.

It is not considered that any follow-up survey work for the characterisation of vegetation types, condition or conservation significance is required, based on the combined results of the Bennett (2011) and current studies.

1 INTRODUCTION

1.1 BACKGROUND

Coterra Environment (Coterra) is assisting a client with the proposed development of Lot 9103 Warton Road (the study area), Piara Waters. The study area is proposed to be developed as a school and the project is currently driven by an urgent timeline. A native vegetation clearing permit (NVCP) will need to be obtained from the Department of Water and Environmental Regulation (DWER). To expediate the application process, Coterra aims to lodge an application for a NVCP as soon as possible, based on reviews of a previous study and an initial field assessment undertaken in summer. To meet regulatory requirements, a follow-up targeted survey is likely to be undertaken in spring.

In October 2011, Bennett Environmental Consulting Pty Ltd (Bennett) undertook a vegetation and flora assessment of selected lots along Warton Road, which included Lot 9103 (the study area) (**Appendix A**). As part of the NVCP application, this current study reviewed previous vegetation mapping by Bennett (2011), to verify the presence of the Banksia Woodlands of the Swan Coastal Plain ecological community (Banksia Woodlands Threatened Ecological Community (TEC)) within the study area. Furthermore, the current study aimed to identify the presence of habitat suitable for conservation flora (identified from desktop studies) to determine the need to target any such flora during future spring surveys.

1.2 LOCATION

The study area is located approximately 20 kilometres (km) south of Perth in the suburb of Piara Waters (**Figure 1**). The study area occupies approximately 12.7 ha.

1.3 SCOPE OF WORK

The scope of work included undertaking an overview site inspection for flora and vegetation values of the study area and reporting the outcomes.

The agreed approach for the study was to address the following:

- request and review a revised Department of Biodiversity, Conservation and Attractions (DBCA) database search, to determine Threatened and Priority flora potentially supported by the site
- review the previous study report by Bennett (2011) as pertinent to the study area (**Appendix A**)
- undertake an overview site inspection, aimed at verifying the vegetation type and condition mapping of Bennett (2011), with a focus on Banksia woodland, in an effort to provide conclusions as to the likely existence, condition and extent of the Banksia Woodlands TEC at the site, plus verification of habitats potentially provided for Threatened flora (focused on *Austrostipa jacobsiana, Caladenia huegelii, Drakaea elastica* and *Diuris purdiei*)
- preparation of a report, to supplement the Bennett (2011) report and accompany the NVCP application that includes:
    - revised (as applicable) vegetation unit mapping
    - revised (as applicable) vegetation condition mapping
    - commentary and preliminary conclusions regarding the existence, condition and extent of the Banksia woodland TEC at the site
    - commentary and preliminary conclusions regarding the provision of suitable habitat for and likelihood of occurrence of conservation significant flora, particularly *Austrostipa jacobsiana, Caladenia huegelii, Drakaea elastica* and *Diuris purdiei*
    - recommendations for further in-fill survey work that may be carried out in spring 2020.

1.4 PREVIOUS BIOLOGICAL ASSESSMENT

The vegetation and flora assessment conducted by Bennett Environmental Consulting (Bennett) during October 2011 (**Appendix A**), encompassed an area in Piara Waters along the eastern side of Warton Road between Erade Drive to the north and Armadale Road to the south (assessment area).

A total of 244 flora species from 58 families were recorded including 74 introduced (weed) species. Two Declared Pest plants (weeds), (**Rubus laudatus* and **Zantedeschia aethiopica*) were recorded. Thirty-three of the weeds recorded were listed as having a high ecological impact on the environment. Furthermore, 47 of the weeds recorded were listed as having a rapid rate of dispersal (Bennett 2011).

Within the assessment area, Bennett (2011) reported large areas as cleared and only small pockets of remnant vegetation remaining. A total of 14 vegetation units were described , broadly classified into uplands (three units), wetlands (nine units) and herblands/sedgelands/grasslands (two units) (Bennett 2011).

Within the current study area, the majority was defined by Bennett (2011) as *cleared areas, homes and surrounds or planted non-endemic trees.* Three vegetation units were recorded within the study area (Bennett 2011) which were defined as:

- **Bm** - Low Woodland A of *Banksia attenuata*, *Banksia menziesii*, *Allocasuarina fraseriana*, *Nuytsia floribunda* and *Eucalyptus marginata* subsp*. marginata* over Low Scrub B dominated by *Xanthorrhoea preissii* or Dwarf Scrub C dominated by *Hibbertia hypericoides* over Tall Grass dominated by **Avena barbata and *Ehrharta calycina* in grey sand
- **Bt** - Low Woodland A of *Banksia attenuata*, *Banksia menziesii*, *Allocasuarina fraseriana*, *Nuytsia floribunda* and *Eucalyptus todtiana* over Heath B of mixed taxa dominated by *Xanthorrhoea preissii* over Open Tall Grass dominated by **Ehrharta calycina* over Open Herbs dominated by *Dasypogon bromeliifolius* or *Phlebocarya ciliata* in grey sand
- **MK** - Low Woodland A of *Melaleuca preissiana* over Dense Thicket of *Kunzea glabrescens* over Herbs dominated by *Dasypogon bromeliifolius* in grey sand.

Bennett (2011) concluded that no TECs or Priority Ecological Communities (PECs) occurred within the assessment area. However, at the time of the assessment, the Banksia Woodlands TEC was not yet listed and there was no targeted survey of Banksia woodland communities in this regard.

The Banksia Woodlands TEC was approved for inclusion as Endangered under the EPBC Act on 16 September 2016 which is discussed in further detail in **Section 2.5**.

No Threatened or Priority flora were recorded by within the assessment area (Bennett 2011). The timing of the assessment was considered optimal for recording and identifying flora on the Swan Coastal Plain. Therefore, it is likely that if Threatened and Priority flora were present, they would have been observed.

0 25 50 75 100 m

GDA 94 / MGA Zone 50

Figure 1 - Study Area

Legend

Study Area

FOCUSED VISION consulting

2 EXISTING ENVIRONMENT

2.1 CLIMATE

The study area occurs on the Swan Coastal Plain, which has a warm Mediterranean climate, is characterised by hot dry summers and cool to mild wet winters (Mitchell *et al.* 2002). The Bureau of Meteorology (BoM) Jandakot Aero weather station (Site 009172) is the closest to the study area, operating since 1972. Average annual long-term rainfall recorded at the station is 819.6 mm. Annual mean maximum temperatures range from 18.0°C in winter to 31.6°C in summer (BoM 2020). In 2020, monthly rainfall in January was very low compared to the long-term average, while in February rainfall increased but was only half the long-term average (**Figure 2**).

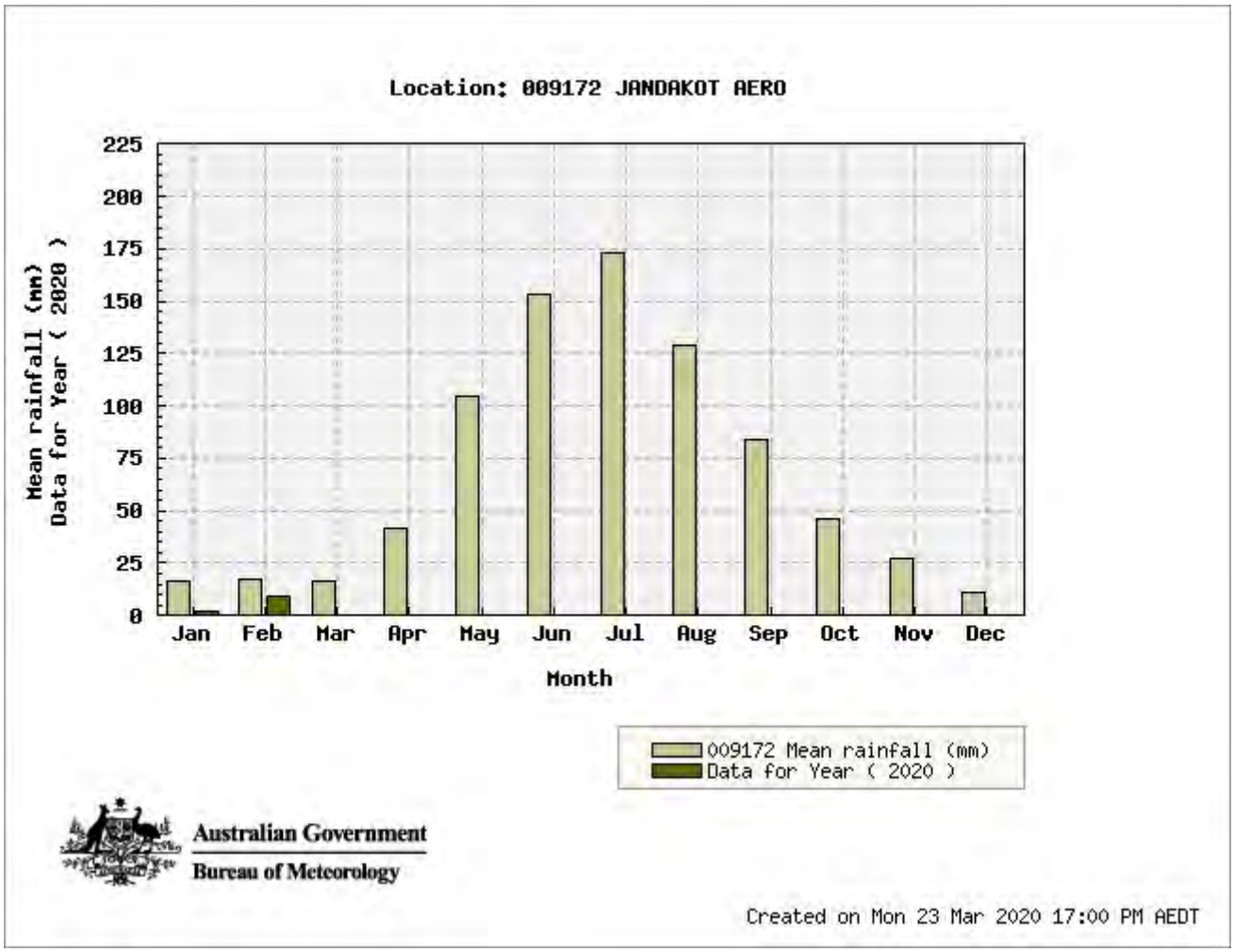


Figure 2 - Climate Data for Jandakot Aero (BoM 2020)

2.2 IBRA REGION

There are 89 recognised Interim Biogeographic Regionalisation for Australia (IBRA) regions across Australia that have been defined based on climate, geology, landforms and characteristic vegetation and fauna (Department of Agriculture, Water and the Environment (DAWE) 2020a). The study area lies within the Swan Coastal Plain (SWA) IBRA region, and at a finer scale, within the Perth subregion (SWA2; Mitchell *et al.* 2002).

The Swan Coastal Plain bioregion is a low lying coastal plain, mainly covered with Banksia and Tuart woodlands on sandy soils. The Perth subregion is composed of colluvial and aeolian sands, alluvial river flats, coastal limestone, as well as heath and/or Tuart woodlands on limestone, Banksia and Jarrah-Banksia woodlands on Quaternary marine dunes of various ages, Marri on colluvial and alluvials (Mitchell *et al.* 2002).

2.3 GEOLOGY AND SOILS

The Swan Coastal Plain supports five major geomorphological systems (landforms) that lie parallel to the coast. From west to east these are: Quindalup Dunes, Spearwood Dunes, Bassendean Dunes, Pinjarra Plain and Ridge Hill Shelf (Churchward and McArthur 1980; Gibson *et al.* 1994). The study area is situated on the Bassendean Dunes system (Churchward and McArthur 1980).

The Bassendean Dunes System consists of sand dunes and sandplains with deep pale sand, semi-wet and wet soil.

2.4 VEGETATION

Vegetation of the Swan Coastal Plain has been broadly mapped by Beard (1990), and later re-assessed by Shepherd *et al.* (2002), into vegetation associations. Mapping depicted the native vegetation as it was presumed to be at the time of European settlement and is referred to as pre-European vegetation mapping.

One vegetation association, 1001, occurs within the study area. This vegetation association only occurs on the Swan Coastal Plain. It is described as a medium very sparse woodland of jarrah, with low woodland of banksia and casuarina (Beard 1990). The remaining extent of the 1001 vegetation association on the Swan Coastal Plain and in the City of Armadale are presented in **Table 1**.

Table 1 – Pre-European Vegetation (1001 Vegetation Association) of the Study Area

Extent Context	Pre–European Extent (ha)	Current Extent (ha)	% Pre-European Extent Remaining	% Current Extent Protected (IUCN I –IV)
Swan Coastal Plain	57,410.23	12,704.45	22.13	2.80
City of Armadale	3,332.90	1,110.02	33.30	2.62

Vegetation of the Swan Coastal Plain has also been defined by Heddle *et al.* (1980) into complexes based on vegetation in association with landforms and underlying geology. The study area is situated on one vegetation complex, the 'Southern River Complex'. This vegetation complex is described as an open woodland of marri - jarrah - Banksia species with fringing woodland of *Eucalyptus rudis* (flooded gum) - *Melaleuca rhaphiophylla* (swamp paperbark) along creek beds. The remaining extent on the Swan Coastal Plain and in the City of Armadale are presented in **Table 2**.

Table 2 – Extent of Southern River Vegetation Complex within the Study Area

Extent Context	Pre–European Extent (ha)	Current Extent (ha)	% Pre-European Extent Remaining
Swan Coastal Plain	58,781.48	10,828.04	18.42
City of Armadale	4,107.89	1,024.58	24.94

2.5 THREATENED ECOLOGICAL COMMUNITIES

TECs are naturally occurring biological assemblages that occur in a particular habitat type and are subject to processes that threaten to destroy or significantly modify the assemblage across its range (DAWE 2020b). Vegetation communities in Western Australia may be considered threatened once they have been identified as such by the Western Australian Threatened Ecological Communities Scientific Advisory Committee.

With regards to Commonwealth significance, some TECs or PECs of State (WA) significance are listed under the EPBC Act. Under the Act, a person must not take an action that has or will have significant impact on a listed TEC without approval from the Commonwealth Minister for the Environment, unless those actions are not prohibited under the Act. One Commonwealth listed TEC, the Banksia woodlands TEC potentially occurs within the study area.

The Banksia Woodlands TEC is woodland associated with some soils of the Swan Coastal Plain with a prominent tree layer of Banksia with scattered Eucalypts and other tree species among or emerging above the canopy. The understorey is comprised of a species rich mix of sclerophyllous shrubs, graminoids and forbs (Threatened Species Scientific Committee (TSSC) 2016).

The Banksia Woodlands TEC is largely restricted to the Swan Coastal Plain IBRA bioregion, within the Perth (SWA02) and Dandaragan (SWA01) subregions. It extends into the adjacent Jarrah Forrest IBRA region (JA01 and JA02 subregions) and areas of the Whicher and Darling escarpments where pockets of Banksia woodland may occur. This TEC mainly occurs on deep Bassendean and Spearwood sands or occasionally on Quindalup sands at the eastern edge (TSSC 2016).

Twenty-one Floristic Community Types (FCTs) described by Gibson *et al.* (1994) best correspond to the Banksia Woodlands TEC (TSSC 2016) and these are summarised in **Table 3**.

Table 3 - Floristic Community Types Corresponding to the Banksia Woodlands TEC

FCT	FCT Name	WA TEC/PEC	EPBC TEC
Supergroup 3 – Uplands centered on Bassendean Dunes and Dandaragan Plateau			
20a	*Banksia attenuata* woodlands over species rich dense shrublands	Endangered	
20b	Eastern *Banksia attenuata* and/or *Eucalyptus marginata* woodlands	Endangered	
20c	Eastern shrublands and woodlands	Critically Endangered	Endangered
21a	Central *Banksia attenuata* - *Eucalyptus marginata* woodlands		
21b	Southern *Banksia attenuata* woodlands	P3	
21c	Low lying *Banksia attenuata* woodlands or shrublands	P3	
22	*Banksia ilicifolia* woodlands	P3	
23a	Central *Banksia attenuata* - *Banksia menziesii* woodlands		
23b	Northern *Banksia attenuata* - *Banksia menziesii* woodlands	P3	
23c	North-eastern *Banksia attenuata* - *Banksia menziesii* woodlands		
S09	*Banksia attenuata* woodlands over dense low shrublands		
Supergroup 4 – Uplands centered on Spearwood and Quindalup Dunes			
24	Northern Spearwood shrublands and woodlands	P3	
25	Southern *Eucalyptus gomphocephala – Agonis flexuosa* woodlands	P3	
28	Spearwood *Banksia attenuata* or *Banksia attenuata – Eucalyptus* woodlands		
Whicher Scarp FCTs (Keighery *et al.* 2012)			
A1	Central Whicher Scarp Mountain Marri Woodland WHSFCT_A1	P1	
A2	North Whicher Scarp Jarrah and Woody Pear woodland WHSFCT_A2		
A3	North Whicher Scarp *Banksia* and Woody Pear woodland WHSFCT_A3		
A4	Whicher Scarp *Banksia grandis*, Jarrah and Marri woodland WHSFCT_A4		
B1	Swan Coastal Plain / North Whicher Scarp *Banksia attenuata* woodland WHSFCT_B1		
B2	West Whicher Scarp *Banksia attenuata* woodland WHSFCT_B2		
C2	Whicher Scarp Jarrah woodland on deep coloured sands WHSFCT_C2		

3 METHODOLOGY

3.1 DESKTOP REVIEW

A desktop assessment for Threatened and Priority flora potentially occurring within the study area was undertaken prior to the field studies. The desktop assessment consisted of database searches using NatureMap (DBCA 2020a) (**Appendix B**), DBCA database (DBCA 2020b) and the Commonwealth Protected Matters Search Tool (PMST) for Matters of National Environmental Significance (MNES) (DAWE 2020b) (**Appendix C**). All search tools were based on the approximate centre of the study area, being -32.1252 latitude, 115.9076 longitude with a 10 km buffer (radius).

3.2 FIELD ASSESSMENT

An overview site inspection (reconnaissance survey) was undertaken by Kellie Bauer-Simpson (Principal Ecologist) and Adrian Barrett (Botanist/Ecologist) on 25 March 2020. The purpose of the survey was to verify the vegetation types and condition mapping of Bennett (2011), with particular focus on Banksia woodlands which may represent the Banksia woodlands TEC.

The survey was also intended to identify any potentially suitable habitats for Threatened and Priority flora, with particular focus on the following Threatened flora; *Austrostipa jacobsiana*, *Caladenia huegelii, Diuris purdiei* and *Drakaea elastica*.

Relevé sites were used to verify and determine vegetation types and condition. In total five relevés (sites) were assessed within the study area (**Figure 3**). Sites were selected using aerial imagery, during initial field planning conducted at a desktop level, plus added in the field where appropriate, such as where different vegetation units and condition were identified. Sites were selected to provide representative and replicate samples of each vegetation unit, with particular focus on Banksia woodland. Field data were collected using an electronic tablet with customised data forms and mobile spatial mapping capability, within the software program, Mappt™.

The following data were collected from each site:

- observer
- date
- site
- GPS location (GDA94; zone 50)
- representative photograph
- soil type and colour
- topography
- flora species observed, including average height and projected foliage cover of dominant species within each stratum
- vegetation condition, assessed against the currently accepted condition scale of Keighery (1994).

The field assessment also included a targeted search for Threatened and Priority flora identified from the desktop search. Where suspected Threatened or Priority flora were observed, the following data were to be recorded:

- GPS location of each individual plant allowing an inventory of the plants/population size
- vegetation type and condition at the recorded location
- condition of plants
- reproductive status.

0 25 50 75 100 m

GDA 94 / MGA Zone 50

Figure 3 - Relevé Locations

Legend

Study Area

Relevé

FOCUSED VISION consulting

4 RESULTS AND DISCUSSION

4.1 DESKTOP REVIEW

4.1.1 Threatened and Priority Flora

The desktop assessment identified 65 Threatened and Priority flora species previously recorded within 10 km of the study area (**Table 4** and **Figure 4**). Of the 65 species identified in the desktop search, 21 are Threatened species listed under the EPBC Act and *Biodiversity Conservation Act* (BC Act), five are Priority 1 flora, six are Priority 2, 20 are Priority 3 and 13 are Priority 4. None of the 65 species were considered 'likely' to occur. Seventeen were considered as 'possibly' occurring within the study area, consisting of four Threatened species, one Priority 1 species, three Priority 2 species, four Priority 3 species and five Priority 4 species. The remaining 48 species were considered 'unlikely' to occur (**Table 4**).

Table 4 - Threatened and Priority Flora with the Potential to Occur within the Study Area

Species	EPBC Conservation Status	WA Conservation Status	Description	Habitat Preference	Likelihood of Occurrence
Austrostipa jacobsiana	Critically Endangered	Critically Endangered	Clumping, rhizomatous perennial grass growing to 1.2 m high (incl. flower spike) with leaves to 0.5 m long. Produces green flowers from October to November.	Grey clay, sandy clay, sandy loam soils. Flats and damplands, fringing winter wet depressions.	Possible – suitable habitat may be present. Closest record approx. 6 km east.
Grevillea thelemanniana	Critically Endangered	Critically Endangered	Spreading, lignotuberous shrub growing between 0.3-1.5 m high. Produces red-pink flowers from May to November.	Sand, sandy clay soils. Winter wet low lying flats.	Unlikely – unlikely suitable habitat present. Closest record >10 km north east.
Synaphea sp. Fairbridge Farm (D. Papenfus 696)	Critically Endangered	Critically Endangered	Dense, clumped shrub growing to 0.3-0.6 m high and 0.4-0.8 m wide. Produces yellow flowers on erect spikes 0.07-0.24 m long from September to October.	Grey clayey sand soil with lateritic pebbles. Near winter wet flats, low woodlands with weedy grasses.	Unlikely – unlikely suitable habitat present. Closest record >5 km north.
Synaphea sp. Serpentine (G.R. Brand 103)	Critically Endangered	Critically Endangered	Erect, compact shrub to 0.3 m high. Produces yellow flowers from September to October.	Grey, yellow or brown sandy clay-loam soils. Edge of wetlands, slopes and flats.	Unlikely – closest record >10 km south.
Andersonia gracilis	Endangered	Vulnerable	Slender, erect or open straggly shrub growing to 0.1-0.5 m high. Produces pink to pale mauve flowers in ovoid oblong groups of 4-14 on terminal heads from September to November.	White-grey sand, sandy clay, gravelly loam soils. Winter wet areas, near swamps.	Unlikely – unlikely suitable habitat present. Closest record >10 km north.
Caladenia huegelii	Endangered	Critically Endangered	Tuberous, perennial herb growing to 0.25-0.6 m high with a single pale green, hairy leaf. Produces 1-2 (rarely 3) distinctive flowers with red and green-cream parts from September to October.	Grey, white or brown sand, clay loam soils. Margins of swamps, low depressions and flats. Mixed jarrah and Banksia woodlands.	Possible – suitable habitat present. Closest record approx. 1 km south-east.
Calytrix breviseta subsp. *breviseta*	Endangered	Critically Endangered	Shrub growing to 0.4-0.6 m high. Produces purple or pink or mauve flowers from October to November.	Grey-brown sand, sandy loam soils. Swampy flats, slopes.	Unlikely – closest record >10 km north-east.
Diuris purdiei	Endangered	Endangered	Tuberous, perennial orchid growing to 0.15-0.45 m high. Produces distinct flattened yellow flowers with brown blotches on their underside from September to October.	Grey-black sand, sandy clay moist soils. Winter wet swamps.	Unlikely – unlikely suitable habitat present.
Drakaea elastica	Endangered	Critically Endangered	Tuberous, perennial herb growing to 0.1-0.3 m high with a single bright green, glossy, prostrate heart-shaped leaf. Produces distinctive flower with red and green-yellow parts from October to November.	Bare patches of white or grey sandy soils. Low lying situations adjoining winter wet swamps.	Possible – suitable habitat present. Closest record approx. 9 km south.

Species	EPBC Conservation Status	WA Conservation Status	Description	Habitat Preference	Likelihood of Occurrence
Eremophila glabra subsp. *chlorella*	Endangered	Endangered	Sprawling shrub growing between 0.2-1 m high and 1.5 m wide. Produces green-yellow flowers from July to November.	Grey sand, clayey soil. Winter wet depressions, low rises and valleys.	Unlikely – unlikely suitable habitat present. Closest records >10 km north-east.
Eucalyptus ×balanites	Endangered	Critically Endangered	Mallee with rough flaky grey bark growing to 5-8 m high and 15 m wide. Produces white flowers from October to December or from January to February.	White-grey sand, brown sandy loam soils with lateritic gravel. Slopes.	Unlikely – unlikely suitable habitat. Closest record >10 km south-east.
Goodenia arthrotricha	Endangered	Endangered	Erect perennial herb growing to 0.4 m high. Produces blue flowers from October to November.	Brown sandy loam soils with laterite or granite. Hilltops, slopes and flats, scattered low forest over mixed scrub.	Unlikely – unlikely suitable habitat. Closest record >10 km east.
Grevillea curviloba subsp. *incurva*	Endangered	Endangered	Variable, prostrate to erect shrub growing between 0.1-2.5 m high and 2.5 m wide with greyish-green leaves. Produces creamy-white flowers from August to October.	Sand and sandy loam soils. Winter-wet areas, heath.	Unlikely – unlikely suitable habitat. Closest record >10 km north.
Lepidosperma rostratum	Endangered	Endangered	Rhizomatous, tufted perennial grass-like sedge growing to 0.5 m high. Produces brown flowers in narrow, spike-like inflorescence and fruits in June to August.	Peaty sand, sand, clayey soils. Winter wet swamps.	Unlikely – wetland areas degraded, closest record >10 km north-east.
Macarthuria keigheryi	Endangered	Endangered	Small, erect shrub growing to 0.4 m high with bright yellow to green stems. Leaves mainly at the base of stems and on young growth. Produces flowers with white and green parts from September to December and February to March.	Open patches of white or grey sandy soil. Winter wet depressions, jarrah and banksia woodlands.	Unlikely – wetland areas degraded, closest record >10 km north.
Thelymitra dedmaniarum	Endangered	Critically Endangered	Tuberous, perennial herb growing to 0.8 m high with a single broad-ovate leaf to 0.15 m long. Produces up to 10 yellow-orange flowers, with distinct cinnamon scent, from October to December.	Red-brown sandy-loam soil associated with granite and dolerite. Wandoo and jarrah woodlands.	Unlikely – unlikely suitable habitat. Closest record >10 km north-east.
Thelymitra stellata	Endangered	Endangered	Tuberous perennial herb growing to 0.25 m high with a single lily-like leaf to 0.9 m long. Produces up to 6 golden-brown or yellow with orange striped flowers from September to November.	Sandy loam soils with lateritic gravel. Ridges, slopes and gullies in wandoo and jarrah woodland.	Unlikely – unlikely suitable habitat. Closest record >10 km north-east.
Conospermum undulatum	Vulnerable	Vulnerable	Erect, compact shrub growing to 1.5-2 m high with distinctive fibrous, longitudinally fissured stems and hairless, wavy leaves to 0.12 m long. Produces white flowers held above the leaves from May to October.	Grey or yellow-orange clayey sand soils. Flats and slopes often over laterite and occasionally in slightly swampy areas.	Unlikely – unlikely suitable habitat. Closest record >10 km north-east.

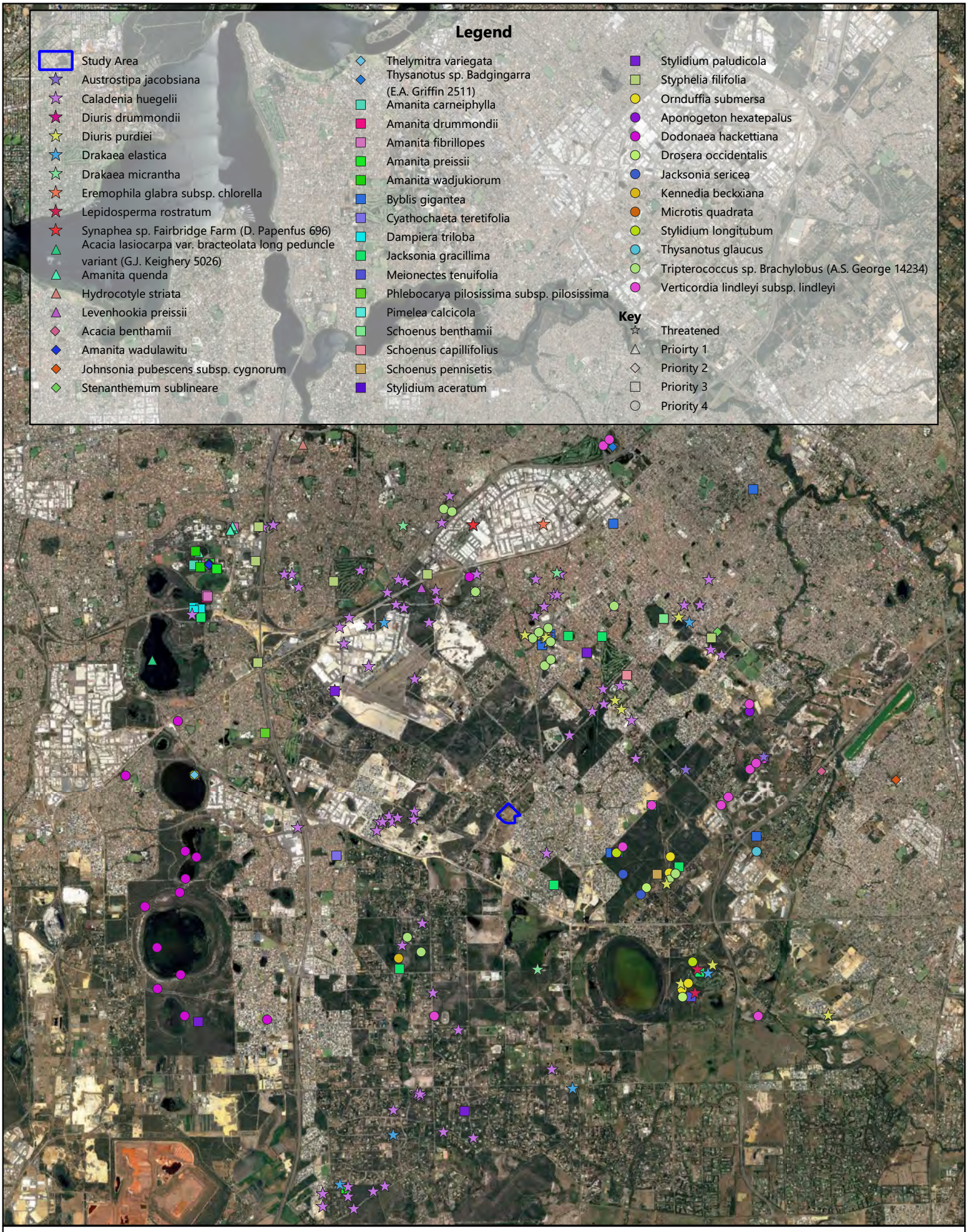
Species	EPBC Conservation Status	WA Conservation Status	Description	Habitat Preference	Likelihood of Occurrence
Diuris drummondii	Vulnerable	Vulnerable	Tuberous, perennial tall orchid growing to 0.5-1 m high. Produces 3-8 pale yellow flowers from November to January.	Brown sandy clay, moist peat soils. Low lying depressions, swamps.	Unlikely – unlikely suitable habitat. Closest record >6 km north-east.
Drakaea micrantha	Vulnerable	Endangered	Tuberous, perennial herb growing to 0.15-0.3 m high with a single silvery-grey, prostrate heart-shaped leaf. Produces distinct flower with red and yellow parts from September to October.	Bare patches of white-grey sandy soils. Winter wet swamps, disturbed areas.	Possible –suitable habitat may be present. Closest record approx. 3.5 km south-east.
Eleocharis keigheryi	Vulnerable	Vulnerable	Tufted, clumping grass like sedge growing to 0.2-0.4 m high and 0.4 m wide with smooth, erect stems and leaves reduced to straw coloured sheaths. Produces pale green flowers in a narrow, cylindrical flower spike from August to November (December in favourable conditions).	Clay, sandy loam soils. Emergent in freshwater creeks, claypans and wetlands.	Unlikely – no standing water for habitat. Closest records >10 km north-east.
Acacia lasiocarpa var. bracteolata long peduncle variant (G.J. Keighery 5026)	-	Priority 1	Spinescent shrub growing between 0.4-1.5 m high. Produces yellow flowers in globular heads from May or August.	Grey or black sand over clay soils. Swampy areas, winter wet lowlands.	Unlikely – unlikely suitable habitat.
Calytrix simplex subsp. *simplex*	-	Priority 1	Shrub growing between 0.2-1 m high. Produces purple flowers in January (likely longer period).	Grey clayey loam, red-brown gravelly loam soils. Swamps, slopes and flats.	Unlikely – unlikely gravelly or loamy soils present.
Hydrocotyle striata	-	Priority 1	Annual herb growing to 0.1-0.3 m high. Produces cream flowers from December (likely longer period).	Sandy peaty soil. Winter wet drainage lines and depressions.	Unlikely – unlikely suitable habitat.
Levenhookia preissii	-	Priority 1	Erect, compact, annual herb growing to 0.1 m high. Produces pink flowers from October to December.	Grey-brown sandy soil. Winter wet areas, undulating plains.	Possible – suitable habitat may be present. Closest record approx. 5.5 km north-west.
Ptilotus sericostachyus subsp. *roseus*	-	Priority 1	Prostrate to ascending perennial herb. Produces pink with white flowers from September to December.	Unknown.	Unknown. Closest records 10 km north and east.
Acacia benthamii	-	Priority 2	Erect, spinose shrub growing to 1 m high. Produces golden-yellow flowers in globular heads on short stalks in leaf axils from August to September.	Brown, yellow, grey sandy soils. Flats and slopes, sometimes with limestone and wetlands.	Possible – suitable habitat may be present. Closest record approx. 5 km north.
Johnsonia pubescens subsp. *cygnorum*	-	Priority 2	Tufted, perennial, grass like herb (lily) growing to 0.25 m high. Produces greenish cream flowers from September to October.	Grey or yellow sand, sandy clayey soils. Gentle slopes and flats.	Possible – suitable habitat may be present. Closest record approx. 8 km east.

Species	EPBC Conservation Status	WA Conservation Status	Description	Habitat Preference	Likelihood of Occurrence
Poranthera moorokatta	-	Priority 2	Small, annual herb growing to 0.05 m high. Produces white flowers from October to November.	Clay, sandy soils. Winter wet depressions, dunes and flats.	Unlikely – limited (if any) suitable flat, sandy habitat present but closest record >10 km north.
Stenanthemum sublineare	-	Priority 2	Minute shrub growing to 0.1 m high with underground stems. Produces small white flowers from October to November.	Sand, sandy loam soils. Ridges, slopes and flats.	Possible – suitable habitat may be present. Closest record approx. 6 km north-east.
Thelymitra variegata	-	Priority 2	Tuberous, perennial herb growing to 0.1-0.35 m high. Produces conspicuous purple-red flowers with dark purple blotches and yellow parts from June to September.	Sandy clay or sandy soils. Associated with laterite	Unlikely – unlikely lateritic soils present.
Thysanotus sp. Badgingarra (E.A. Griffin 2511)	-	Priority 2	Tuberous, perennial herb growing to 0.4 m high. Produces purple flowers in December (likely longer period).	Sand, sandy loam, sandy clay soils with lateritic gravel. Slopes and occasionally granite outcropping.	Unlikely – unlikely suitable habitat present.
Acacia horridula	-	Priority 3	Harsh, slender, pungent, single-stemmed shrub growing to 0.3-0.6(-1) m high. Produces yellow flowers in globular heads from May to August.	Dark brown sandy loam gravelly soils over granite. Rocky hillsides.	Unlikely – unlikely suitable habitat present.
Asteridea gracilis	-	Priority 3	Annual herb growing to 0.15-0.35 m high. Produces white-pink flowers from September to December.	Sand, clay, gravelly soils. Slopes and flats.	Unlikely – unlikely suitable habitat present. Closest records >10 km east. Species generally occurs at base of, or on, Darling Scarp.
Byblis gigantea	-	Priority 3	Small, branched perennial herb (or sub-shrub) growing to 0.45 m high. Produces purple flowers from September to December or January.	Grey sandy clay, brown-white sand, loamy soils. Seasonally wet areas, swamps and flats.	Possible – suitable habitat may be present but likely disturbed. Closest record approx. 2.5 km east.
Cyathochaeta teretifolia	-	Priority 3	Rhizomatous, clumped, perennial sedge growing to 2 m high and 1.0 m wide. Produces brown-straw flowers from September to January.	Grey sand, sandy clay soil. Lowlands, swamps, creek edges and drainage lines.	Unlikely – unlikely suitable habitat present.
Dampiera triloba	-	Priority 3	Erect perennial, herb or shrub growing to 0.5 m high. Produces blue flowers from August to December.	Dark brown/black peaty, dry grey loamy soils. Wetlands, swamps, slopes and flats.	Unlikely – unlikely peaty, loamy soils present and closest record approx. 8.5 km north-west.
Eryngium pinnatifidum subsp. Palustre (G.J. Keighery 13459)	-	Priority 3	Tuberous, perennial herb growing to 0.4 m high. Produces blue-pale blue flowers from September to November.	Sand, sandy loam, clay soils. Winter wet depression, claypans and flats.	Unlikely – suitable habitat may be present but degraded. Closest record >10 km north.

Species	EPBC Conservation Status	WA Conservation Status	Description	Habitat Preference	Likelihood of Occurrence
Halgania corymbosa	-	Priority 3	Erect shrub growing between 0.35-1 m high. Produces blue-purple flowers from August to November.	Sand, brown loam, clay, laterite gravelly soils. Slopes.	Unlikely – unlikely suitable habitat present.
Jacksonia gracillima	-	Priority 3	Prostrate, spreading or scrambling spindly shrub growing to 0.5-1 m high and 1 m wide. Produces flowers with yellow, red and orange parts from October and November.	Sand and loam soils. Wetlands, winter wet flats, slopes and flats.	Possible – suitable habitat likely present. Closest record approx. 1.8 km south-east.
Lasiopetalum glutinosum subsp. *glutinosum*	-	Priority 3	Multi stemmed shrub growing to 0.5 to 1 m high. Produces dark pink-purple flowers from September to December.	Brown clay gravel, sandy loam. Outcrops on Darling Scarp, rocky hillsides and slopes.	Unlikely – unlikely suitable habitat present.
Meionectes tenuifolia	-	Priority 3	Semi aquatic annual herb growing to 0.3 m high. Produces orange or red flowers with green from September to December.	Clay, loam soils. Swamps, seasonally wet areas and valleys.	Unlikely – unlikely suitable habitat present.
Phlebocarya pilosissima subsp. *pilosissima*	-	Priority 3	Compactly tufted, rhizomatous perennial grass-like shrub growing to 0.15-0.4 m high. Produces cream-white flowers from August to October.	White or grey sandy soil, sometimes with lateritic gravel. Slopes.	Possible – suitable habitat may be present. Closest record approx. 5.5 km west.
Pimelea calcicola	-	Priority 3	Erect to spreading shrub growing to 0.2 to 1 m high. Produces white flowers with some pink from September to November.	Brown sandy loam, white/grey sandy soil associated with limestone. Coastal limestone ridges.	Unlikely – unlikely suitable habitat present.
Pithocarpa corymbulosa	-	Priority 3	Erect to scrambling, perennial herb growing between 0.5-1 m high. Produces white flowers from January to April.	Sandy loam, loamy clay soils with lateritic gravel. Granite outcrops, ridges and slopes.	Unlikely – unlikely suitable habitat present.
Schoenus benthamii	-	Priority 3	Tufted perennial sedge growing to 0.15-0.45 m high. Produces brown flowers from October to November.	White, grey sand, sandy clay soils. Winter-wet flats and swamps.	Unlikely – unlikely suitable habitat present.
Schoenus capillifolius	-	Priority 3	Semi-aquatic, tufted annual sedge growing to 0.05 m high. Produces green flowers from October to November.	Brown sand, clay. Claypans and seasonally wet depressions.	Unlikely – unlikely suitable habitat present.
Schoenus pennisetis	-	Priority 3	Tufted annual sedge growing to 0.1-0.4 m high. Produces purple-black flowers from August to October.	Grey or brown peaty sand, sandy clay soils. Swamps, winter-wet depressions and flats.	Unlikely – unlikely peaty, clayey soils present.

Species	EPBC Conservation Status	WA Conservation Status	Description	Habitat Preference	Likelihood of Occurrence
Stylidium aceratum	-	Priority 3	Fibrous rooted annual herb growing to 0.1 m high with spathulate leaves. Produces pink-white flowers from October to November.	Black-grey sand and clayey soils. Swamp heathland and low lying depressions.	Unlikely – unlikely suitable habitat present.
Stylidium paludicola	-	Priority 3	Reed-like perennial herb growing to 0.35-1 m high. Produces pink flowers from October to December.	Peaty sand over clay soils. Winter wet habitats. Marri and Melaleuca woodland, Melaleuca shrubland.	Unlikely – unlikely suitable habitat present.
Styphelia filifolia	-	Priority 3	Erect, spreading shrub growing to 0.4 to 0.9 m high. Produces white flowers from March to June.	Grey, yellow-brown sandy soils. Flats and slopes.	Possible – suitable habitat may be present. Closest record approx. 6 km north-east.
Thysanotus anceps	-	Priority 3	Rhizomatous, leafless perennial herb growing to 0.4 m high. Produces purple flowers from October to December.	White or grey sand, brown loam, lateritic gravelly soils. Ridges, slopes and sandstone breakaways.	Unlikely – unlikely suitable habitat present.
Acacia oncinophylla subsp. *patulifolia*	-	Priority 4	Shrub growing between 0.5-2.5 m high with 'minni-ritchi' bark and phyllodes 4-9 cm long, 3-6 mm wide. Produces yellow flowers in cylindrical heads from August to December.	Brown sandy loam soils over granite, occasionally on laterite. Granite outcrops on the Darling scarp.	Unlikely – unlikely suitable habitat present.
Aponogeton hexatepalus	-	Priority 4	Rhizomatous or cormous, aquatic perennial herb with floating leaves. Produces green-white flowers from May to November.	Clay soil. Freshwater ponds, rivers, claypans and wetlands.	Unlikely – no standing water present.
Boronia tenuis	-	Priority 4	Procumbent or erect and slender shrub growing between 0.1-0.5 m high. Produces white or mauve or light blue flowers from August to November.	Pale orange sandy gravel, brown loam, clayey soils, associated with laterite and granite. Outcrops, slopes and winter-wet areas.	Unlikely – unlikely suitable habitat present.
Dodonaea hackettiana	-	Priority 4	Erect shrub or tree growing to 1-5 m high. Produces yellow flowers with green and red parts mainly between July to October.	Sandy soils often associated with limestone outcropping. Limestone ridges, slopes and dunes.	Possible – suitable habitat may be present. Closest records approx. 7 km west.
Drosera occidentalis	-	Priority 4	Fibrous-rooted, small red rosetted perennial herb growing to 0.02 m high. Produces white flowers from October to December.	White-yellow sand, clayey soils. Swamps, seasonally wet depressions and slopes.	Possible – suitable habitat may be present. Closest record approx. 3.5 km east.
Jacksonia sericea	-	Priority 4	Low spreading shrub growing to 0.6 m high. Produces flowers with yellow and red and orange parts usually from December to February.	Grey-white, yellow-brown sandy loam soils often associated with limestone. Limestone ridges, slopes and flats.	Possible – suitable habitat may be present. Closest records approx. 3 km east.

Species	EPBC Conservation Status	WA Conservation Status	Description	Habitat Preference	Likelihood of Occurrence
Kennedia beckxiana	-	Priority 4	Prostrate or twining shrub or climber. Produces red flowers from September to December.	Sand, loamy soils. Granite hills and outcrops.	Unlikely – Perth record likely planted. Species occurs east of Esperance.
Microtis quadrata	-	Priority 4	Erect herb growing to 0.4 m high. Produces cream-white flowers from October to December.	Sand, clay, loam soils. Winter wet flats, near wetlands, drainage lines, slopes.	Unlikely – unlikely suitable habitat present.
Ornduffia submersa	-	Priority 4	Aquatic floating herb with submerged leaves growing to 0.3 m high. Produces white-cream flowers from August to November.	Black-grey sandy clay. Permanent and seasonally inundated wetlands, swamps and claypans.	Unlikely – unlikely suitable habitat present.
Stylidium longitubum	-	Priority 4	Erect annual (ephemeral) herb growing to 0.05-0.12 m high. Produces pink flowers with white markings from October to December.	Sandy clay, clay soils. Seasonal wetlands.	Unlikely – unlikely suitable habitat present.
Thysanotus glaucus	-	Priority 4	Erect, tuberous perennial herb growing to 0.2 m high. Produces purple flowers from October to January.	Sandy soils. Undulating terrain.	Possible – suitable habitat likely present. Closest record approx. 5.5 km east but recorded in 1960.
Tripterococcus sp. Brachylobus (A.S. George 14234)	-	Priority 4	Slender, erect, multi-stemmed perennial herb to 0.6 m high. Produces orange-yellow flowers from October to February.	Grey-white sand, peaty sand over clay soils. Winter wet flats, shallow depressions, dry flats and slopes.	Possible – suitable habitat likely present. Closest record approx. 3 km north.
Verticordia lindleyi subsp. *lindleyi*	-	Priority 4	Erect shrub growing to 0.2 to 0.75 m high. Produces pink flowers with white fringes from November to January (also known from May).	Sand, sandy clay soils. Winter-wet depressions.	Unlikely – unlikely suitable habitat present.



0 1.25 2.5 3.75 5 km

GDA 94 / MGA Zone 50

Figure 4 - Previously Recorded Threatened and Priority Flora

FOCUSED VISION consulting

4.2 FIELD ASSESSMENT

4.2.1 Flora

In total, 57 flora species were recorded within the study area (**Appendix D**). Of these, six (10.53%) are introduced (weed) species but none are listed as Declared Pest (plants) listed under the *Biosecurity and Agricultural Management Act* (BAM Act) (Department of Primary Industries and Regional Development (DPIRD) 2020). No Declared Pests listed under the BAM Act were recorded within the study area.

4.2.1.1 Threatened and Priority Flora

No Threatened flora species, listed under the EPBC Act, were recorded within the study area. One possible Priority flora species according to the DBCA, *Jacksonia* ?*gracillima* (P3), was recorded within the study area. One specimen of this species was recorded in site PR02, although the identity of the collection was not certain, due to insufficient material as a result of sub-optimal survey timing.

Jacksonia gracillima (P3) is a prostrate to spreading shrub growing between 0.5 to 1.5 m high occurring from north of Perth south to Busselton (Western Australian Herbarium (WAH) 2020). It flowers from October to November (WAH 2020), hence the specimen collected was sterile but considered possibly *Jacksonia gracillima* (P3) based on morphological attributes.

The timing of the field survey (late March) was sub-optimal to conduct a targeted significant flora survey, as March is outside the flowering period for most conservation significant species identified as potentially occurring from the desktop search. The Bennett (2011) field assessment, conducted on 10-11 October 2011 was suitably timed to target the four Threatened flora species focused on during the current study (*Austrostipa jacobsiana*, *Caladenia huegelii, Diuris purdiei* and *Drakaea elastica*). One of the aims of the current study was to identify the specific suitability of the habitat within the study area for the four conservation significant flora which were the main focus. Targeted search traverses demonstrating search effort are presented in **Figure 5**.

Of the four Threatened species listed above, on a regional level, potentially suitable habitat is considered to be provided within the study area for *Caladenia huegelii* within the upland, Banksia woodland vegetation (particularly units EmBaLW and BaEtLW), and for *Austrostipa jacobsiana* and *Drakaea elastica* within the lower-lying vegetation (particularly units EmBaLW(-B) and BaEtLW(-B)). Potentially suitable habitat for *Drakaea micrantha* is also generally considered to be supported by the study area, within the lower-lying areas (predominantly EmBaLW(-B) and BaEtLW(-B)). However, on a site-specific level, the actual micro-habitat suitability of the study area are is low and therefore, the likelihood of occurrence of the four Threatened flora species focused on is also low, as discussed further below.

Caladenia huegelii has previously been recorded 1 km from the study area. This species occurs in areas of mixed *Eucalyptus marginata* and *Banksia attenuata* and *B. menziesii* woodland with scattered *Allocasuarina fraseriana* over *Hibbertia hypericoides* and *Xanthorrhoea preissii* on deep grey-white sand (Department of Environment and Conservation (DEC) 2009a), consistent with vegetation unit EmBmLW.

Austrostipa jacobsiana is known to occur from two populations; Gosnells and Bunbury. The population in Gosnells (closest to the study area) occurs in calcareous-clay to fine sandy-clay soil in low-lying area fringing seasonally wet depression (Department of Parks and Wildlife (DPaW) 2016). Vegetation units EmBaLW(-B) and BaEtLW(-B)) are somewhat low-lying, supporting *Melaleuca preissiana* and *Kunzea glabrescens,* which may provide suitable habitat. There is a more pronounced (small) low-lying area in the eastern part of the study area, however this area is significantly degraded, with an understorey consisting of weedy grasses. It is therefore considered possible that this species could occur within the study area. However, if present, it is also considered likely that it would have been observed during the March field assessment.

Diuris purdiei grows in sand, sandy-clay soils in winter wet depressions amongst sedges and dense heath with emergent *Melaleuca preissiana, Corymbia calophylla, Eucalyptus marginata* and *Nuytsia floribunda* (TSSC 2008). Soils and vegetation of the study area may be suitable for this species, however, *Diuris purdiei* also relies on relatively recent fire, which is not apparent in the study area. Furthermore, the study area lacks the sedges and dense heath preferred by the species. Therefore, it is unlikely this species would occur within the study area.

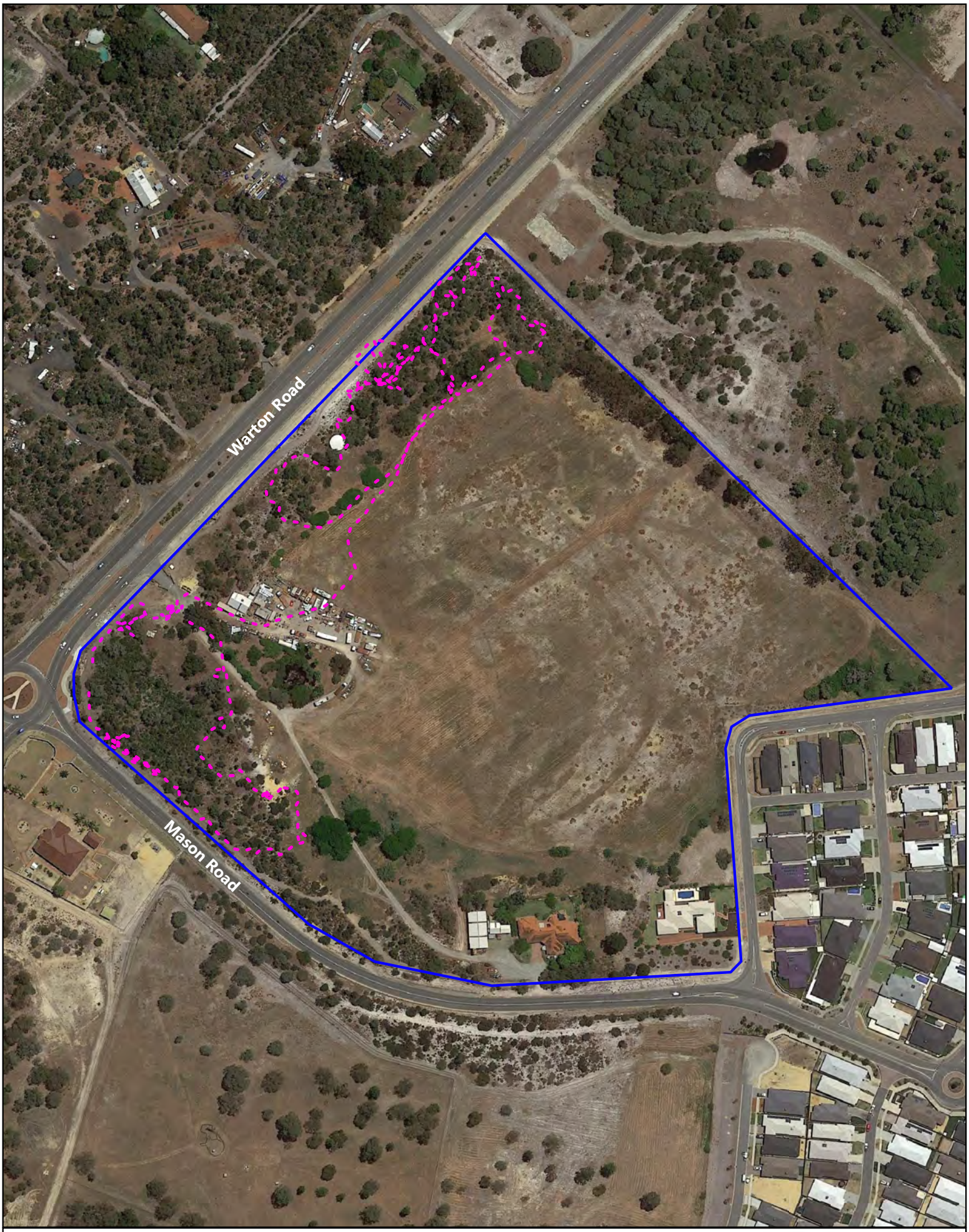
Drakaea elastica has previously been recorded 9 km from the study area. This species grows in bare patches of sand within a mosaic of dense vegetation in low-lying areas adjacent to winter wet swamps. Generally occurring in *Banksia attenuata* and *B. menziesii* woodland or *Kunzea glabrescens* thickets, with a requirement for a shady canopy (DEC 2009b). Similarly, *Drakaea micrantha* typically grows in association with winter-wet swamps, on bare sand lenses, often with *Kunzea* sp. and some upland woodland species, including Banksia (Kellie Bauer-Simpson, pers. comm.). Accordingly, it is possible that either *Drakaea* species could occur within the study area. However, given the lack of bare sand lenses throughput the study area, the likelihood of occurrence of both species is considered reduced.

4.2.2 Vegetation Units

Six vegetation units, plus 'planted' and 'cleared' areas were recorded within the study area. A brief description of each of the recorded units is presented in **Table 5**. Two of the six vegetation units, EmBaLW and BaEtLW were consistent with Bennett (2011) descriptions for the study area. One other vegetation unit described and mapped by Bennett (2011) outside of the study area, MpOLW, was incorporated into the resulting vegetation units for the study area. The description and mapping of three further vegetation units was considered warranted, which included, EmBaLW(-B), a degraded variant of the EmBaLW unit (containing little to no *Banksia attenuata* or *B. menziesii*) and BaEtLW(-B), a degraded variant of the BaEtLW unit (also containing little to no *Banksia attenuata* or *B. menziesii*). These degraded variant units also appear to be lower in the landscape, with Kunzea thickets dominant in some locations. The last of six vegetation units, AcOS, was also added, since none of the Bennett (2011) vegetation units were similar.

Flora species recorded by site are presented in **Appendix D** and site data are presented in **Appendix E**.

Vegetation mapping by Bennett (2011) was refined and added to where appropriate, with additional vegetation units (as listed above) described in accordance with Muir (1977) vegetation structural definitions (**Appendix F**). The descriptions for each of the relevant vegetation units is provided in **Table 5** and the spatial extent of vegetation mapping is presented in **Figure 6**.



0 25 50 75 100 m

GDA 94 / MGA Zone 50

Figure 5 - Threatened and Priority Flora Habitat Traverses

Legend

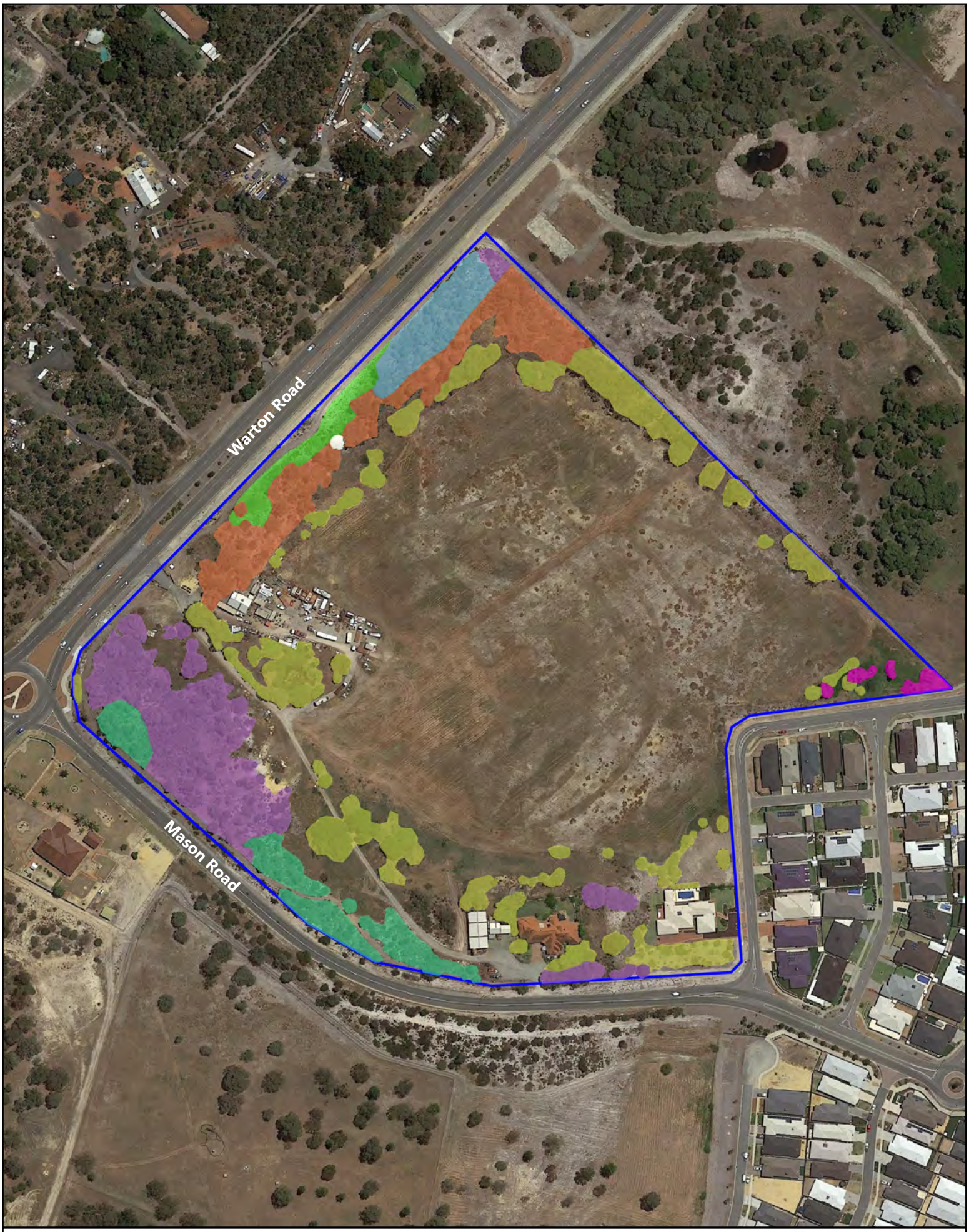
Study Area

Walked Traverse

FOCUSED VISION consulting

Table 5 – Summary of Recorded Vegetation Units

Vegetation Unit and Description	Representative Relevé	Area (ha)	Area (%)
EmBaLW Low Woodland A of *Eucalyptus marginata* subsp. *marginata* over *Banksia attenuata, Banksia menziesii, Allocasuarina fraseriana* and *Nuytsia floribunda* and Low Scrub B dominated by *Xanthorrhoea preissii* or Dwarf Scrub C dominated by *Hibbertia hypericoides* over Tall Grass dominated by **Avena barbata* and **Ehrharta calycina* in grey sand.	PR02	0.340	2.676
BaEtLW Low Woodland A of *Banksia attenuata, Banksia menziesii, Allocasuarina fraseriana, Nuytsia floribunda* and *Eucalyptus todtiana* over Heath B of mixed taxa dominated by *Xanthorrhoea preissii* over Open Tall Grass dominated by **Ehrharta calycina* over Open Herbs dominated by *Dasypogon bromeliifolius* or *Phlebocarya ciliata* in grey sand.	PR03	0.225	1.770
EmBaLW(-B) Low Woodland A of *Eucalyptus marginata* subsp. *marginate* over *Allocasuarina fraseriana, Nuytsia floribunda* and *Melaleuca preissiana* over Dense Thicket of *Kunzea glabrescens* over Low Scrub B dominated by *Xanthorrhoea preissii* or Dwarf Scrub C dominated by *Hibbertia hypericoides* over Tall Grass dominated by **Avena barbata* and **Ehrharta calycina* in grey sand.	PR01	0.832	6.549
BaEtLW(-B) Low Woodland A of *Eucalyptus todtiana, Allocasuarina fraseriana* and *Nuytsia floribunda* over Thicket of *Kunzea glabrescens* over Low Scrub B dominated by *Xanthorrhoea preissii* over Open Tall Grass dominated by **Ehrharta calycina* over Open Herbs dominated by *Dasypogon bromeliifolius* in grey sand.	PR05	0.597	4.699
MpOLW Open Low Woodland A of *Melaleuca preissiana* over Dense Tall Grass of **Ehrharta calycina, *Eragrostis curvula* and **Ehrharta longiflora* in low lying grey sand over Open Herbs dominated by **Arctotheca calendula* in low lying grey sand.	NA	0.045	0.354
AcOS Open Scrub of *Adenanthos cygnorum* regrowth over scattered sparse mixed shrubs and herbs.	PR04	0.138	1.086
Planted Introduced tree species.	NA	1.061	8.351
Cleared Cleared areas for commercial operations, tracks.	NA	9.467	75.514
	Total	**12.705**	



0 25 50 75 100 m

GDA 94 / MGA Zone 50

Figure 6 - Vegetation Units

Legend

- Study Area
- AcOS
- BaEtLW
- BaEtLW(-B)
- EmBaLW
- EmBaLW(-B)
- MpOLW
- Planted

FOCUSED VISION consulting

4.2.3 Vegetation Condition

The majority of the study area has been subjected to clearing and subsequent commercial use for turf farming. Areas of better condition vegetation are limited to the southern and western outer fringes of the property, adjacent to fire breaks.

Excluding cleared areas categorised as 'Completely Degraded' (equating to 74.514 % of the study area), but not specifically mapped, the condition of the vegetation within the study area was found to range from 'Good' to 'Degraded – Completely Degraded'. The majority (9.595%) of the mapped vegetation was considered to be in 'Degraded – Completely Degraded' condition. Areas considered to be in 'Good' condition represent 5.171% of the study area and are limited to small areas within the EmBaLW and BaEtLW vegetation units (**Table 6** and **Figure 7**).

Table 6 – Summary of Recorded Vegetation Condition

Vegetation Condition	Area (ha)	Area (%)
Good	0.665	5.171
Degraded – Good	0.782	6.226
Degraded	0.571	4.494
Degraded – Completely Degraded	1.218	9.595
Completely Degraded	9.467	74.514
Total	**12.705**	**100**

Bennett (2011) vegetation condition mapping generally differed from the results of the current study, with areas previously mapped as 'Degraded – Completely Degraded' now considered to be in better condition, 'Degraded – Good', and conversely areas Bennett (2011) mapped as 'Good' were considered to be in poorer condition, now mapped as 'Degraded' or 'Degraded – Good'. Differences between vegetation condition mapping may be due to temporal changes and possibly from regrowth and vegetation improvement or increased disturbance over the period of time between the studies.

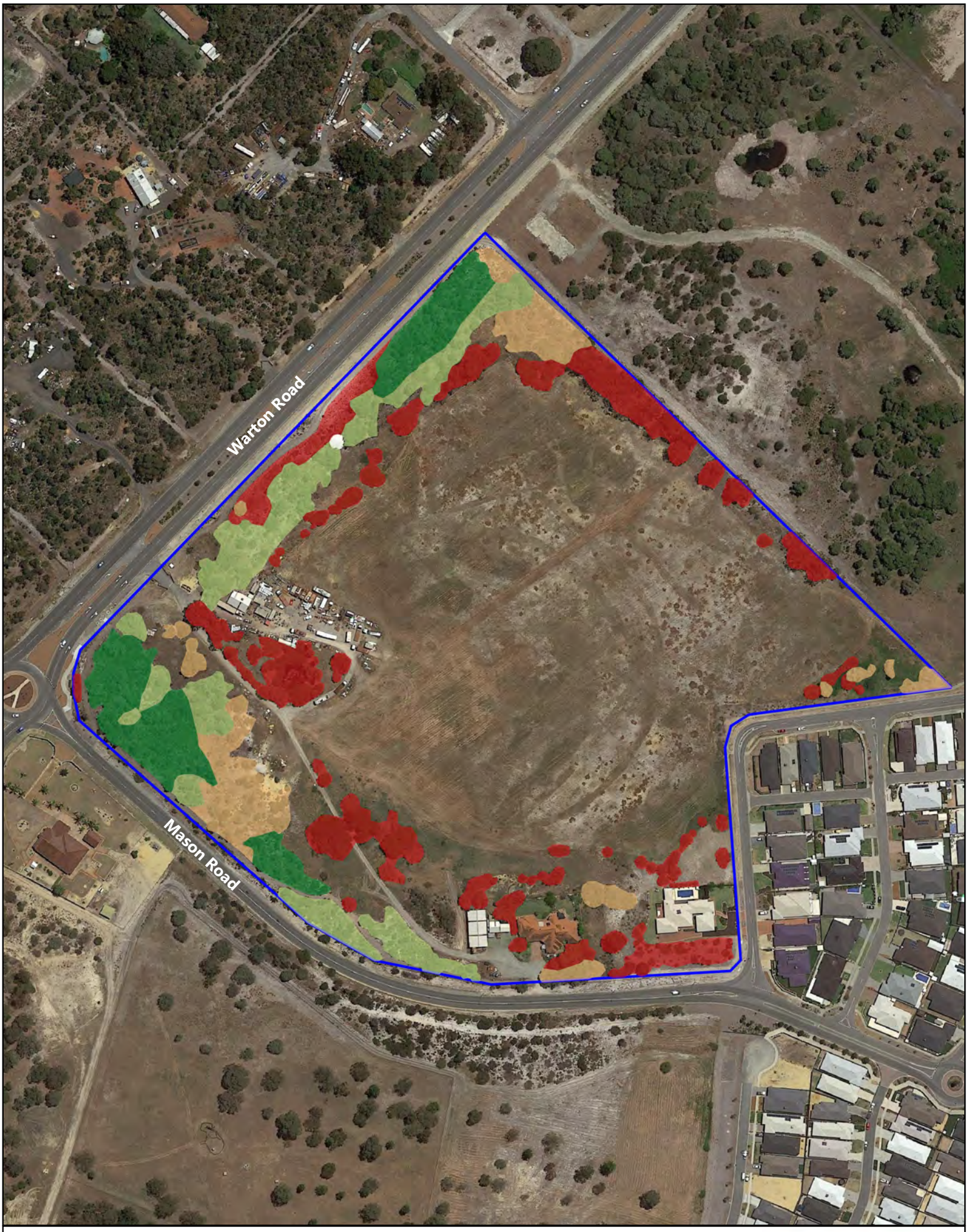
It is possible that a field survey conducted during spring may produce different results for vegetation condition, since annual and ephemeral native and introduced flora will be present, however, it is considered unlikely that results and mapping would differ considerably from those reported herein.

4.2.4 Conservation-Significant Vegetation

4.2.4.1 Banksia Woodlands TEC

Two vegetation units described and mapped within the study area, EmBaLW and BaEtLW are Banksia woodlands. The respective degraded variant units, EmBaLW(-B) and BaEtLW(-B) are not considered to be banksia woodlands, due to a complete lack or near lack of any Banksia trees and various levels of degradation.

Relevé data from vegetation units EmBaLW and BaEtLW were analysed to determine likely equivalence to the Banksia Woodlands TEC, based on a checklist derived from the Conservation Advice (Threatened Species Scientific Committee (TSSC) 2016). The results of this analysis determined that the vegetation characteristics are representative of the Banksia Woodlands TEC (**Table 6**), the extent of which is presented in **Figure 8**.



0 25 50 75 100 m

GDA 94 / MGA Zone 50

Figure 7 - Vegetation Condition

Legend

Study Area
D
G
D-CD
D-G

FOCUSED VISION consulting

Table 7 – Banksia Woodlands TEC Characterisation of Relevant Relevés

Key Character*			a).	b).	c).	d).	e).	f).	g).	Confirmed?
Relevé No./Unit	PR02	EmBaLW	+	+	+	+	+	+	+	Yes
	PR03	BaEtLW	+	+	+	-	+	+	+	Yes

***Key**

a) Swan Coastal Plain or Jarrah Forest location

b) Soils and landform either deep Bassendean, Spearwood or occasionally Quindalup sands, sandy colluvium, Aeolian sands of the Ridge Hill Shelf or Whicher Scarp

c) Distinctive upper sclerophyllous layer dominated by *Banksia attenuata, Banksia menziesii, Banksia ilicifolia* or *Banksia prionotes*

d) With (although can be without) an emergent tree layer of *Corymbia calophylla, Eucalyptus marginata* or *Eucalyptus gomphocephala*

e) With (although can be without) other trees including *Eucalyptus todtiana, Nuytsia floribunda, Allocasuarina fraseriana, Callitris arenaria, Callitris pyramidalis* or *Xylomelum occidentale*

f) Understorey/mid-ground sclerophyllous shrub layer including mostly Asteraceae, Dilleniaceae, Droseraceae, Ericaceae, Fabaceae, Haemodoraceae, Iridaceae, Myrtaceae, Orchidaceae, Proteaceae, Restionaceae

g) Herbaceous ground layer including mostly Apiaceae, Asteraceae, Cyperaceae, Haemodoraceae, Poaceae, Restionaceae, Stylidiaceae

To be considered a MNES protectable under the EPBC Act, a Banksia Woodland patch the must meet at least the 'Good' condition category as outlined in the Conservation Advice (TSSC 2016). Although the vegetation within units EmBaLW and BaEtLW has been diagnosed to be representative of the Banksia Woodlands TEC, in accordance with diagnostic criteria from the Conservation Advice (TSSC 2016), the advice also stipulates condition thresholds and minimum patch sizes as follows:

- Pristine - no minimum patch size
- Excellent – 0.5 ha
- Very Good – 1 ha
- Good – 2 ha.

None of the local patches within the study area meet any of the above area and condition thresholds, with the areas of 'Good' condition vegetation (some of which is Banksia woodland) totalling only 0.665 ha across the entire study area.

To be considered part of a regional patch (connected to other areas of Banksia woodland outside the study area), the areas of eligible Banksia woodland within the study area would need to be adjacent to other areas of eligible Banksia woodland and separated by not more than 30 m. The closest adjacent Banksia Woodland vegetation occurs on the other side of Warton Road, which is approximately 39 m from the closest occurrence of Banksia woodland within the study area. Therefore, Banksia woodland within the study area is not considered part of a broader regional patch.

0 25 50 75 100 m

GDA 94 / MGA Zone 50

Figure 8 - Banksia Vegetation

Legend

Study Area

Banksia Vegetation

FOCUSED VISION consulting

4.2.5 Vegetation Representation

The Environmental Protection Authority's (EPA) Position Statement No. 2 lists a series of objectives which relate to biodiversity (EPA 2000). One of them is to protect at least 30% of the original extent of vegetation complexes in unconstrained areas and 10% in constrained areas (i.e. urban regions). Pre-European vegetation (1001 vegetation association) within the study area is above the 10% threshold for constrained areas. Within the City of Armadale, 33.30% of the 1001 vegetation association remains and 22.13% remains within the Swan Coastal Plain.

5 CONCLUSION AND RECOMMENDATIONS

The key findings arising from the flora and vegetation review of the study area are as follows:

- No Threatened flora listed under EPBC Act or BC Act were recorded.
- One possible Priority flora species, *Jacksonia* ?*gracillima* (P3), was recorded within vegetation unit EmBaLW.
- The survey timing (late March) was not optimal for the identification of flowering flora, annual and ephemeral species and therefore, it is unlikely all species relevant to the study area were recorded.
- The timing of the field assessment could have also limited the accuracy of vegetation unit and condition mapping, since not all flora species naturally occurring during spring would have been observable. However, given the degraded nature of the majority of the study area, this is unlikely to have represented a major limitation.
- Of the four Threatened flora species given particular focus; *Austrostipa jacobsiana*, *Caladenia huegelii, Diuris purdiei* and *Drakaea elastica*, it is considered that all could possibly occur. However, specific habitat suitability for all species besides *Caladenia huegelii* is low to negligible. *Caladenia huegelii* could occur within vegetation units EmBaLW or BaEtLW.
- It is also considered possible for a fifth Threatened flora species, *Drakaea micrantha,* to occur, however, specific micro-habitats (bare sand lenses) were not observed within the study area and therefore, the actual likelihood if this species occurrence is also considered unlikely.
- Six vegetation units, plus 'planted' and 'cleared' areas were recorded within the study area, with two of the recorded units representing remnant vegetation with areas in 'Good' or better condition.
- Of the recorded vegetation units, two represent Banksia woodland, which both meet diagnostic criteria to be considered representative of the Banksia Woodlands TEC. However, the size of the areas of these woodlands do not meet minimum condition thresholds, even when considered in the context of regional adjacent Banksia woodland vegetation and therefore are not eligible for inclusion as a MNES protectable under the EPBC Act

Based on the findings of the study, it is recommended that suitably timed targeted flora surveys be carried out, focused on *Caladenia huegelii* and *Jacksonia gracillima,* and also addressing other relevant species arising from the desktop assessment.

It is not considered that any follow-up survey work for the characterisation of vegetation types, condition or conservation significance is required, based on the combined results of the Bennett (2011) and current studies.

6 REFERENCES

Beard, J.S. (1990) *Plant Life of Western Australia*. Kangaroo Press, Kenthurst NSW.

Bureau of Meteorology (BoM) (2020) *Climate statistics for Australian locations*. Monthly climate statistic. http://www.bom.gov.au/climate/averages/tables/cw_009172.shtml Accessed 23 March 2020.

Churchward, H. M. and McArthur, W. M. (1980) *Landforms and Soils of the Darling System* in: Atlas of Natural Resources, Darling Systems, Western Australia. Department of Conservation and Environment, Western Australia.

Department of Agriculture, Water and the Environment (DAWE) (2020a) *Australia's Bioregions (IBRA)* http://www.environment.gov.au/land/nrs/science/ibra Accessed 23 March 2020.

Department of Agriculture, Water and the Environment (DAWE) (2020b) *Threatened Ecological Communities*. https://environment.gov.au/biodiversity/threatened/communities Accessed 23 March 2020.

Department of Agriculture, Water and the Environment (DAWE) (2020c) *Protected Matters Search Tool*. http://environment.gov.au/epbc/protected-matters-search-tool Accessed 23 March 2020.

Department of Biodiversity, Conservation and Attractions (DBCA) (2020a) *NatureMap*. https://naturemap.dbca.wa.gov.au/ Accessed 23 March 2020.

Department of Biodiversity, Conservation and Attractions (DBCA) (2020b) *Threatened and Priority Flora Database Search Results for the Piara Waters area*. 23 March 2020.

Department of Environment and Conservation (DEC) (2001) *Conserving Threatened Ecological Communities*. Department of Environment and Conservation in conjunction with National Heritage Trust.

Department of Environment and Conservation (DEC) (2009a) *Grand Spider Orchid (Caladenia huegelii) Recovery Plan*. Department of Environment and Conservation in conjunction with Commonwealth Department of the Environment, Water, Heritage and the Arts, Canberra.

Department of Environment and Conservation (DEC) (2009b) *Glossy-leafed Hammer Orchid (Drakaea elastica) Recovery Plan*. Department of Environment and Conservation, Western Australia.

Department of Parks and Wildlife (DPaW) (2016) *Austrostipa jacobsiana Interim Recovery Plan 2016–2021. Interim Recovery Plan No. 369*. Department of Parks and Wildlife, Western Australia.

Department of Primary Industries and Regional Development (DPIRD) (2020) *Western Australian Organism List*. https://www.agric.wa.gov.au/organisms Accessed 6 April 2020.

Environmental Protection Authority (EPA) (2000) *Position Statement No. 2: Environmental Protection of Native Vegetation in Western Australia: Clearing Native Vegetation with Particular Reference to Agricultural Areas*. Environmental Protection Authority, Western Australia.

Gibson, N., Keighery, B., Keighery, G., Burbidge, A. and Lyons, M. (1994) *A Floristic Survey of the southern Swan Coastal Plain*. Unpublished report prepared by the Western Australian Department of Conservation and Land Management and the Western Australian Conservation Council for the Heritage Commission.

Heddle, E.M., Loneragan, O.W. and Havel, J.J. (1980) *Atlas of Natural Resources*. Western Australia Department of Conservation and Environment.

Mitchell, D., Williams K. and Desmond A. (2002) *Swan Coastal Plain 2 (SWA2 – Swan Coastal Plain subregion)* in: A Biodiversity Audit of Western Australia's 53 Biogeographical Subregions in 2002. Collaboration between the Department of Conservation and Land Management and the Western Australian Museum.

Muir B.G. (1977) *Biological Survey of the Western Australian Wheatbelt - Part II*. Records of the Western Australian Museum, Supplement No 3.

Shepherd, D.P., Beeston, G.R. and Hopkins, A.J.M. (2002) *Native Vegetation in Western Australia Extent, Type and Status*. Department of Agriculture and Food, Government of Western Australia.

Threatened Species Scientific Committee (TSSC) (2016) *Approved Conservation Advice (incorporating listing advice) for the Banksia Woodlands of the Swan Coastal Plain ecological community.* Available from http://environment.gov.au/biodiversity/threatened/communities/pubs/131-conservation-advice.pdf

Threatened Species Scientific Committee (TSSC) (2008) *Approved Conservation Advice for Diuris purdiei (Purdie's Donkey orchid)*. Available from http://www.environment.gov.au/biodiversity/threatened/species/pubs/12950-conservation-advice.pdf

Western Australian Herbarium (WAH) (2020) *FloraBase—the Western Australian Flora*. Department of Biodiversity, Conservation and Attractions. Accessed 6 April 2020.

APPENDIX A – BENNETT (2011)

Botanical Assessment of Selected Lots
Along Warton Road, Armadale Road and Wright Road
FORRESTDALE

Prepared for:
COTERRA ENVIRONMENT
19/336 Churchill Avenue,
SUBIACO WA 6008

Prepared by:
Bennett Environmental Consulting Pty Ltd

Sollya heterophylla

PO Box 341
KALAMUNDA 6926

December 2011

STATEMENT OF LIMITATIONS

Scope of Services

This report ("the report") has been prepared in accordance with the scope of services set out in the contract, or as otherwise agreed, between the Client and Eleanor Bennett ("the Author"). In some circumstances a range of factors such as time, budget, access and/or site disturbance constraints may have limited the scope of services.

Reliance on Data

In preparing the report, the Author has relied upon data, surveys, analyses, designs, plans and other information provided by the Client and other individuals and organisations, most of which are referred to in the report ("the data"). Except as otherwise stated in the report, the Author has not verified the accuracy or completeness of the data. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations in the report ("conclusions") are based in whole or part on the data, those conclusions are contingent upon the accuracy and completeness of the data. The Author will not be liable in relation to incorrect conclusions should any data, information or condition be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed to the Author.

Environmental Conclusions

In accordance with the scope of services, the Author has relied upon the data and has conducted environmental field monitoring and/or testing in the preparation of the report. The nature and extent of monitoring and/or testing conducted is described in the report.

The conclusions are based upon field data and the environmental monitoring and/or testing carried out over a limited period of time and are therefore merely indicative of the environmental condition of the site at the time of preparing the report. Also it should be recognised that site conditions, can change with time.

Within the limitations imposed by the scope of services, the field assessment and preparation of this report have been undertaken and performed in a professional manner, in accordance with generally accepted practices and using a degree of skill and care ordinarily exercised by reputable environmental consultants under similar circumstances. No other warranty, expressed or implied, is made.

Report for Benefit of Client

The report has been prepared for the benefit of the Client and no other party. The Author assumes no responsibility and will not be liable to any other person or organisation for or in relation to any matter dealt with or conclusions expressed in the report, or for any loss or damage suffered by any other person or organisation arising from matters dealt with or conclusions expressed in the report (including without limitation matters arising from any negligent act or omission of the Author or for any loss or damage suffered by any other party relying upon the matters dealt with or conclusions expressed in the report). Other parties should not rely upon the report or the accuracy or completeness of any conclusions and should make their own enquiries and obtain independent advice in relation to such matters.

Other Limitations

The Author will not be liable to update or revise the report to take into account any events or emergent circumstances or facts occurring or becoming apparent after the date of the report. The scope of services did not include any assessment of the title to or ownership of the properties, buildings and structures referred to in the report nor the application or interpretation of laws in the jurisdiction in which those properties, buildings and structures are located.

INDEX

SUMMARY

Bennett Environmental Consulting Pty Ltd undertook a vegetation and flora overview of Lots 737, 9006, 9001, 1001, 88, 99, 100, 151 and 150 along Warton Road; Lots 13, 14, 15, 3, 28 and 29 along Armadale Road and Lots 4, 5, 6 and 1 along Wright Road in Forrestdale, within the City of Armadale. Large areas were completely cleared and only small pockets of remnant vegetation remained. The vegetation at the site could be classified upon its location in the landscape. The vegetation units described are provided below.

UPLAND VEGETATION

- Low Woodland A of *Banksia attenuata*, *Banksia menziesii*, *Allocasuarina fraseriana*, *Nuytsia floribunda* and *Eucalyptus marginata* subsp. *marginata* over Low Scrub B dominated by *Xanthorrhoea preissii* or Dwarf Scrub C dominated by *Hibbertia hypericoides* over Tall Grass dominated by **Avena barbata* and **Ehrharta calycina* in grey sand.
- Low Woodland A of *Banksia attenuata*, *Banksia menziesii*, *Allocasuarina fraseriana*, *Nuytsia floribunda* and *Eucalyptus todtiana* over Heath B of mixed taxa dominated by *Xanthorrhoea preissii* over Open Tall Grass dominated by **Ehrharta calycina* over Open Herbs dominated by *Dasypogon bromeliifolius* or *Phlebocarya ciliata* in grey sand.
- Open Low Woodland A of *Banksia attenuata* over Scrub of *Kunzea glabrescens* over Dense Tall Grass of **Ehrharta calycina* over Open Herbs dominated by **Hypochaeris glabra* in pale grey sand.

WETLAND VEGETATION

- Low Forest A of *Eucalyptus rudis* subsp. *rudis* over Open Herbs dominated by **Lotus subbiflorus* over Open Tall Sedges of *Juncus pallidus* in black sandy loam.
- Dense Low Forest A of *Melaleuca preissiana* over Scrub of *Taxandria linearifolia* over Dense Tall Sedges of *Lepidosperma longitudinale* and *Juncus pallidus* in black sand.
- Low Woodland A of *Melaleuca preissiana* over Dense Thicket of *Kunzea glabrescens* over Herbs dominated by *Dasypogon bromeliifolius* in grey sand.
- Low Woodland A of *Melaleuca preissiana* and *Melaleuca rhaphiophylla* over Scrub of *Melaleuca teretifolia* and *Astartea scoparia* over Tall Grass dominated by **Eragrostis curvula* and **Ehrharta longifolia* over Herbs dominated by **Lotus subbiflorus* in black sandy loam.
- Dense Low Forest A of *Melaleuca preissiana* with occasional trees of *Eucalyptus rudis* subsp. *rudis* over Open Scrub of *Astartea scoparia* over Dense Herbs dominated by **Zantedeschia aethiopicum* in very damp grey sand with areas of open water in which *Lemna disperma* was recorded.
- Dense Thicket of *Kunzea glabrescens* over Dwarf Scrub C dominated by *Hypocalymma angustifolium* and *Lechenaultia floribunda* over Tall Sedges of *Schoenus rigens* in grey sand.
- Dense Low Forest A of *Melaleuca preissiana* over Open Scrub of *Kunzea glabresecns* over Dense Tall Sedges of *Lepidosperma longitudinale* and/or *Dielsia stenostachya* and/or *Hypolaena exsulca* in black silty sand.
- Heath A of *Melaleuca viminea* and *Melaleuca incana* subsp. *incana* over Open Herbs dominated by **Hypochaeris glabra* and **Lotus subbiflorus* over Tall Sedges dominated by *Baumea juncea* and *Lepidosperma longitudinale* in damp grey sand.
- Open Low Woodland A of *Melaleuca preissiana* over Dense Tall Grass of **Ehrharta calycina*, **Eragrostis curvula* and **Ehrharta longiflora* in low lying grey sand over Open Herbs dominated by **Arctotheca calendula* in low lying grey sand.

HERBLAND/SEDGELAND/GRASSLAND

- Dense Herbs dominated by **Lotus subbiflorus* over Open Tall Sedges of *Meeboldina scariosa* and *Baumea articulata* in damp sandy loam.
- Open Low Grass of *Pennisetum clandestinum* over Open Herbs dominated by **Lotus subbiflorus* over Very Open Low Sedges of **Cyperus tenellus* in very damp grey sand.

The vegetation at the site varied between very good and completely degraded. Some of the better condition vegetation was recorded from:

- Lot 6 Wright Road recorded vegetation in very good condition. The remnant vegetation was at the back of the block;
- Lot 99 Warton Road, again at the back of the block where it adjoined Lot 6, the vegetation was in very good to good condition;
- Lot 5 Wright Road, also at the back of the block where it adjoined Lot 6 had an area where the vegetation was regrowing after disturbance, and its vegetation condition was recorded as good but there were patches of very good and others of degraded condition; and
- Three other lots, Lot 9103 and Lot 100 along Warton Road and Lot 15 along Armadale Road recorded patches of vegetation that were in good condition.

None of the vegetation units are listed as threatened or priority ecological communities and no threatened or priority flora were observed.

Most of the area is low lying, and some was damp when the survey was undertaken. Although most of the site recorded a degraded to completely degraded condition, due to clearing and planting with non-endemics or clearing with occasional scattered native trees retained, consideration will need to be given to the low lying nature of the area if development is to proceed.

.

1. INTRODUCTION

1.1 Background

Coterra Environment commissioned Bennett Environmental Consulting Pty Ltd to undertake a vegetation overview and listing of selected Lots in Forrestdale, within the City of Armadale. The lots were 737, 9006, 9001, 1001, 88, 99, 100, 151 and 150 along Warton Road; Lots 13, 14, 15, 3, 28 and 29 along Armadale Road and Lots 4, 5, 6 and 1 along Wright Road ('the site').

Figure 1. Location of the site surveyed - outlined in red.

1.2 Scope of Works

The requirements for this project were to:

i. Undertake a Level 2 vegetation survey (Environmental Protection Authority, 2004); and to

ii. Search for and record all significant species at the site.

2. BACKGROUND INFORMATION

2.1 Geology and Landform

The area is included in the Bassendean Dunes which have off-white to pale grey sands at the surface and cream to yellow sands at depth. The Bassendean Dunes are again separated into three units based on the characteristics of their swamps. The study site occurs within the Southern River Complex, the sand appears to have been blown over the alluvial soils resulting in swamps with a clay base (Churchward and McArthur, 1980).

2.2 Vegetation

The Interim Biogeographical Regionalisation for Australia (IBRA) (Thackway and Cresswell, 1995) recognizes 85 bioregions. The IBRA is used as the common unit to compare biological and biophysical attributes. Bioregions represent a landscape-based approach to classifying the land surface and each region is defined by a set of major environmental influences, which shape the occurrence of flora and fauna and their interaction with the physical environment. Baldivis occurs in the Swan Coastal Plain, which has been subdivided into the northern section and the southern section. The study area is located in the southern section, abbreviated SWA2 (Mitchell, Williams and Desmond, 2002).

The survey area is mapped by Beard (1981) as a Low Woodland of *Allocasuarina fraseriana*, *Banksia* species and *Eucalyptus marginata* (abbreviated e2,3Mi). Shepherd *et al.* (2002) have determined the pre-European and current extent of the vegetation associations described by Beard. In addition they have assessed the percentage of each vegetation association remaining, the amount in IUCN reserves and the percentage in other reserves. The pre-European area of e2,3Mi is estimated to be 79,001ha, the current extent is 18,398ha which represents 23.2% remaining vegetated of which 38% is included in conservation.

Heddle *et al.* (1980) described the vegetation complexes of the Darling System at a scale of 1:250 000. There was found to be a distinct pattern of plant distribution linked to landforms, soils and climate. The most obvious trend was associated with increasing aridity from west to east on the Darling Plateau. The vegetation changes observed were a decrease in height and percentage cover of the tallest stratum and a distinct change in floristics. Forrestdale occurs in the Southern River Complex which is described as an Open Woodland of *Corymbia calophylla – Eucalyptus marginata* subsp. *marginata* and Banksia species with fringing Woodland of *Eucalyptus rudis* subsp. *rudis* and *Melaleuca rhaphiophylla* along creek beds.

Bush Forever (Government of Western Australia, 2000) states that 17% of the original area of the Southern River Complex remains vegetated within the Swan Coastal Plain. The area proposed for protection (Government of Western Australia, 2000) is 10%.

2.3 Threatened Ecological Communities

An ecological community is a naturally occurring biological assemblage that occurs in a particular type of habitat. A Threatened Ecological Community is one which falls into one of the following categories, presumed totally destroyed, critically endangered, endangered or vulnerable (Department Environment and Conservation, 2011b).

A possible ecological community which does not meet the above is added to the Priority Ecological Community List. Priorities 1, 2, and 3 are adequately known but are not currently believed to be threatened. Those that have recently been removed from the threatened list are listed as Priority 4. Conservation dependent ecological communities are placed in Priority 5.

2.4 Significant Flora

Prior to undertaking the field work a search was undertaken of the Department of Conservation and Environment Threatened Flora Database. The resulting data is provided in Table 3.

Table 1. Code and description of Threatened and Priority Flora (Department Environment and Conservation, 2011a)

Code	Declared Rare and Priority Flora Categories
T	T (Threatened Flora) -Extant Taxa. Taxa, which 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.
X	T (Threatened Flora) -Presumed Extinct Taxa. Taxa which have not been collected, or otherwise verified, over the past 50 years despite thorough searching, or of which all known wild populations have been destroyed more recently.
1	Priority One -Poorly Known Taxa. Taxa, which are known from one or a few (generally <5) populations, which are under threat.
2	Priority Two -Poorly Known Taxa. Taxa which are known from one or a few (generally <5) populations, at least some of which are not believed to be under immediate threat.
3	Priority Three -Poorly Known Taxa. Taxa, which are known from several populations, at least some of which are not believed to be under immediate threat.
4	Priority Four - Rare, Near Threatened and other species in need of monitoring. Taxa which are considered to have been adequately surveyed and which whilst being rare, are not currently threatened by any identifiable factors.
5	Priority Five - Conservation dependent species. Species that are not threatened but are subject to a specific conservation program, the cessation of which would result in the species becoming threatened within five years.

Table 1 presents the definitions of Threatened and the five Priority Flora ratings under the Wildlife Conservation Act (1950) as extracted from Department of Environment and Conservation (2011a). Table 2 presents the definitions of the threatened species under the Environmental Protection and Biodiversity Conservation Act, 1999 (Department of Sustainability, Environment, Water, Populations and Communities, 2011).

Table 2. Categories of Threatened Flora Species (Department of Sustainability, Environment, Water, Populations and Communities, 2011)

Code	Declared Rare and Priority Flora Categories
Ex	Extinct Taxa which at a particular time if, at that time, there is no reasonable doubt that the last member of this species has died.
ExW	Extinct in the Wild Taxa which is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
CE	Critically Endangered Taxa which at any particular time if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
E	Endangered Taxa, which is not critically endangered, and it is facing a very high risk of extinction in the wild in the immediate or near future, as determined in accordance with the prescribed criteria.

Code	Declared Rare and Priority Flora Categories
V	Vulnerable Taxa which is not critically endangered or endangered and is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.
CD	Conservation Dependent Taxa which at a particular time if, at that time, the species is the focus of a specific conservation program, the cessation of which would result in the species becoming vulnerable, endangered or critically endangered within a period of 5 years.

Table 3. Threatened and Priority Flora Species List as provided by the Department of Environment and Conservation

Taxon	Code	Description
Caladenia huegelii	T	Tuberous, perennial, herb, 0.25-0.6 m high. Fl. green & cream & red, Sep to Oct. Grey or brown sand, clay loam.
Diuris purdiei	T	Tuberous, perennial, herb, 0.15-0.35 m high. Fl. yellow, Sep to Oct. Grey-black sand, moist. Winter-wet swamps.
Drakaea elastica	T	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.
Drakaea micrantha	T	Tuberous, perennial, herb, 0.15-0.3 m high. Fl. red & yellow, Sep to Oct. White-grey sand.
Lepidosperma rostratum	T	Rhizomatous, tufted perennial, grass-like or herb (sedge), 0.5 m high. Fl. brown. Peaty sand, clay.
Eryngium pinnatifidum subsp. *palustre*	3	Erect perennial, herb, 0.15-0.5 m high. Fl. white/blue, Oct to Nov. Clay, sandy clay. Claypans, seasonally wet flats.
Jacksonia gracillima	3	No description provided.
Stylidium longitubum	3	Erect annual (ephemeral), herb, 0.05-0.12 m high. Fl. pink, Oct to Dec. Sandy clay, clay. Seasonal wetlands.
Drosera occidentalis subsp. *occidentalis*	4	Fibrous-rooted, rosetted perennial, herb, to 0.01 m high. Fl. pink/white, Nov to Dec. Sandy & clayey soils. Swamps & wet depressions.
Grevillea thelemanniana subsp. *thelemanniana*	4	No description provided.
Jacksonia sericea	4	Low spreading shrub, to 0.6 m high. Fl. orange, usually Dec or Jan to Feb. Calcareous & sandy soils.
Ornduffia submersa	4	No description provided.
Thysanotus glaucus	4	Caespitose, glaucous perennial, herb, 0.1-0.2 m high. Fl. purple, Oct to Dec or Jan to Mar. White, grey or yellow sand, sandy gravel.
Tripterococcus paniculatus	4	Perennial, herb, to 1 m high. Fl. yellow-green, Oct to Nov. Grey, black or peaty sand. Winter-wet flats.
Verticordia lindleyi subsp. *lindleyi*	4	Erect shrub, 0.2-0.75 m high. Fl. pink, May or Nov to Dec or Jan. Sand, sandy clay. Winter-wet depressions.

3. METHODS

All tracks were driven and transects were walked through the remnant bushland listing the vegetation units in the area and the dominant taxa. As this was being undertaken the bushland was searched for Threatened and Priority Flora. As a Level 2 vegetation survey was required temporary quadrats were recorded. Plants unknown in the field were collected, pressed and identified using the Reference Collection at the Western Australian Herbarium, which has limited collections and sometimes makes the positive identification difficult. The vegetation at the site is described using the vegetation classification of Muir (1977) as described in Table 4.

Table 4 Vegetation Classification (from Muir, 1977)

LIFE FORM / HEIGHT CLASS	Canopy Cover			
	DENSE 70 % - 100%	**MID DENSE 30% - 70%**	**SPARSE 10% - 30%**	**VERY SPARSE 2% - 10%**
Trees > 30 m	Dense Tall Forest	Tall Forest	Tall Woodland	Open Tall Woodland
Trees 15 – 30 m	Dense Forest	Forest	Woodland	Open Woodland
Trees 5 – 15 m	Dense Low Forest A	Low Forest A	Low Woodland A	Open Low Woodland A
Trees < 5 m	Dense Low Forest B	Low Forest B	Low Woodland B	Open Low Woodland B
Mallee (tree form)	Dense Tree Mallee	Tree Mallee	Open Tree Mallee	Very Open Tree Mallee
Mallee (shrub form)	Dense Shrub Mallee	Shrub Mallee	Open Shrub Mallee	Very Open Shrub Mallee
Shrubs > 2 m	Dense Thicket	Thicket	Scrub	Open Scrub
Shrubs 1.5 – 2 m	Dense Heath A	Heath A	Low Scrub A	Open Low Scrub A
Shrubs 1 - 1.5 m	Dense Heath B	Heath B	Low Scrub B	Open Low Scrub B
Shrubs 0.5 – 1 m	Dense Low Heath C	Low Heath C	Dwarf Scrub C	Open Dwarf Scrub C
Shrubs 0 - 0.5 m	Dense Low Heath D	Low Heath D	Dwarf Scrub D	Open Dwarf Scrub D
Mat plants	Dense Mat Plants	Mat Plants	Open Mat Plants	Very Open Mat Plants
Hummock grass	Dense Hummock Grass	Mid-Dense Hummock Grass	Hummock Grass	Open Hummock Grass
Bunch grass > 0.5 m	Dense Tall Grass	Tall Grass	Open Tall Grass	Very Open Tall Grass
Bunch grass < 0.5 m	Dense Low Grass	Low Grass	Open Low Grass	Very Open Low Grass
Herbaceous spp.	Dense Herbs	Herbs	Open Herbs	Very Open Herbs
Sedges > 0.5 m	Dense Tall Sedges	Tall Sedges	Open Tall Sedges	Very Open Tall Sedges
Sedges < 0.5 m	Dense Low Sedges	Low Sedges	Open Low Sedges	Very Open Low Sedges
Ferns	Dense Ferns	Ferns	Open Ferns	Very Open Ferns
Mosses, liverworts	Dense Mosses	Mosses	Open Mosses	Very Open Mosses

4. RESULTS

Field work was undertaken on 10-11th October 2011. Some sites were completely cleared Lot 737 Warton Road, Lot 14 Armadale Road, Lots 28 and 29 Armadale Road.

4.1 Vegetation

As with the vegetation description for the Bush Forever Sites it is possible to divide the vegetation at the site into Uplands and Wetlands. The descriptions below will be general covering the different vegetation units recorded from each of the individual lots. The taxa recorded from each quadrat are listed in Appendix B and the vegetation recorded from each Lot is mapped in Appendix C.

UPLAND VEGETATION

- Low Woodland A of *Banksia attenuata*, *Banksia menziesii*, *Allocasuarina fraseriana*, *Nuytsia floribunda* and *Eucalyptus marginata* subsp. *marginata* over Low Scrub B dominated by *Xanthorrhoea preissii* or Dwarf Scrub C dominated by *Hibbertia hypericoides* over Tall Grass dominated by **Avena barbata* and **Ehrharta calycina* in grey sand.
  This vegetation was recorded from the slopes and crest of the sand dune at the site. It was recorded from Lot 88 Warton Road (no quadrat), Lot 99 Warton Road (quadrat F6) , Lot 1001 Warton, Lot (quadrat F21) and Lot 9103 Warton Road (quadrats F02 and F03).

- Low Woodland A of *Banksia attenuata*, *Banksia menziesii*, *Allocasuarina fraseriana*, *Nuytsia floribunda* and *Eucalyptus todtiana* over Heath B of mixed taxa dominated by *Xanthorrhoea preissii* over Open Tall Grass dominated by **Ehrharta calycina* over Open Herbs dominated by *Dasypogon bromeliifolius* or *Phlebocarya ciliata* in grey sand.
  This vegetation was recorded from the lower slopes of sand dunes at the site. It was recorded from Lot 9103 Warton Road (quadrat F04), Lot 15 Armadale Road (quadrat F10) and Lot 9101 Warton Road (quadrat F20).

- Open Low Woodland A of *Banksia attenuata* over Scrub of *Kunzea glabrescens* over Dense Tall Grass of **Ehrharta calycina* over Open Herbs dominated by **Hypochaeris glabra* in pale grey sand.

This vegetation was recorded from low lying ground in Lot 100 Warton Road (quadrat F08).

WETLAND VEGETATION

- Low Forest A of *Eucalyptus rudis* subsp. *rudis* over Open Herbs dominated by**Lotus subbiflorus* over Open Tall Sedges of *Juncus pallidus* in black sandy loam.
  This vegetation was recorded from Lot 9006 Warton Road (quadrat F17).

- Dense Low Forest A of *Melaleuca preissiana* over Scrub of *Taxandria linearifolia* over Dense Tall Sedges of *Lepidosperma longitudinale* and *Juncus pallidus* in black sand.
  This vegetation was recorded from low lying ground in Lot 6 Wright Road (quadrat F14).

- Low Woodland A of *Melaleuca preissiana* over Dense Thicket of *Kunzea glabrescens* over Herbs dominated by *Dasypogon bromeliifolius* in grey sand.
  This vegetation was recorded from the lower slope to flat. At Lot 100 the trees of *Melaleuca preissiana* were scattered and not a dominant stratum of the vegetation It was recorded from Lot 100 (quadrat F07) and Lot 9103 Warton Road (quadrat F01).

- Low Woodland A of *Melaleuca preissiana* and *Melaleuca rhaphiophylla* over Scrub of *Melaleuca teretifolia* and *Astartea scoparia* over Tall Grass dominated by **Eragrostis curvula* and **Ehrharta longifolia* over Herbs dominated by **Lotus subbiflorus* in black sandy loam.
  This vegetation was recorded in Lot 9101 Wright Road (quadrat F19).

- Dense Low Forest A of *Melaleuca preissiana* with occasional trees of *Eucalyptus rudis* subsp. *rudis* over Open Scrub of *Astartea scoparia* over Dense Herbs dominated by **Zantedeschia aethiopicum* in very damp grey sand with areas of open water in which *Lemna disperma* was recorded.
  This vegetation was recorded from low lying ground in Lot 3 Armadale Road (quadrat F11).

- Dense Thicket of *Kunzea glabrescens* over Dwarf Scrub C dominated by *Hypocalymma angustifolium* and *Lechenaultia floribunda* over Tall Sedges of *Schoenus rigens* in grey sand.
  This vegetation was recorded from low lying ground in Lot 15 Armadale Road (quadrat F09).

- Dense Low Forest A of *Melaleuca preissiana* over Open Scrub of *Kunzea glabrescens* over Dense Tall Sedges of *Lepidosperma longitudinale* and/or *Dielsia stenostachya* and/or *Hypolaena exsulca* in black silty sand.
  This vegetation was recorded from low lying ground in Lot 5 Wright Road (quadrat F12) and Lot 99 (quadrat F05).

- Heath A of *Melaleuca viminea* and *Melaleuca incana* subsp. *incana* over Open Herbs dominated by **Hypochaeris glabra* and **Lotus subbiflorus* over Tall Sedges dominated by *Baumea juncea* and *Lepidosperma longitudinale* in damp grey sand.
  This vegetation was recorded from damp, flat ground in Lot 6 Wright Road (quadrat F13).

- Open Low Woodland A of *Melaleuca preissiana* over Dense Tall Grass of **Ehrharta calycina*, **Eragrostis curvula* and **Ehrharta longiflora* in low lying grey sand over Open Herbs dominated by **Arctotheca calendula* in low lying grey sand.
  This vegetation was recorded from Lot 9006 Warton Road (quadrat F18).

HERBLAND/SEDGELAND/GRASSLAND

- Dense Herbs dominated by **Lotus subbiflorus* over Open Tall Sedges of *Meeboldina scariosa* and *Baumea articulata* in damp flat area. This vegetation was recorded from Lot 5 Wright Road (quadrat F15).

- Open Low Grass of *Pennisetum clandestinum* over Open Herbs dominated by **Lotus subbiflorus* over Very Open Low Sedges of **Cyperus tenellus* in very damp grey sand.
  This vegetation was recorded from Lot 9006 Warton Road (quadrat F16).

4.2 Vegetation Condition

Bushland has been historically subject to ongoing degradation and is especially susceptible to disturbances arising as a result of indirect impacts from surrounding developments and human activity. Degradation is caused by a wide range of factors, including isolation, edge effects, weed invasion, plant diseases, changes in fire frequency, landscape fragmentation, increased predation on native fauna by feral animals, decrease in species richness and general modification of ecological function.

Vegetation condition was rated according to the vegetation condition scale used in Keighery (1994). The vegetation condition of the remnant vegetation at the survey site was mainly good (condition 4) to completely degraded (condition 6) with a small area on the south eastern side that was in very good condition. There were groups of trees with good cover or scattered trees where the understorey had been completely replaced with weeds. These areas were degraded (condition 5). Where there were no trees or scattered trees and the weeds were dominant the vegetation condition was completely degraded (condition 6). The vegetation condition of the site is mapped in Figure 3, Appendix C.

Table 5. Explanation of Vegetation Condition Rating (Keighery, 1994)

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

Table 6. Vegetation condition recorded for each quadrat

VEGETATION CONDITION	QUADRAT NUMBERS
Very good	F13, F14
Very good to good	F05
Good	F03, F04, F07, F09, F10, F12
Good to degraded	F02, F16, F19, F20, F21
Degraded	F01, F17
Degraded to completely degraded	F06, F08, F11, F15
Completely degraded	F18

The vegetation condition for each of the individual lots is discussed under the lot number in Appendix C.

4.3 Species Recorded

A total of 58 vascular plant families, 173 genera and 244 species were recorded during the survey (See Appendix A). The dominant plant families were: Myrtaceae (Eucalyptus family) with 24 species; Fabaceae (Wattle and pea family) with 23 species; Poaceae (grass family) with 23 species; and Asteraceae (daisy family) with 17 species.

4.4 Weeds

A total of 74 weeds were recorded during the current survey with the dominant weed families being Poaceae recording 17 and Asteraceae 11 weed species. All have been determined as weeds by the Western Australian Herbarium (2011) and Department of Environment and Conservation (2011c). There are several ratings allocated to each weed in the Invasive Plant Prioritisation but only three have been selected to include in this report. These are ecological impacts, impact attributes and invasiveness which are shown in Table 7 for each of the non-endemic species recorded. Thirty three of the weeds are listed as having a high ecological impact on the environment and 47 are listed having a rapid rate of dispersal.

Table 6. Ecological Impacts and Invasiveness of recorded weeds

Species	Ecological Impacts		Invasiveness
	Ecological impact L – low impact species M – medium impact species H – high impact species U – unknown impact	Impact attributes 1, 2,3,4, 5, 6, 7, 8, 9, 10. See explanation below table	Rate of dispersal R=rapid, M=moderate, S=slow
**Acacia longifolia*	H	1,2,4,6,7,8,9	M
**Aira caryophyllaceae*	U		U
**Arctotheca calendula*	H	8,9	R
**Arundo donax*	H		S
**Avena barbata*	H		R
**Briza maxima*	U		R
**Briza minor*	U		R
**Bromus diandrus*	H		R
**Carpobrotus edulis*	H	8,9	R
**Cicendia filiformis*	L		H
**Conyza bonariensis*	L		M
**Cotula coronopifolia*	U		R
**Crepis capillaris*	L		Not recorded
**Cynodon dactylon*	H	9	R
**Cyperus tenellus*	L		U
**Echium plantagineum*	H	increasing	R
**Ehrharta calycina*	H	1,2,6,8,9	R
**Ehrharta longiflora*	H	1,2,6,8,9	R
**Eragrostis curvula*	H		R
**Erodium botrys*	U		M
**Euphorbia peplus*	H	8,9	R
**Euphorbia terracina*	H	8,9	R
**Ficus carica*	H		M
**Foeniculum vulgare*	L		M
**Freesia alba x leichtlinii*	H	8,9	R
**Fumaria capreolata*	H	7,9	R
**Gladiolus caryophyllaceus*	H		R
**Gomphocarpus fruticosus*	H	9	R
**Hedypnois rhagadioloides*	U		U
**Holcus lanatus*	H		U
**Hordeum vulgare*	H		U
**Hypochaeris glabra*	H		R
**Isolepis marginata*	U		U
**Juncus bufonius*	U		R

Species	Ecological Impacts		Invasiveness
	Ecological impact L – low impact species M – medium impact species H – high impact species U – unknown impact	Impact attributes 1, 2,3,4, 5, 6, 7, 8, 9, 10. See explanation below table	Rate of dispersal R=rapid, M=moderate, S=slow
**Juncus capitatus*	U		R
**Lactuca serriola*	H		R
**Lagurus ovatus*	H		R
**Lolium rigidum*	M		R
**Lotus subbiflorus*	U		R
**Lysimachia arvensis*	U		R
**Lythrum hyssopifolia*	M		R
**Medicago polymorpha*	L		Not recorded
**Monopsis debilis*	M		R
**Moraea flaccida*	H	8,9	R
**Ornithopus pinnatus*	M		R
**Orobanche minor*	U		R
**Oxalis corniculata*	L		S
**Oxalis pes-caprae*	H		S
**Oxalis purpurea*	H		S
**Paspalum urvillei*	H		M
**Pelargonium capitatum*	H	8,9	R
**Pennisetum clandestinum*	H		S
**Petrorhagia dubia*	M	8	R
**Phytolacca octandra*	U		M
**Ranunculus sessiliflorus*	U		R
**Raphanus raphanistrum*	U		M
**Ricinus communis*	M	2,8,9	R
**Romulea rosea*	U		R
**Rubus laudatus*	H	3,7,8,9	M
**Rumex crispus*	U		R
**Schinus terebinthifolia*	H	3,7,8,9	M
**Silene gallica*	L		M
**Solanum americanum*	U		R
**Solanum nigrum*	M		R
**Sonchus asper*	U		R
**Sonchus oleraceus*	U	increasing	R
**Stellaria media*	L		R
**Trifolium campestre*	U		U
**Ursinia anthemoides*	U	increasing	R
** Vellereophyton dealbatum*	M		R
**Vicia sativa*	U		U
**Vulpia bromoides*	H		R
**Wahlenbergia capensis*	U		R
**Zantedeschia aethiopicum*	H	6,7,8,9,10	R

Impact Attributes: 1 - changed fire regime; 2 - changed nutrient conditions; 3 - changed hydrological patterns; 4 - changed soil erosion patterns; 5 - changed geomorphological processes; 6 - changed biomass distribution; 7 - changed light distribution; 8 - loss of biodiversity; 9 - substantially reduces regeneration opportunities of native plants; 10 - allelopathic effects. Increasing means that the weed is increasing its distribution from original known areas.

4.5 Significant Taxa

No Threatened or Priority Flora were recorded during the survey.

5. DISCUSSION

The greatest proportion of the total area surveyed was completely degraded due to clearing, gardens associated with homes, the planting of non-endemic taxa and a market garden which grew strawberries. The site varied between high ground and low ground, and at the time of the survey some areas were inundated.

Most of the remnant vegetation in the higher ground areas recorded a number of tree deaths, especially *Banksia* species but also some *Eucalyptus marginata* subsp. *marginata*. These deaths follow recent very hot summers and low rainfall years which would be expected to put trees under stress. These deaths considerably reduced the vegetation condition of these vegetation units in the Lots where they were recorded.

The lower ground vegetation varied considerably in condition but there several *Melaleuca preissiana* trees scattered through even the degraded areas that were of a good size. On the whole the wetland vegetation did not seem to be suffering the same number of tree deaths as the higher ground.

Lot 6 had remnant vegetation in the best condition with a large area of Lot 5 also being in a good condition. The better condition vegetation of these two lots adjoined each other representing a remnant of a reasonable size. The area represented by quadrat F11 on Lot 3 had very dense *Melaleuca preissiana* and a few *Melaleuca rhaphiophylla* trees, all of a reasonable size and in very good condition. Unfortunately the understory had mainly been replaced by weeds but the area was fenced keeping any stock out.

The vegetation condition recorded for the different lots (see Table 6) has 9 lots with a vegetation condition of good or better and 12 with a vegetation condition between good to degraded and completely degraded. This may suggest that the remnant vegetation present at the Lots is of a reasonably quality, but quadrats were placed in the area within each lot where the vegetation was in the best condition, skewing the overall results to the better or above end of the vegetation condition scale. Very little of the remnant vegetation was worthy of retention but a very important factor irrespective of the vegetation units and their condition is the dampness level of the whole site and how any proposed development could alter that regime.

None of the vegetation units are threatened or priority ecological communities and no threatened or priority flora were recorded.

Several aggressive weeds were recorded including Blackberry (**Rubus lauatus*) and Arum lily (**Zantedeschia aethiopica*).

6. REFERENCES

Beard, J.S. (1981). *Vegetation Survey of Western Australia Swan*. University of Western Australia Press, Crawley

Beard, J.S. (1990). *Plant Life of Western Australia*. Kangaroo Press, Kenthurst NSW

Biggs, E.R. and Wilde, S.A. (1980). *Geology, Mineral Resources and Hydrology of the Darling System, Western Australia*. Department of Conservation and Environment, Perth, Western Australia

Churchward, H.M. and McArthur, W.M. (1980). *Landform and Soils of the Darling System* In *Atlas of Natural Resources, Darling System, Western Australia*. Department of Conservation and Environment, Perth, Western Australia

Commonwealth of Australia (2001). *National Objectives and Targets for Biodiversity Conservation 2001-2005*. Environment Australia; Department of Environment and Heritage, Canberra

Department of Environment and Conservation (2011a). *Threatened and Priority List for Western Australia.* Published list by the Department of Conservation and Land Management, Western Australia

Department of Environment and Conservation (2011b). *List of Threatened Ecological Communities on the Department of Environment and Conservation Threatened Ecological Communities (TEC) Database endorsed by the Minister for the Environment*. http://www.naturebase.net/plants_animals/watscu/pdf/tec/endorsed_tec_list_jan04.pdf

Department of Environment and Conservation. (2011c). *Invasive Plant Prioritisation Process for Department of Environment and Conservation*. http://www.dec.wa.gov.au/content/view/6295/2275/1/1/

Department of Sustainability, Environment. Water. Populations and Communities (2011). *EPBC Act List of Threatened Flora.* http://www.deh.gov.au/

Environmental Protection Authority (2000). *Environmental Protection of Native Vegetation in Western Australia. EPA Position Statement No. 2.* EPA, Perth

Environmental Protection Authority (2004). *Guidance for the Assessment of Environmental Factors, Terrestrial flora and vegetation surveys for environmental impact assessment in Western Australia. No. 51.* EPA, Perth

Gibson, N., Keighery, B.J., Keighery, G.J., Burbidge, A.H. and Lyons, M.N. (1994). *A Floristic Survey of the southern Swan Coastal Plain.* Unpublished report for the Australian Heritage Commission prepared by the Department of Conservation and Land Management and the Conservation Council of Western Australia (Inc.)

Government of Western Australia (2000). *Bush Forever*. Department of Environmental Protection, WA

Havel, J.J. (2002). *Review of Management Options of Poorly Represented Vegetation Complexes*. Unpublished report for the Conservation Commission

Hearn, R., Williams, K., Comer, S. and Beecham, B. (2002). *Jarrah Forest 2 (JF2 – Southern Jarrah Forest subregion)* In *A Biodiversity Audit of Western Australia's 53 Biogeographical subregions.* Department of Conservation and Land Management

Heddle, E.M., Loneragan, O.W. and Havell, J.J. (1980). *Vegetation of the Darling System* In *Atlas of Natural Resources, Darling System, Western Australia*. Department of Conservation and Environment, Perth, Western Australia

Hussey, B.M.J., Keighery, G.J., Cousens, R.D., Dodd, J. and Lloyd, S.G. (1997). *Western Weeds – A guide to the weeds of Western Australia.* Plant Protection Society of Western Australia

Keighery, B.J. (1994). *Bushland Plant Survey: a Guide to Plant Community Surveys for the Community.* Wildflower Society of Western Australia (Inc.) Nedlands, Western Australia

Mitchell, D., Williams, K. and Desmond, A. (2002). *Swan Coastal Plain 2 (SWA2 – Swan Coastal Plain subregion)* In *A Biodiversity Audit of Western Australia's 53 Biogeographical subregions*. Department of Conservation and Land Management

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

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

Thackway, R. and Cresswell I. D. (1995). *An Interim Biogeographical Regionalisation for Australia: a Framework for Setting Priorities in the National Reserves System Cooperative Program.* Australian Nature Conservation Agency, Canberra, ACT

Western Australian Herbarium (2011a). *Florabase*. Department of Environment and Conservation. http://www.calm.wa.gov.au/science/florabase.html

Western Australian Herbarium (2011b). *Max*. Department of Environment and Conservation

APPENDIX A

Species Listed Under Vascular Plant Family

FAMILY	***species***
ANACARDIACEAE	**Schinus terebinthifolia*
APIACEAE	*Centella asiatica*
	**Foeniculum vulgare*
	Homalosciadium homalocarpum
	Trachymene pilosa
ARACEAE	*Lemna disperma*
	**Zantedeschia aethiopica*
APOCYNACEAE	**Gomphocarpus fruticosus*
ASPARAGACEAE	*Chamaescilla corymbosa*
	Laxmannia grandiflora
	Lomandra caespitosa
	Lomandra hermaphrodita
	Lomandra nigricans
	Lomandra preissii
	Lomandra suaveolens
	Thysanotus dichotomus
	Thysanotus patersonii
	Thysanotus tenellus
ASTERACEAE	**Arctotheca calendula*
	**Conyza bonariensis*
	**Cotula coronopifolia*
	**Crepis capillaris*
	**Hedypnois rhagadioloides*
	Hyalosperma cotula
	**Hypochaeris glabra*
	**Lactuca serriola*
	Millotia tenuiflora var. *tenuiflora*
	Podolepis angustifolia
	Podotheca gnaphalioides
	Senecio pinnatifida subsp. *latilobus*
	Siloxerus multiflorus
	**Sonchus asper*
	**Sonchus oleraceus*
	**Ursinia anthemoides*
	**Vellereophyton dealbatum*
BORAGINACEAE	**Echium plantagineum*
BRASSICACEAE	**Raphanus raphanistrum*
CAMPANULACEAE	**Monopsis debilis*
	**Wahlenbergia capensis*
	Wahlenbergia gracilenta
	Wahlenbergia preissii
CARYOPHYLLACEAE	**Petrorhagia dubia*
	**Silene gallica*
	**Stellaria media*

FAMILY	***species***
CASUARINACEAE	*Allocasuarina fraseriana*
	Allocasuarina humilis
CENTROLEPIDACEAE	*Aphelia cyperoides*
	Centrolepis drummondiana
COLCHICACEAE	*Burchardia umbellata*
CRASSULACEAE	*Crassula colorata*
CYPERACEAE	*Baumea articulata*
	Baumea juncea
	**Cyperus tenellus*
	Isolepis cyperoides
	**Isolepis marginatus*
	Lepidosperma leptostachyum
	Lepidosperma longitudinale
	Lepidosperma squamatum
	Schoenus clandestinus
	Schoenus curvifolius
	Schoenus efoliatus
	Schoenus rigens
DASYPOGONACEAE	*Calectasia narragara*
	Dasypogon bromeliifolius
DILLENIACEAE	*Hibbertia huegelii*
	Hibbertia hypericoides
	Hibbertia racemosa
DROSERACEAE	*Drosera erythrorhiza*
	Drosera gigantea subsp. *gigantea*
	Drosera glanduligera
	Drosera macrantha
	Drosera paleacea subsp. paleacea
	Drosera pallida
EPACRIDACEAE	*Astroloma xerophyllum*
	Conostephium pendulum
	Conostephium preissii
	Leucopogon conostephioides
	Leucopogon propinquus
	Styphelia tenuiflora
EUPHORBIACEAE	**Euphorbia peplus*
	**Euphorbia terracina*
	Monotaxis grandiflora
	**Ricinus communis*

FAMILY	***species***
FABACEAE	*Acacia huegelii*
	**Acacia longifolia*
	Acacia pulchella var. *glabrescens*
	Acacia pulchella var. *pulchella*
	Acacia saligna
	Acacia stenoptera
	Aotus gracillima
	Bossiaea eriocarpa
	Daviesia triflora
	Eutaxia virgata
	Gastrolobium capitatum
	Gompholobium tomentosum
	Hovea trisperma
	Jacksonia furcellata
	Kennedia prostrata
	**Lotus subbiflorus*
	**Medicago polymorpha*
	**Ornithopus pinnatus*
	Oxylobium linearifolium
	Pultenaea reticulata
	Sphaerolobium medium
	**Trifolium campestre*
	**Vicia sativa*
FUMARIACEAE	**Fumaria capreolata*
GENTIANACEAE	**Cicendia filiformis*
GERANIACEAE	**Erodium botrys*
	Geranium solandri
	**Pelargonium capitatum*
GOODENIACEAE	*Dampiera linearis*
	Goodenia pulchella
	Lechenaultia floribunda
	Scaevola repens
HAEMODORACEAE	*Anigozanthos humilis*
	Anigozanthos manglesii
	Conostylis aculeata subsp. *aculeata*
	Conostylis serrulata
	Haemodorum spicatum
	Phlebocarya ciliata
	Phlebocarya filifolia
HALORAGACEAE	*Gonocarpus pithyoides*
	Myriophyllum tillaeoides

FAMILY	***species***
HEMEROCALLIDACEAE	*Arnocrinum preissii*
	Caesia micrantha
	Dianella revoluta
	Hensmania turbinata
	Tricoryne elatior
IRIDACEAE	**Freesia alba* x *leichtlinii*
	**Gladiolus caryophyllaceus*
	**Moraea flaccida*
	Patersonia juncea
	Patersonia occidentalis
	**Romulea rosea*
JUNCACEAE	**Juncus bufonius*
	**Juncus capitatus*
	Juncus pallidus
JUNCAGINACEAE	*Triglochin lineare*
LAMIACEAE	*Hemiandra pungens*
LAURACEAE	*Cassytha capillaris*
	Cassytha racemosa
LOBELIACEAE	*Lobelia alata*
LOGANIACEAE	*Phyllangium paradoxa*
LORANTHACEAE	*Nuytsia floribunda*
LYTHRACEAE	**Lythrum hyssopifolium*
MESEMBRYANTHACEAE	**Carpobrotus edulis*
MORACEAE	**Ficus carica*
MYRTACEAE	*Astartea scoparia*
	Calothamnus lateralis
	Calytrix flavescens
	Calytrix fraseri
	Eremaea pauciflora
	Eucalyptus marginata subsp. *marginata*
	Eucalyptus rudis subsp. *rudis*
	Eucalyptus todtiana
	Hypocalymma angustifolium
	Hypocalymma robustum
	Kunzea glabrescens
	Melaleuca incana subsp. *incana*
	Melaleuca pauciflora
	Melaleuca preissiana
	Melaleuca rhaphiophylla
	Melaleuca seriata
	Melaleuca systena
	Melaleuca teretifolia
	Melaleuca thymoides
	Melaleuca viminea subsp. *viminea*

FAMILY	***species***
MYRTACEAE (cont.)	*Pericalymma ellipticum*
	Regelia ciliata
	Scholtzia involucrata
	Taxandria linearifolia
ORCHIDACEAE	*Caladenia flava* subsp. *flava*
	Caladenia paludosa
	Caladenia sp.
	Diuris corymbosa
	Eriochilus dilatatus
	Lyperanthus nigricans
	Microtis media subsp. *media*
	Prasophyllum gracile
	Prasophyllum sp.
	Pterostylis pyramidalis
	Pterostylis pyramidalis
	Pterostylis vittata
	Thelymitra crinita
OROBANCHACEAE	**Orobanche minor*
OXALIDACEAE	**Oxalis corniculata*
	**Oxalis pes-caprae*
	**Oxalis purpurea*
PHYTOLACCACEAE	**Phytolacca octandra*
POACEAE	**Aira caryophyllaceae*
	Amphibromus nervosus
	Amphipogon turbinatus
	**Arundo donax*
	Austrostipa compressa
	**Avena barbata*
	**Briza maxima*
	**Briza minor*
	**Bromus diandrus*
	**Cynodon dactylon*
	**Ehrharta calycina*
	Eragrostis elongata
	**Ehrharta longiflora*
	**Eragrostis curvula*
	**Holcus lanatus*
	**Hordeum vulgare*
	**Lagurus ovatus*
	**Lolium rigidum*
	**Paspalum urvillei*
	**Pennisetum clandestinum*
	**Vulpia bromoides*
	**Vulpia sp.*
POLYGALACEAE	**Rumex crispus*

FAMILY	***species***
PORTULACEAE	*Calandrinia corrigioloides*
	Calandrinia granulifera
	Calandrinia linifolia
PRIMULACEAE	**Lysimachia arvensis*
PROTEACEAE	*Adenanthos cygnorum* subsp. *cygnorum*
	Banksia attenuata
	Banksia ilicifolia
	Banksia menziesii
	Petrophile linearis
	Stirlingia latifolia
	Synaphea spinulosa
RANUNCULACEAE	*Ranunculus colonorum*
RANUNCULACEAE	**Ranunculus sessiliflorus*
RESTIONACEAE	*Desmocladus flexuosus*
	Dielsia stenostachya
	Hypolaena exsulca
	Lepyrodia glauca
	Lyginia barbata
	Meeboldina scariosa
ROSACEAE	**Rubus laudatus*
RUTACEAE	*Boronia ramosa* subsp. *anethifolia*
	Philotheca spicatus
SOLANACEAE	**Solanum americanum*
STYLIDIACEAE	*Levenhookia stipitata*
	Stylidium brunonianum
	Stylidium piliferum
	Stylidium repens
	Stylidium schoenoides
XANTHORRHOEACEAE	*Xanthorrhoea brunonis*
	Xanthorrhoea preissii
ZAMIACEAE	*Macrozamia riedlei*

APPENDIX B

Quadrat Data

QUADRAT F01

Location: Lot 9103
GPS: 396749E; 6445152N also at 396743E; 6445296N
Soil Type: Grey sand
Vegetation Description: Low Woodland A of *Melaleuca preissiana* over Dense Thicket of *Kunzea glabrescens* over Herbs dominated by *Dasypogon bromeliifolius* (mainly dead)
Vegetation Condition: Degraded
Notes: It was on the edge of the vegetation where the greater diversity was recorded

SPECIES	HEIGHT (cm)	% COVER
**Arctotheca calendula*	45	<1
Banksia attenuata	1200	all dead 3%
Banksia ilicifolia	1200	2
Bossiaea eriocarpa	40	3
**Briza maxima*	60	1
**Briza minor*	25	70
Burchardia umbellata	70	<1
Caesia micrantha	70	<1
Caladenia flava subsp. *flava*	35	<1
Caladenia paludosa	50	<1
Conostylis serrulata	45	2
Dasypogon bromeliifolius	60	50
Drosera macrantha	twiner	<1
**Ehrharta calycina*	75	1
**Ehrharta longiflora*	60	<1

SPECIES	HEIGHT (cm)	% COVER
Eriochilus dilatatus	10	<1
**Euphorbia terracina*	60	<1
**Fumaria capreolata*	50	<1
**Gladiolus caryophyllaceus*	80	<1
Gompholobium tomentosum	50	<1
**Hypochaeris glabra*	50	<1
Kunzea glabrescens	1200	1
**Lactuca serriola*	55	<1
Lepidosperma longitudinale	50	25
Lomandra caespitosa	50	<1
Melaleuca preissiana	1200	<1
Monotaxis grandiflora	10	<1
**Pelargonium capitatum*	5	<1
Pterostylis pyramidalis	35	<1
Pterostylis vittata	30	1
Ranunculus sessiliflorus	5	<1
Schoenus curvifolius	60	1
**Sonchus oleraceus*	40	1
Stylidium schoenoides	50	<1
Thysanotus tenellus	50	<1
Trachymene pilosa	30	<1
Tricoryne elatior	40	<1
**Avena barbata*	Opportunistic	
Acacia pulchella var. *pulchella*	Opportunistic	
Allocasuarina fraseriana	Opportunistic	
Amphipogon turbinatus	Opportunistic	
Astartea scoparia	Opportunistic	
Boronia ramosa	Opportunistic	
**Bromus diandrus*	Opportunistic	
Chamaescilla corymbosa	Opportunistic	
Conostephium preissii	Opportunistic	
Conostylis aculeata subsp. *aculeata*	Opportunistic	
Desmocladus flexuosus	Opportunistic	
**Freesia alba* x *leichtlinii*	Opportunistic	
Hibbertia hypericoides	Opportunistic	
Hyalosperma cotula	Opportunistic	
Kennedia prostrata	Opportunistic	
Lomandra caespitosa	Opportunistic	
Lomandra preissii	Opportunistic	
Lyginia barbata	Opportunistic	
**Lysimachia arvensis*	Opportunistic	
Melaleuca seriata	Opportunistic	
Melaleuca thymoides	Opportunistic	
Microtis media subsp. *media*	Opportunistic	
**Oxalis purpurea*	Opportunistic	
Patersonia occidentalis	Opportunistic	

SPECIES	HEIGHT (cm)	% COVER
Philotheca spicatus	Opportunistic	
Phyllangium paradoxa	Opportunistic	
Scholtzia involucrata	Opportunistic	
**Sonchus oleraceus*	Opportunistic	
Thelymitra crinita	Opportunistic	
**Ursinia anthemoides*	Opportunistic	
**Wahlenbergia capensis*	Opportunistic	
Xanthorrhoea brunonis	Opportunistic	
Xanthorrhoea preissii	Opportunistic	

QUADRAT F02

Location: Lot 9103
GPS: 396802E; 6445083N
Soil Type: Grey / yellow sand
Vegetation Description: Low Woodland A of *Banksia attenuata, Banksia menziesii* and occasional trees of *Eucalyptus marginata* subsp. *marginata* over Low Scrub B of *Xanthorrhoea preissii* over Dwarf Scrub C dominated by *Hibbertia hypericoides* over Herbs dominated by *Burchardia umbellata*
Vegetation Condition: Good
Notes: Most of this unit is degraded with large areas of **Ehrharta calycina*. Several deaths in *Banksia* species possibly due to hot summer of 2010-2011 and dry 2010 winter

SPECIES	HEIGHT (cm)	% COVER
Adenanthos cygnorum subsp. *cygnorum*	120	<1
Arnocrinum preissii	60	<1
**Avena barbata*	95	1
Banksia attenuata	800	15
Banksia menziesii	800	3
**Briza maxima*	50	5
Burchardia umbellata	70	15
Chamaescilla corymbosa	20	5
Dasypogon bromeliifolius	70	1
Desmocladus flexuosus	50	5
**Ehrharta calycina*	95	70
**Ehrharta longiflora*	65	5
Eriochilus dilatatus	15	<1
**Gladiolus caryophyllaceus*	90	5
Gompholobium tomentosum	75	1

SPECIES	HEIGHT (cm)	% COVER
Hibbertia hypericoides	60	<1
**Hypochaeris glabra*	30	1
Kennedia prostrata	5	1
Kunzea glabrescens	200	1
Lepidosperma squamatum	70	<1
Lomandra nigricans	40	<1
Lyginia barbata	80	<1
**Lysimachia arvensis*	10	<1
Macrozamia riedlei	75	2
Melaleuca thymoides	90	<1
Monotaxis grandiflora	5	<1
Nuytsia floribunda	600	1
**Pelargonium capitatum*	50	2
Schoenus curvifolius	50	2
Scholtzia involucrata	50	<1
**Sonchus oleraceus*	65	2
Trachymene pilosa	20	<1
Tricoryne elatior	70	<1
**Ursinia anthemoides*	70	5
**Vicia sativa*	twiner	<1-25
Xanthorrhoea brunonis	75	2
Xanthorrhoea preissii	120	10
Allocasuarina fraseriana	Opportunistic	
Anigozanthos humilis	Opportunistic	
Astroloma xerophyllum	Opportunistic	
Austrostipa compressa	Opportunistic	
Banksia ilicifolia	Opportunistic	
Boronia ramosa	Opportunistic	
**Briza minor*	Opportunistic	
**Bromus diandrus*	Opportunistic	
Caladenia flava subsp. *flava*	Opportunistic	
Calandrinia liniflora	Opportunistic	
Calytrix flavescens	Opportunistic	
Conostephium preissii	Opportunistic	
Conostylis aculeata subsp. *aculeata*	Opportunistic	
Crassula colorata	Opportunistic	
Dampiera linearis	Opportunistic	
Daviesia triflora	Opportunistic	
Eucalyptus marginata subsp. *marginata*	Opportunistic	
**Euphorbia terracina*	Opportunistic	
**Freesia alba x leichtlinii*	Opportunistic	
**Fumaria capreolata*	Opportunistic	
Gastrolobium capitatum	Opportunistic	
Hemiandra pungens	Opportunistic	
Hibbertia racemosa	Opportunistic	
Hyalosperma cotula	Opportunistic	

SPECIES	HEIGHT (cm)	% COVER
Laxmannia grandiflora	Opportunistic	
Lomandra caespitosa	Opportunistic	
Melaleuca systena	Opportunistic	
Microtis media subsp. *media*	Opportunistic	
**Oxalis pes-caprae*	Opportunistic	
Patersonia occidentalis	Opportunistic	
Petrophile linearis	Opportunistic	
Podolepis angustifolia	Opportunistic	
Podotheca gnaphalioides	Opportunistic	
Schoenus clandestinus	Opportunistic	
Senecio pinnatifida subsp. *latilobus*	Opportunistic	
Stirlingia latifolia	Opportunistic	
Synaphea spinulosa	Opportunistic	
**Wahlenbergia capensis*	Opportunistic	

QUADRAT F03

Location: Lot 9103
GPS: 396879E; 6444990N
Soil Type: Yellow grey sand
Vegetation Description: Open Low Woodland A of *Banksia attenuata* over Dwarf Scrub C of mixed taxa dominated by *Hibbertia hypericoides* over Open Tall Grass dominated by **Ehrharta calycina* over Open Herbs dominated by *Burchardia umbellata* and *Chamaescilla umbellata*
Vegetation Condition: Good
Notes: Very small area at the eastern edge of the property

SPECIES	HEIGHT (cm)	% COVER
Acacia pulchella var. *glabrescens*	70	<1
Adenanthos cygnorum subsp. *cygnorum*	250	3
Allocasuarina humilis	150	3
Amphipogon turbinatus	60	<1
Arnocrinum preissii	70	<1
Astroloma xerophyllum	50	1
**Avena barbata*	120	3
Banksia attenuata	600	5
Boronia ramosa	70	<1
**Briza maxima*	70	5
Burchardia umbellata	70	5
Chamaescilla corymbosa	20	5
Conostephium pendulum	50	<1
Daviesia triflora	75	1
**Ehrharta calycina*	120	15
**Euphorbia terracina*	30	<1
**Fumaria capreolata*	70	<1

SPECIES	HEIGHT (cm)	% COVER
**Gladiolus caryophyllaceus*	120	3
Gompholobium tomentosum	60	1
Hemiandra pungens	10	<1
Hensmania turbinata	20	1
Hibbertia huegelii	25	<1
Hibbertia hypericoides	70	5
**Hypochaeris glabra*	15	<1
Jacksonia furcellata	200	<1
Laxmannia grandiflora	10	<1
Lomandra caespitosa	50	1
Melaleuca systena	80	1
**Oxalis pes-caprae*	40	<1
**Romulea rosea*	50	1
Schoenus clandestinus	5	<1
Stirlingia latifolia	175	3
Synaphea spinulosa	60	1
Thysanotus dichotomus	70	<1
Trachymene pilosa	25	<1
Tricoryne elatior	60	<1
**Ursinia anthemoides*	60	5
Acacia huegelii	Opportunistic	
Allocasuarina fraseriana	Opportunistic	
Anigozanthos humilis	Opportunistic	
**Arctotheca calendula*	Opportunistic	
Austrostipa compressa	Opportunistic	
Calytrix flavescens	Opportunistic	
Conostylis aculeata subsp. *aculeata*	Opportunistic	
Dampiera linearis	Opportunistic	
Eucalyptus marginata subsp. *marginata*	Opportunistic	
Eucalyptus todtiana	Opportunistic	
Gonocarpus pithyoides	Opportunistic	
Hibbertia racemosa	Opportunistic	
Kunzea glabrescens	Opportunistic	
Lyginia barbata	Opportunistic	
Melaleuca thymoides	Opportunistic	
Millotia tenuiflora var. *tenuiflora*	Opportunistic	
Nuytsia floribunda	Opportunistic	
Patersonia occidentalis	Opportunistic	
**Pelargonium capitatum*	Opportunistic	
Petrophile linearis	Opportunistic	
Philotheca spicatus	Opportunistic	
Podotheca gnaphalioides	Opportunistic	
Thysanotus patersonii	Opportunistic	
**Wahlenbergia capensis*	Opportunistic	

QUADRAT F04

Location: Lot 9103
GPS: 396879E; 6445297N
Soil Type: Grey sand
Vegetation Description: Low Forest A of *Eucalyptus todtiana* and *Banksia attenuata* over Dwarf Scrub C dominated by *Hibbertia hypericoides* over Tall Grass dominated by **Ehrharta calycina* over Herbs of mixed taxa dominated by *Gladiolus caryophyllaceus*
Vegetation Condition: Good
Notes: Occasional *Eucalyptus marginata* subsp. *marginata* trees in this vegetation unit

SPECIES	HEIGHT (cm)	% COVER
Acacia pulchella var. *pulchella*	60	<1
Allocasuarina humilis	90	1
Astroloma xerophyllum	50	<1
Austrostipa compressa	50	1
Banksia attenuata	500	8
Bossiaea eriocarpa	50	<1
**Briza maxima*	70	10
Burchardia umbellata	75	5
Caesia micrantha	50	<1
Calectasia narragara	60	<1
Chamaescilla corymbosa	5	3
Conostylis aculeata subsp. *aculeata*	50	3
Dampiera linearis	20	<1
Dasypogon bromeliifolius	90	3
Desmocladus flexuosus	35	1
Diuris corymbosa	70	<1

SPECIES	HEIGHT (cm)	% COVER
Drosera erythrorhiza	2	<1
**Ehrharta calycina*	90	<1
Eriochilus dilatatus	15	<1
Eucalyptus todtiana	1400	45
**Gladiolus caryophyllaceus*	120	40
Gompholobium tomentosum	70	<1
Hibbertia huegelii	50	<1
Hibbertia hypericoides	80	10
Lomandra caespitosa	60	<1
Lomandra hermaphrodita	50	<1
**Lysimachia arvensis*	30	<1
Microtis media subsp. *media*	50	<1
Patersonia occidentalis	60	1
**Pelargonium capitatum*	50	<1
Petrophile linearis	40	<1
Pterostylis vittata	50	<1
Senecio pinnatifida subsp. *latilobus*	10	<1
**Sonchus oleraceus*	70	1
Stirlingia latifolia	70	1
Thysanotus dichotomus	70	<1
Thysanotus patersonii	twiner	<1
Trachymene pilosa	10	5
**Ursinia anthemoides*	80	5
**Zantedeschia aethiopica*	20	<1
Acacia saligna	Opportunistic	
Adenanthos cygnorum subsp. *cygnorum*	Opportunistic	
Allocasuarina fraseriana	Opportunistic	
Anigozanthos humilis	Opportunistic	
**Bromus diandrus*	Opportunistic	
Calytrix flavescens	Opportunistic	
Conostephium pendulum	Opportunistic	
Daviesia triflora	Opportunistic	
Eucalyptus marginata subsp. *marginata*	Opportunistic	
**Euphorbia terracina*	Opportunistic	
Hibbertia racemosa	Opportunistic	
Laxmannia grandiflora	Opportunistic	
Lyginia barbata	Opportunistic	
Melaleuca systena	Opportunistic	
Melaleuca thymoides	Opportunistic	
Nuytsia floribunda	Opportunistic	
Phlebocarya filifolia	Opportunistic	
Scaevola repens	Opportunistic	
Scholtzia involucrata	Opportunistic	
Xanthorrhoea preissii	Opportunistic	

QUADRAT F05

Location: Lot 99
GPS: 396653E; 6444217N: also recorded from Lot 100 at 396661E; 6444150N
Soil Type: Black silty sand
Vegetation Description: Dense Low Forest A of *Melaleuca preissiana* over Dense Tall Sedges dominated by *Lepidosperma longitudinale*
Vegetation Condition: Good to very good at Lot 99; degraded to completely degraded at Lot 100
Notes: Thick humus layer. Where the area is more open there are a lot of *Astartea* regenerating. At Lot 100 the area has been sown with wheat

SPECIES	HEIGHT (cm)	% COVER
Acacia pulchella var. *glabrescens*	60	<1
Aotus gracillima	80	<1
Astartea scoparia	175	1
**Avena barbata*	70	<1
**Briza maxima*	30	<1
**Bromus diandrus*	70	
**Conyza bonariensis*	5	<1
Dianella revoluta	60	<1
Dielsia stenostachya	80	20-75
Juncus pallidus	120	1
Lepidosperma longitudinale	120	75-0
Lobelia alata	20	<1
Melaleuca preissiana	1200	85
Myriophyllum tillaeoides	5	<1
**Pennisetum clandestinum*	80	<1

SPECIES	HEIGHT (cm)	% COVER
Pterostylis pyramidalis	10	<1
**Rubus laudatus*	90	5-50
**Sonchus oleraceus*	50	<1
**Zantedeschia aethiopica*	90	5
Aphelia cyperoides	Opportunistic	
**Briza minor*	Opportunistic	
Cassytha capillaris	Opportunistic	
**Cotula coronopifolia*	Opportunistic	
Dampiera linearis	Opportunistic	
Eutaxia virgata	Opportunistic	
**Ficus carica*	Opportunistic	
**Fumaria capreolata*	Opportunistic	
Gomphocarpus fruticosus	Opportunistic	
Goodenia pulchella	Opportunistic	
Hypocalymma angustifolium	Opportunistic	
**Hypochaeris glabra*	Opportunistic	
**Juncus bufonius*	Opportunistic	
**Juncus capitatus*	Opportunistic	
Kunzea glabrescens	Opportunistic	
**Lolium rigidum*	Opportunistic	
**Lotus subbiflorus*	Opportunistic	
**Monopsis debilis*	Opportunistic	
Oxylobium linearifolium	Opportunistic	
Patersonia juncea	Opportunistic	
Patersonia occidentalis	Opportunistic	
**Pelargonium capitatum*	Opportunistic	
**Pennisetum clandestinum*	Opportunistic	
Phyllangium paradoxa	Opportunistic	
Pultenaea reticulata	Opportunistic	
**Romulea rosea*	Opportunistic	
**Schinus terebinthifolia*	Opportunistic	
Schoenus efoliatus	Opportunistic	
**Solanum americanum*	Opportunistic	
Taxandria linearifolia	Opportunistic	
**Vellereophyton dealbatum*	Opportunistic	
Xanthorrhoea preissii	Opportunistic	

QUADRAT F06N

Location: Lot 99
GPS: 396272E; 6444401N also at 396454E; 6444331
Soil Type: Pale yellow grey sand
Vegetation Description: Low Woodland A of *Banksia attenuata, Banksia menziesii, Eucalyptus marginata* subsp. *marginata* and *Allocasuarina fraseriana* over Low Heath C of mixed shrubs dominated by *Hibbertia hypericoides* over Open Sedges dominated by *Lyginia barbata*
Vegetation Condition: Good
Notes: Best high ground vegetation recorded during the survey

SPECIES	HEIGHT (cm)	% COVER
Acacia pulchella var. *glabrescens*	90	1
Acacia stenoptera	30	<1
Adenanthos cygnorum subsp. *cygnorum*	300	5
Allocasuarina fraseriana	900	3
Allocasuarina humilis	90	<1
Amphipogon turbinatus	70	1
Austrostipa compressa	60	
Banksia attenuata	800	15
Banksia menziesii	600	5
Bossiaea eriocarpa	60	<1
**Briza maxima*	70	1
Burchardia umbellata	70	<1
Caladenia flava subsp. *flava*	20	<1
Calytrix flavescens	50	2
Calytrix fraseri	80	<1
Conostylis aculeata subsp. *aculeata*	30	2
Dampiera linearis	20	<1
Daviesia triflora	70	<1

SPECIES	HEIGHT (cm)	% COVER
Desmocladus flexuosus	60	5
Diuris corymbosa	70	<1
Drosera pallida	twiner	<1
**Ehrharta calycina*	150	5
Eremaea pauciflora	100	2
**Gladiolus caryophyllaceus*	90	5
Gompholobium tomentosum	60	2
Hemiandra pungens	20	<1
Hibbertia hypericoides	70	10
Hibbertia racemosa	50	1
Hovea trisperma	50	<1
**Hypochaeris glabra*	30	3
Jacksonia furcellata	120	1
Kunzea glabrescens	200	<1
Laxmannia grandiflora	25	<1
Lomandra caespitosa	30	<1
Lyginia barbata	80	5
Lyperanthus nigricans	2	<1
Lysimachia arvensis	30	<1
Microtis media subsp. *media*	60	<1
Nuytsia floribunda	700	2
Petrophile linearis	60	2
Phlebocarya filifolia	60	5
Phyllangium paradoxa	10	<1
Pterostylis vittata	30	<1
Scholtzia involucrata	50	8
Senecio pinnatifida subsp. *latilobus*	10	<1
**Sonchus oleraceus*	60	1
Stirlingia latifolia	120	5
Stylidium brunonianum	20	<1
Stylidium piliferum	5	<1
Stylidium repens	5	<1
Thelymitra crinita	30	<1
Thysanotus patersonii	twiner	<1
Trachymene pilosa	15	3
**Ursinia anthemoides*	60	1
**Wahlenbergia capensis*	70	<1
Eucalyptus marginata subsp. *marginata*	Opportunistic	
Haemodorum spicatum	Opportunistic	
**Hedypnois rhagadioloides*	Opportunistic	
Hypocalymma robustum	Opportunistic	
Macrozamia riedlei	Opportunistic	
Schoenus curvifolius	Opportunistic	

QUADRAT F07

Location: Lot 100
GPS: 396527E; 6444181N
Soil Type: Grey sand
Vegetation Description: Dense Thicket of *Kunzea glabrescens* over Low Scrub A of *Xanthorrhoea preissii* and *Xanthorrhoea brunonis* over Herbs dominated by *Dasypogon bromeliifolius*
Vegetation Condition: Good

SPECIES	HEIGHT (cm)	% COVER
**Aira caryophyllaceae*	15	<1
**Briza maxima*	60	<1
Caladenia flava subsp. *flava*	20	<1
Caladenia sp.	10	<1
Crassula colorata	10	<1
Dasypogon bromeliifolius	50	20-50
**Gladiolus caryophyllaceus*	40	<1
**Hypochaeris glabra*	40	5
Kunzea glabrescens	1000	90
**Lagurus ovatus*	30	<1
Lobelia alata	30	<1
Lomandra hermaphrodita	30	<1
Pterostylis pyramidalis	40	<1
Schoenus curvifolius	40	1
**Solanum americanum*	50	<1
Trachymene pilosa	25	<1
**Ursinia anthemoides*	60	1

SPECIES	HEIGHT (cm)	% COVER
**Vulpia bromoides*	30	<1
**Wahlenbergia gracilenta*	50	<1
Xanthorrhoea brunonis	100	10
Xanthorrhoea preissii	120	10
**Zantedeschia aethiopica*	5	<1
Allocasuarina fraseriana	Opportunistic	
Calandrinia liniflora	Opportunistic	
Conyza bonariensis	Opportunistic	
**Crepis capillaris*	Opportunistic	
Drosera paleacea subsp. *paleacea*	Opportunistic	
Eremaea pauciflora	Opportunistic	
**Isolepis marginatus*	Opportunistic	
**Lactuca serriola*	Opportunistic	
Melaleuca preissiana	Opportunistic	
**Sonchus oleraceus*	Opportunistic	
**Wahlenbergia preissii*	Opportunistic	

QUADRAT F 08

Location: Lot 100
GPS: 396455E; 6444227N
Soil Type: Pale grey sand
Vegetation Description: Open Woodland A of *Banksia attenuata* over Scrub of *Kunzea glabrescens* over Dense Tall Grass dominated by **Ehrharta calycina* over Very Open Herbs dominated by *Dasypogon bromeliifolius*
Vegetation Condition: Degraded to completely degraded
Notes: Most of the Banksias and Kunzeas are dead

SPECIES	HEIGHT (cm)	% COVER
**Arctotheca calendula*	5	<1
Banksia attenuata	1200	5
**Briza maxima*	80	<1
Burchardia umbellata	70	3
Caladenia flava subsp. *flava*	20	<1
Crassula colorata	15	<1
Dasypogon bromeliifolius	60	5
**Ehrharta calycina*	120	3
**Ehrharta longiflora*	90	75
Eucalyptus todtiana	400	3
**Gladiolus caryophyllaceus*	120	3
**Hypochaeris glabra*	10	25
**Isolepis marginatus*	5	<1
Kunzea glabrescens	800	20
Lomandra suaveolens	30	<1
Nuytsia floribunda	500	2

SPECIES	HEIGHT (cm)	% COVER
**Solanum americanum*	70	<1
**Stellaria media*	20	<1
**Ursinia anthemoides*	50	5
**Briza minor*	Opportunistic	
**Bromus diandrus*	Opportunistic	
Calytrix flavescens	Opportunistic	
**Lagurus ovatus*	Opportunistic	
**Wahlenbergia capensis*	Opportunistic	

QUADRAT F09

Location: Lot 15
GPS: 396625E; 6444096N
Soil Type: Grey sand
Vegetation Description: Dense Thicket of *Kunzea glabrescens* over Dwarf Scrub C of *Hypolaena angustifolia* and *Lechenaultia floribunda* over Tall Sedges of *Schoenus rigens*
Vegetation Condition: Good
Notes: Large area in this good condition

SPECIES	HEIGHT (cm)	% COVER
**Aira caryophyllacea*	10	<1
**Briza maxima*	70	1
Caladenia flava subsp. *flava*	30	2
**Carpobrotus edulis*	5	<1
Cassytha racemosa	twiner	<1
Dampiera linearis	30	<1
Dasypogon bromeliifolius	70	3
Drosera glanduligera	5	1
**Gladiolus caryophyllaceus*	70	<1
Homalosciadium homalocarpum	5	<1
Hypocalymma angustifolium	70	10
**Hypochaeris glabra*	40	2
Hypolaena exsulca	50	2
**Isolepis marginatus*	5	<1
Kunzea glabrescens	600	75
Lechenaultia floribunda	50	10
Nuytsia floribunda	500	2

SPECIES	HEIGHT (cm)	% COVER
Pericalymma ellipticum	120	<1
**Petrorhagia dubia*	30	<1
Phyllangium paradoxa	15	<1
Pterostylis pyramidalis	30	<1
Schoenus rigens	80	35
**Sonchus oleraceus*	50	<1
Trachymene pilosa	20	<1
**Ursinia anthemoides*	70	1
Xanthorrhoea brunonis	100	2
**Acacia longifolia*	Opportunistic	
Allocasuarina fraseriana	Opportunistic	
Crassula colorata	Opportunistic	
Dielsia stenostachya	Opportunistic	
Eucalyptus rudis subsp. *rudis*	Opportunistic	
**Lotus subbiflorus*	Opportunistic	
Melaleuca preissiana	Opportunistic	
Microtis media subsp. *media*	Opportunistic	
**Ornithopus pinnatus*	Opportunistic	
Podotheca gnaphalioides	Opportunistic	

QUADRAT F10

Location: Lot 15
GPS: 396556E; 6444016N
Soil Type: Grey sand
Vegetation Description: Low Woodland A of *Banksia attenuata, Banksia menziesii, Allocasuarina fraseriana* and *Eucalyptus todtiana* over Scrub A of *Kunzea glabrescens* and *Adenanthos cygnorum* subsp. *cygnorum* over Herbs dominated by *Phlebocarya ciliata* and *Dasypogon bromeliifolius*
Vegetation Condition: Good

SPECIES	HEIGHT (cm)	% COVER
Acacia pulchella var. *glabrescens*	150	3
Adenanthos cygnorum subsp. *cygnorum*	400	5
Allocasuarina fraseriana	1400	5
**Avena barbata*	70	2
Banksia attenuata	600	2
Banksia menziesii	1000	5
Bossiaea eriocarpa	50	5
**Briza maxima*	60	<1
Caladenia flava subsp. *flava*	25	<1
Calandrinia corrigioloides	5	<1
Calytrix fraseri	40	<1
Conostylis aculeata subsp. *aculeata*	30	<1
Conostylis serrulata	40	<1
Crassula colorata	15	<1
Dasypogon bromeliifolius	50	10-30
Desmocladus flexuosus	30	1
**Ehrharta calycina*	80	2

SPECIES	HEIGHT (cm)	% COVER
**Gladiolus caryophyllaceus*	90	1
Gompholobium tomentosum	70	2
Hibbertia hypericoides	50	2
Hibbertia racemosa	30	1
**Hypochaeris glabra*	30	<1
Hypolaena exsulca	50	<1
Jacksonia furcellata	300	<1
Kunzea glabrescens	600	10
Laxmannia grandiflora	25	<1
Lepidosperma squamatum	80	<1
Leucopogon conostephioides	60	<1
Lomandra caespitosa	30	<1
Lomandra hermaphrodita	70	<1
Lomandra preissii	70	<1
Lyginia barbata	80	1
**Medicago polymorpha*	10	<1
Patersonia occidentalis	60	<1
**Petrorhagia dubia*	70	<1
Phlebocarya ciliata	50	40
Podolepis gnaphalioides	50	1
Pterostylis vittata	70	<1
Regelia ciliata	200	5
Stylidium repens	10	<1
Styphelia tenuiflora	50	<1
Thysanotus patersonii	twiner	<1
**Ursinia anthemoides*	60	<1
Anigozanthos manglesii	Opportunistic	
**Avena barbata*	Opportunistic	
Calytrix flavescens	Opportunistic	
Eucalyptus todtiana	Opportunistic	
**Sonchus oleraceus*	Opportunistic	

QUADRAT F11

Location: Lot 3
GPS: 396643E; 6443837N
Soil Type: Grey sand
Vegetation Description: Dense Forest A of *Melaleuca preissiana* and *Eucalyptus rudis* subsp. *rudis* over Open Low Scrub of *Astartea* over Dense Herbs of **Zantedeschia aethiopica*
Vegetation Condition: Good to degraded
Notes: Although the understorey has been replaced by weeds the density of cover of the Melaleucas is worthy of retention. *Lemna disperma* in open water

SPECIES	HEIGHT (cm)	% COVER
Astartea scoparia	200	10
**Ehrharta longiflora*	60	12
Eucalyptus rudis subsp. *rudis*	1600	10
**Euphorbia peplus*	50	1
Geranium solandri	30	1
**Lysimachia arvensis*	20	<1
Melaleuca preissiana	1200	85
Melaleuca rhaphiophylla	1400	3
**Phytolacca octandra*	70	2
Ranunculus colonorum	40	<1
**Solanum americanum*	50	<1
**Sonchus oleraceus*	60	<1
**Stellaria media*	40	1
**Zantedeschia aethiopica*	120	80
**Arctotheca calendula*	Opportunistic	
**Briza minor*	Opportunistic	

SPECIES	HEIGHT (cm)	% COVER
**Fumaria capreolata*	Opportunistic	
**Isolepis marginatus*	Opportunistic	
Lemna disperma	Opportunistic	
**Lotus subbiflorus*	Opportunistic	
Monotaxis grandiflora	Opportunistic	
**Rumex crispus*	Opportunistic	
**Trifolium campestre*	Opportunistic	

QUADRAT F12

Location: Lot 5
GPS: 396661E; 6444086N
Soil Type: Black sandy loam
Vegetation Description: Regenerating Low Woodland A of *Melaleuca preissiana* over Open Scrub of *Kunzea glabrescens* over Herbs dominated by *Mitrasacme paradoxa* and **Hypochaeris glabra* over Open to Dense Low Sedges of *Dielsia stenostachya* and *Hypolaena exsulca*
Vegetation Condition: Varies between very good and degraded
Notes: Areas with deaths of *Hypocalymma angustifolia* and *Dielsia stenostachya*

SPECIES	HEIGHT (cm)	% COVER
Aotus gracillima	50	<1
Astartea scoparia	70	1
**Briza maxima*	35	<1
**Briza minor*	35	1
**Bromus diandrus*	60	1
**Carpobrotus edulis*	5	<1
Dielsia stenostachya	50	95-5
Drosera gigantea subsp. *gigantea*	40	<1
**Ehrharta longiflora*	60	<1
Homalosciadium homalocarpum	5	10
Hypocalymma angustifolium	50	1
**Hypochaeris glabra*	30	10
Hypolaena exsulca	50	2-30
**Isolepis marginatus*	5	2
Jacksonia furcellata	150	<1
Kunzea glabrescens	200	5

SPECIES	HEIGHT (cm)	% COVER
**Lolium rigidum*	50	<1
Melaleuca preissiana	200	15
Myriophyllum tillaeoides	2	2
**Ornithopus pinnatus*	2	1
Patersonia juncea	60	<1
Phyllangium paradoxa	20	20
**Sonchus asper*	130	1
**Sonchus oleraceus*	50	<1
**Ursinia anthemoides*	50	<1
**Vulpia* sp.	5	2
Xanthorrhoea brunonis	70	1
**Acacia longifolia*	Opportunistic	
Acacia saligna	Opportunistic	
Aphelia cyperoides	Opportunistic	
Calothamnus lateralis	Opportunistic	
Cassytha racemosa	Opportunistic	
Centrolepis drummondiana	Opportunistic	
Drosera glanduligera	Opportunistic	
**Ehrharta calycina*	Opportunistic	
Lepidosperma longitudinale	Opportunistic	
Melaleuca incana subsp. *incana*	Opportunistic	
Melaleuca pauciflora	Opportunistic	
Melaleuca viminea subsp. *viminea*	Opportunistic	
Microtis media subsp. *media*	Opportunistic	
Sphaerolobium medium	Opportunistic	
Taxandria linearifolia	Opportunistic	

QUADRAT F13

Location: Lot 6
GPS: 396803E; 6444108N
Soil Type: Black sandy loam
Vegetation Description: Heath A dominated by *Melaleuca viminea* over Open Herbs dominated by **Lotus subbiflorus* and **Hypochaeris glabra* over Open Tall Sedges of *Lepidosperma longitudinale* and *Baumea juncea*
Vegetation Condition: Very good
Notes: Very dense shrubland

SPECIES	HEIGHT (cm)	% COVER
Baumea juncea	70	<1-20
**Briza minor*	30	2
**Bromus diandrus*	70	2
Cassytha racemosa	twiner	1
**Cicendia filiformis*	10	5
**Cyperus tenellus*	5	2
**Eragrostis curvula*	90	<1
**Hypochaeris glabra*	30	15
Isolepis cyperoides	20	<1
**Isolepis marginatus*	5	4
**Juncus bufonius*	10	<1
Lepidosperma longitudinale	70	20
**Lotus subbiflorus*	25	15
Melaleuca incana subsp. *incana*	170	5
Melaleuca viminea subsp. *viminea*	200	40-60
Microtis media subsp. media	50	<1

SPECIES	HEIGHT (cm)	% COVER
**Paspalum urvillei*	40	<1
Prasophyllum sp.	10	<1
**Vulpia bromoides*	25	1
Acacia saligna	Opportunistic	
Baumea articulata	Opportunistic	
**Gladiolus caryophyllaceus*	Opportunistic	
Kunzea glabrescens	Opportunistic	
Melaleuca teretifolia	Opportunistic	
**Sonchus asper*	Opportunistic	
**Zantedeschia aethiopica*	Opportunistic	

QUADRAT F14

Location: Lot 6
GPS: 396730E; 6444214N
Soil Type: Black sand
Vegetation Description: Dense Low Forest A of *Melaleuca preissiana* and *Taxandria linearifolia* over Dense Tall Sedges of *Lepidosperma longitudinale*
Vegetation Condition: Very good
Notes: Near firebreak the condition is good to degraded due to **Acacia longifolia* tall shrubs and **Rubus* species and **Zantedeschia aethiopica*. There are some open areas where *Taxandria linearifolia* has died

SPECIES	HEIGHT (cm)	% COVER
Acacia pulchella var. *glabrescens*	70	<1
Eutaxia virgata	50	<1
Hypocalymma angustifolium	120	<1
Juncus pallidus	700	20
Lepidosperma longitudinale	160	80
Meeboldina scariosa	200	2
Melaleuca preissiana	1200	90
Oxylobium lineare	300	1
Podolepis gnaphalioides	50	<1
**Rubus laudatus*	50	<1
Taxandria linearifolia	1000	10
**Zantedeschia aethiopica*	20	<1
Aotus gracillima	Opportunistic	
Astartea scoparia	Opportunistic	
**Briza maxima*	Opportunistic	

SPECIES	HEIGHT (cm)	% COVER
Caesia micrantha	Opportunistic	
Cassytha racemosa	Opportunistic	
Dielsia stenostachya	Opportunistic	
Kunzea glabrescens	Opportunistic	
**Paspalum urvillei*	Opportunistic	
Patersonia occidentalis	Opportunistic	
Podotheca gnaphalioides	Opportunistic	
**Schinus terebinthifolia*	Opportunistic	
**Sonchus oleraceus*	Opportunistic	
Xanthorrhoea brunonis	Opportunistic	
Xanthorrhoea preissii	Opportunistic	

QUADRAT F15

Location: Lot 5
GPS: 396837E; 6444033N
Soil Type: Black sand
Vegetation Description: Dense Herbs dominated by **Lotus subbiflorus* over Very Open Tall Sedges of *Baumea articulata* and *Juncus pallidus*
Vegetation Condition: completely degraded
Notes: Many *Prasophyllum gracile* located in this area

SPECIES	HEIGHT (cm)	% COVER
Amphibromus nervosus	110	1
**Arctotheca calendula*	30	<1
Baumea articulata	80	10
**Briza maxima*	40	<1
**Briza minor*	20	5
**Cicendia filiformis*	5	<1
**Cyperus tenellus*	5	3
**Hypochaeris glabra*	20	1
Isolepis cyperoides	15	<1
**Isolepis marginatus*	10	5
**Juncus bufonius*	15	<1
Juncus pallidus	100	34
**Lolium rigidum*	50	<1
**Lotus subbiflorus*	20	95
**Lysimachia arvensis*	20	<1
Meeboldina scariosa	120	5
Prasophyllum gracile	50	<1

SPECIES	HEIGHT (cm)	% COVER
**Romulea rosea*	30	20
**Vulpia bromoides*	60	2
**Arundo donax*	Opportunistic	
**Avena barbata*	Opportunistic	
*Cultivated trees	Opportunistic	
**Gomphocarpus fruticosus*	Opportunistic	
**Hordeum leporinum*	Opportunistic	
Microtis media subsp. *media*	Opportunistic	
**Rumex crispus*	Opportunistic	
Triglochin lineare	Opportunistic	
**Zantedeschia aethiopica*	Opportunistic	

QUADRAT F16

Location: Lot 9006
GPS: Not recorded
Soil Type: Grey sand
Vegetation Description: Low Grass dominated by **Pennisetum clandestinum* over Open Herbs of **Lotus subbiflorus*
Vegetation Condition: Degraded to completely degraded
Notes: Series of wetlands with few sedges

SPECIES	HEIGHT (cm)	% COVER
**Arctotheca calendula*	30	3
**Avena barbata*	150	5
**Cynodon dactylon*	40	3
**Cyperus tenellus*	5	5
**Ehrharta calycina*	90	3
**Erodium botrys*	40	<1
**Holcus lanatus*	70	2
**Juncus bufonius*	25	3
Juncus pallidus	70	5
**Lolium rigidum*	60	2
**Lotus subbiflorus*	40	25
**Lysimachia arvensis*	5	<1
**Lythrum hyssopifolium*	15	5
Melaleuca teretifolia	200	1
**Pennisetum clandestinum*	25	20
**Phytolacca octandra*	60	3
Triglochin lineare	20	1
Astartea scoparia	Opportunistic	

QUADRAT F17

Location: Lot 9001
GPS: 397520E; 6445542N
Soil Type: Black sandy loam
Vegetation Description: Low Forest A of *Eucalyptus rudis* subsp. *rudis* over Herbs dominated by **Lotus subbiflorus* over Tall Sedges dominated by *Juncus pallidus*
Vegetation Condition: Degraded
Notes: Lot of rubbish dumped in area. *Eucalyptus rudis* subsp. *rudis* trees are mainly saplings

SPECIES	HEIGHT (cm)	% COVER
**Avena barbata*	90	<1
Centella asiatica	20	2
Eucalyptus rudis subsp. *rudis*	1500	60
**Isolepis marginatus*	15	5
Juncus pallidus	150	25
**Lotus subbiflorus*	40	2-40
**Lythrum hyssopifolium*	15	1
**Oxalis corniculata*	20	<1
**Paspalidium urvillei*	50	<1
**Acacia longifolia*	Opportunistic	
Astartea scoparia	Opportunistic	
**Carpobrotus edulis*	Opportunistic	
**Ehrharta longiflora*	Opportunistic	
**Homeria flaccida*	Opportunistic	
Melaleuca rhaphiophylla	Opportunistic	
Melaleuca teretifolia	Opportunistic	

SPECIES	HEIGHT (cm)	% COVER
Melaleuca viminea subsp. *viminea*	Opportunistic	
**Phytolacca octandra*	Opportunistic	
**Rubus laudatus*	Opportunistic	
**Rumex crispus*	Opportunistic	
**Sonchus oleraceus*	Opportunistic	

QUADRAT 18

Location: Lot 9001
GPS: 397293E; 6445477N
Soil Type: Grey sand
Vegetation Description: Open Low Woodland A of *Melaleuca preissiana* over Tall Grass dominated by **Ehrharta calycina* and **Ehrharta longiflora* over Open Herbs dominated by **Arctotheca calendula*
Vegetation Condition: Completely degraded
Notes: Lots of *Melaleuca preissiana* are dead or with tops dying. Occasional clumps of *Melaleuca preissiana* scattered through area

SPECIES	HEIGHT (cm)	% COVER
Acacia pulchella var. *glabrescens*	150	1
**Arctotheca calendula*	40	15
**Bromus diandrus*	40	<1
**Carpobrotus edulis*	20	5
**Cynodon dactylon*	20	<1
**Ehrharta calycina*	130	20
**Ehrharta longiflora*	90	25
**Eragrostis curvula*	120	10-90
**Lotus subbiflorus*	20	2
Melaleuca preissiana	1200	10
**Orobanche minor*	25	<1
**Romulea rosea*	30	2
**Vulpia bromoides*	40	50
Acacia saligna	Opportunistic	
**Arundo donax*	Opportunistic	

SPECIES	HEIGHT (cm)	% COVER
**Avena barbata*	Opportunistic	
Eucalyptus rudis subsp. *rudis*	Opportunistic	
Eucalyptus todtiana	Opportunistic	
**Euphorbia terracina*	Opportunistic	
Jacksonia furcellata	Opportunistic	
Kunzea glabrescens	Opportunistic	
Nuytsia floribunda	Opportunistic	
**Oxalis pes-caprae*	Opportunistic	
**Phytolacca octandra*	Opportunistic	
**Ricinus communis*	Opportunistic	
**Schinus terebinthifolia*	Opportunistic	
**Sonchus oleraceus*	Opportunistic	
**Zantedeschia aethiopica*	Opportunistic	

QUADRAT F19

Location: Lot 9101
GPS: 397103E; 6445486N
Soil Type: Black sandy loam
Vegetation Description: Low Woodland A of *Melaleuca preissiana* and *Melaleuca rhaphiophylla* over Scrub of *Astartea scoparia* and *Melaleuca teretifolia* over Tall Grass dominated by *Eragrostis elongata* and* *Ehrharta longiflora* over Open Herbs dominated by **Lotus subbiflorus*
Vegetation Condition: Good to degraded

SPECIES	HEIGHT (cm)	% COVER
**Arctotheca calendula*	15	1
Astartea scoparia	200	10
**Briza minor*	30	2
**Carpobrotus edulis*	15	2
Cassytha racemosa	twiner	5
Centella asiatica	20	2
Drosera glanduligera	10	<1
**Echium plantagineum*	35	3
**Ehrharta calycina*	70	1
**Ehrharta longiflora*	70	10
Eragrostis elongata	70	20
**Hypochaeris glabra*	50	3
Juncus pallidus	80	3
**Lactuca serriola*	40	<1
Lepyrodia glauca	80	1
**Lotus subbiflorus*	20	15
**Lysimachia arvensis*	20	5

SPECIES	HEIGHT (cm)	% COVER
Melaleuca rhaphiophylla	800	15
Melaleuca teretifolia	200	10
**Romulea rosea*	40	3
**Sonchus asper*	90	<1
**Bromus diandrus*	Opportunistic	
Crassula colorata	Opportunistic	
**Euphorbia terracina*	Opportunistic	
Lepidosperma leptostachyum	Opportunistic	
Melaleuca viminea subsp. *viminea*	Opportunistic	
Nuytsia floribunda	Opportunistic	
**Paspalum urvillei*	Opportunistic	
**Pelargonium capitatum*	Opportunistic	
**Schinus terebinthifolia*	Opportunistic	
**Zantedeschia aethiopica*	Opportunistic	

QUADRAT F20

Location: Lot 9101
GPS: 397070E; 6445337N
Soil Type: Pale grey sand
Vegetation Description: Low Forest A of *Eucalyptus todtiana, Banksia attenuata, Banksia menziesii* and *Allocasuarina fraseriana* over Scrub of *Kunzea glabrescens* and *Adenanthos cygnorum* subsp. *cygnorum* over Open Tall Grass dominated by **Ehrharta calycina*
Vegetation Condition: Good to degraded
Notes: Narrow strip only on higher ground

SPECIES	HEIGHT (cm)	% COVER
Adenanthos cygnorum subsp. *cygnorum*	300	5
**Arctotheca calendula*	25	<1
Austrostipa compressa	30	<1
Banksia attenuata	400	2
Boronia ramosa subsp. *anethifolia*	60	1
Bossiaea eriocarpa	60	2
**Briza maxima*	45	3
Burchardia umbellata	80	2
Caesia micrantha	30	<1
Caladenia flava subsp. *flava*	20	<1
Calandrinia granulifera	10	1
Conostylis aculeata subsp. *aculeata*	50	2
Crassula colorata	15	<1
Dasypogon bromeliifolius	50	3
Desmocladus flexuosus	50	2
Drosera pallida	twiner	<1

SPECIES	HEIGHT (cm)	% COVER
**Ehrharta calycina*	90	15
Eucalyptus todtiana	800	30
**Gladiolus caryophyllaceus*	80	2
Gompholobium tomentosum	50	2
Hibbertia hypericoides	70	5
Hyalosperma cotula	20	<1
**Isolepis marginatus*	10	<1
Jacksonia furcellata	250	3
Kunzea glabrescens	300	10
Lepidosperma squamatum	60	<1
Leucopogon propinquus	65	1
Levenhookia stipitata	5	<1
Lomandra caespitosa	40	<1
Lyginia barbata	70	3
Monotaxis grandiflora	5	<1
**Oxalis pes-caprae*	50	<1
Patersonia occidentalis	70	1
**Pelargonium capitatum*	30	<1
Pterostylis vittata	60	<1
Scholtzia involucrata	30	<1
Siloxerus multiflorus	2	<1
Stirlingia latifolia	70	5
Thysanotus patersonii	twiner	<1
Trachymene pilosa	15	<1
**Ursinia anthemoides*	70	3
Wahlenbergia preissii	40	<1
**Zantedeschia aethiopica*	40	<1
Acacia pulchella var. *glabrescens*	Opportunistic	
Acacia stenoptera	Opportunistic	
Allocasuarina fraseriana	Opportunistic	
Allocasuarina humilis	Opportunistic	
Calandrinia corrigioloides	Opportunistic	
Cassytha racemosa	Opportunistic	
Conostephium pendulum	Opportunistic	
Dampiera linearis	Opportunistic	
Hemiandra pungens	Opportunistic	
Lechenaultia floribunda	Opportunistic	
Nuytsia floribunda	Opportunistic	
Stylidium repens	Opportunistic	

QUADRAT F21

Location: Lot 1001
GPS: 396588E; 6444401N
Soil Type: Pale grey sand
Vegetation Description: Low Forest A of *Eucalyptus marginata* subsp. *marginata, Banksia attenuata, Banksia menziesii* and *Allocasuarina fraseriana* over Open Low Scrub B of *Macrozamia riedlei* and *Xanthorrhoea preissii* over Open Dwarf Scrub C of *Hibbertia hypericoides* over Open Tall Grass dominated by **Ehrharta calycina* over Open Herbs dominated by **Gladiolus caryophyllaceus*
Vegetation Condition: Good to degraded
Notes: Very narrow strip at the top of the dune. Down slope there was a lot of *Adenanthos cygnorum* subsp. *cygnorum* and *Acacia microstachya*. The remainder of this lot planted with non-endemic species with a small amount of natural regeneration after the sand pit was closed

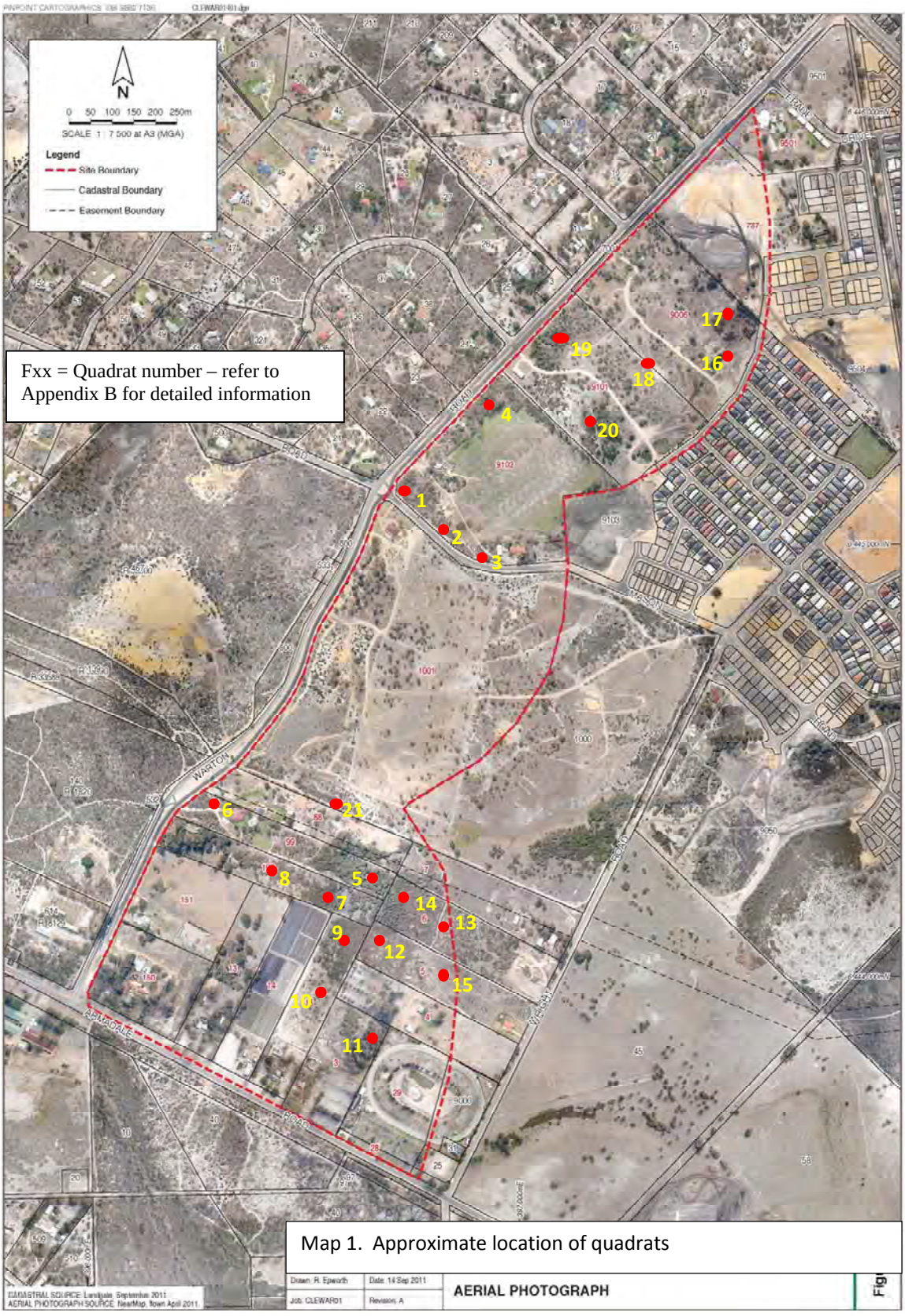
SPECIES	HEIGHT (cm)	% COVER
Acacia stenoptera	70	<1
Adenanthos cygnorum subsp. *cygnorum*	200	5
Allocasuarina fraseriana	1200	5
Austrostipa compressa	45	<1
**Avena barbata*	150	3
Banksia attenuata	600	3
Banksia menziesii	600	3
Burchardia umbellata	80	3
Caladenia flava subsp. *flava*	25	<1
Calandrinia granulifera	400	3
Conostylis aculeata subsp. *aculeata*	40	2
Dampiera linearis	20	<1
Dasypogon bromeliifolius	40	1
Desmocladus flexuosus	30	1

SPECIES	HEIGHT (cm)	% COVER
Dianella revoluta	80	2
Drosera pallida	twiner	<1
**Ehrharta calycina*	100	10
**Gladiolus caryophyllaceus*	80	15
Gompholobium tomentosum	70	2
Hibbertia hypericoides	60	5
Jacksonia furcellata	200	2
Laxmannia grandiflora	30	<1
Lepidosperma squamatum	50	5
Levenhookia stipitata	10	<1
Lomandra caespitosa	50	3
Lyginia barbata	70	2
Lyperanthus nigricans	2	<1
Macrozamia riedlei	120	5
Microtis media subsp. *media*	70	<1
Patersonia occidentalis	70	2
**Sonchus oleraceus*	20	<1
Stirlingia latifolia	90	3
Trachymene pilosa	25	<1
**Ursinia anthemoides*	50	5
Xanthorrhoea preissii	175	5
**Zantedeschia aethiopica*	20	<1
Bossiaea eriocarpa	Opportunistic	
Hypocalymma robustum	Opportunistic	
Kunzea glabrescens	Opportunistic	
Lomandra hermaphrodita	Opportunistic	
Melaleuca thymoides	Opportunistic	
Thysanotus patersonii	Opportunistic	

APPENDIX C

Maps

1. Approximate Location of Quadrats
2. Vegetation Units
3. Vegetation Condition

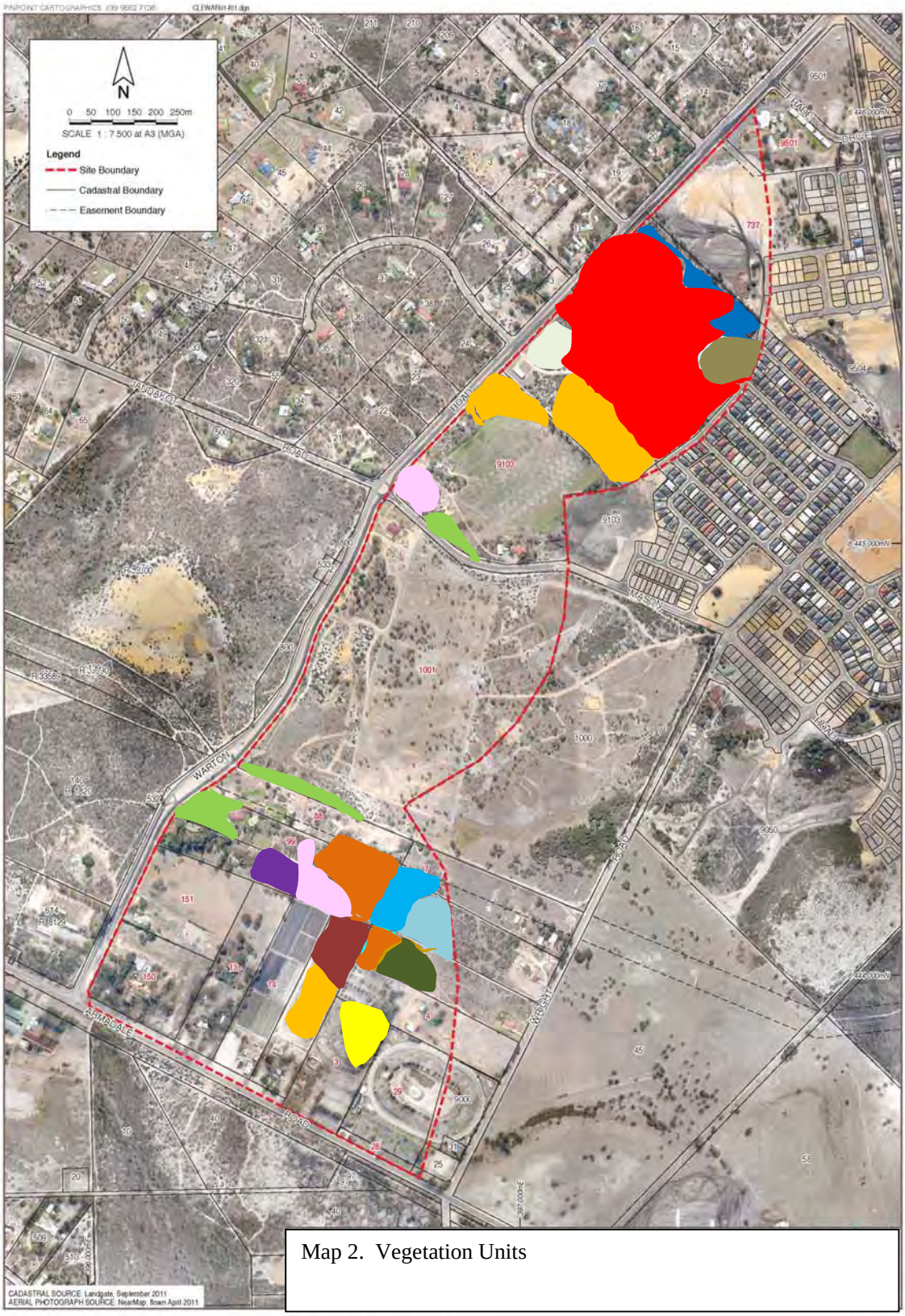


Map 1. Approximate location of quadrats

Figure 2. Vegetation Units

Colours used in vegetation map

Colour	Vegetation Description
	Low Woodland A of *Banksia attenuata, Banksia menziesii, Allocasuarina fraseriana, Nuytsia floribunda* and *Eucalyptus marginata* subsp. *marginata* over Low Scrub B dominated by *Xanthorrhoea preissii* or Dwarf Scrub C dominated by *Hibbertia hypericoides* over Tall Grass dominated by **Avena barbata and *Ehrharta calycina* in grey sand
	Low Woodland A of *Banksia attenuata, Banksia menziesii, Allocasuarina fraseriana, Nuytsia floribunda* and *Eucalyptus todtiana* over Heath B of mixed taxa dominated by *Xanthorrhoea preissii* over Open Tall Grass dominated by **Ehrharta calycina* over Open Herbs dominated by *Dasypogon bromeliifolius* or *Phlebocarya ciliata in* grey sand
	Open Low Woodland of *Banksia attenuata* over Scrub of *Kunzea glabrescens* over Dense Tall Grass of **Ehrharta calycina* over Open Herbs dominated by **Hypochaeris glabra* in pale grey sand.
	Low Forest of *Eucalyptus rudis* subsp. *rudis* over Open Herbs dominated by**Lotus subbiflorus* over Open Tall Sedges of *Juncus pallidus* in black sandy loam.
	Dense Low Forest A of *Melaleuca preissiana* over Scrub of *Taxandria linearifolia* over Dense Tall Sedges of *Lepidosperma longitudinale* and *Juncus pallidus* in black sand.
	Low Woodland A of *Melaleuca preissiana* over Dense Thicket of *Kunzea glabrescens* over Herbs dominated by *Dasypogon bromeliifolius* in grey sand
	Low Woodland A of *Melaleuca preissiana* and *Melaleuca rhaphiophylla* over Scrub of *Melaleuca teretifolia* and *Astartea scoparia* over Tall Grass dominated by **Eragrostis curvula* and **Ehrharta longifolia* over Herbs dominated by **Lotus subbiflorus* in black sandy loam.
	Dense Low Forest A of *Melaleuca preissiana* with occasional trees of *Eucalyptus rudis* subsp. *rudis* over Open Scrub of *Astartea scoparia* over Dense Herbs dominated by **Zantedeschia aethiopicum* in very damp grey sand with areas of open water
	Dense Thicket of *Kunzea glabrescens* over Dwarf Scrub C dominated by *Hypocalymma angustifolium* and *Lechenaultia floribunda* over Tall Sedge of *Schoenus rigens* in grey sand
	Dense Low Forest A of *Melaleuca preissiana* over Open Scrub of *Kunzea glabrescens* over Dense Tall Sedges of *Lepidosperma longitudinale* and/or *Dielsia stenostachya* and/or *Hypolaena exsulca* in black silty sand.
	Heath A of *Melaleuca viminea* and *Melaleuca incana* subsp. *incana* over Open Herbs dominated by **Hypochaeris glabra* and **Lotus subbiflorus* over Tall Sedges dominated by *Baumea juncea* and *Lepidosperma longitudinale* in damp grey sand.
	Open Low Woodland A of *Melaleuca preissiana* over Dense Tall Grass of **Ehrharta calycina*, **Eragrostis curvula* and **Ehrharta longiflora* in low lying grey sand over Open Herbs dominated by **Arctotheca calendula* in low lying grey sand.
	Dense Herbs dominated by **Lotus subbiflorus* over Open Tall Sedges of *Meeboldina scariosa* and *Baumea articulata* in damp flat area.
	Open Low Grass of *Pennisetum clandestinum* over Open Herbs dominated by **Lotus subbiflorus* over Very Open Sedges of **Cyperus tenellus* in very damp grey sand.
No colour	Cleared areas, homes and surrounds or planted non-endemic trees



Map 2. Vegetation Units

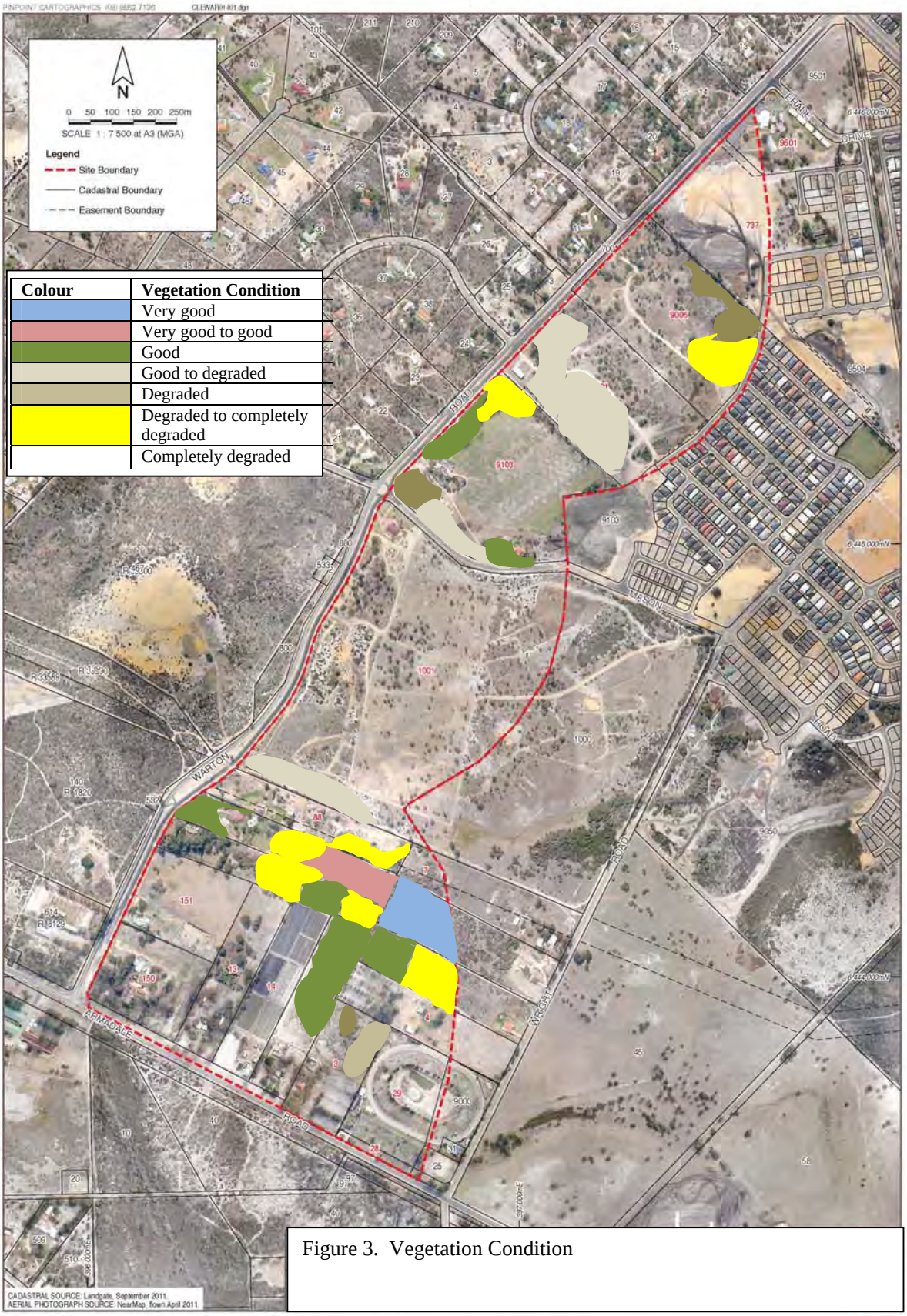


Figure 3. Vegetation Condition

APPENDIX D

Detailed Vegetation Units Maps for Lots with Remnant Vegetation

Vegetation Unit Abbreviation	Vegetation Description
Bm	Low Woodland A of *Banksia attenuata*, *Banksia menziesii*, *Allocasuarina fraseriana*, *Nuytsia floribunda* and *Eucalyptus marginata* subsp. *marginata* over Low Scrub B dominated by *Xanthorrhoea preissii* or Dwarf Scrub C dominated by *Hibbertia hypericoides* over Tall Grass dominated by **Avena barbata and* **Ehrharta calycina* in grey sand
Bt	Low Woodland A of *Banksia attenuata*, *Banksia menziesii*, *Allocasuarina fraseriana*, *Nuytsia floribunda* and *Eucalyptus todtiana* over Heath B of mixed taxa dominated by *Xanthorrhoea preissii* over Open Tall Grass dominated by **Ehrharta calycina* over Open Herbs dominated by *Dasypogon bromeliifolius* or *Phlebocarya ciliata in* grey sand
BK	Open Low Woodland of *Banksia attenuata* over Scrub of *Kunzea glabrescens* over Dense Tall Grass of **Ehrharta calycina* over Open Herbs dominated by **Hypochaeris glabra* in pale grey sand.
Er	Low Forest of *Eucalyptus rudis* subsp. *rudis* over Open Herbs dominated by**Lotus subbiflorus* over Open Tall Sedges of *Juncus pallidus* in black sandy loam.
Mp	Dense Low Forest A of *Melaleuca preissiana* over Scrub of *Taxandria linearifolia* over Dense Tall Sedges of *Lepidosperma longitudinale* and *Juncus pallidus* in black sand.
MK	Low Woodland A of *Melaleuca preissiana* over Dense Thicket of *Kunzea glabrescens* over Herbs dominated by *Dasypogon bromeliifolius* in grey sand
MM	Low Woodland A of *Melaleuca preissiana* and *Melaleuca rhaphiophylla* over Scrub of *Melaleuca teretifolia* and *Astartea scoparia* over Tall Grass dominated by **Eragrostis curvula* and **Ehrharta longifolia* over Herbs dominated by **Lotus subbiflorus* in black sandy loam.
EA	Dense Low Forest A of *Melaleuca preissiana* with occasional trees of *Eucalyptus rudis* subsp. *rudis* over Open Scrub of *Astartea scoparia* over Dense Herbs dominated by **Zantedeschia aethiopicum* in very damp grey sand with areas of open water
Kg	Dense Thicket of *Kunzea glabrescens* over Dwarf Scrub C dominated by *Hypocalymma angustifolium* and *Lechenaultia floribunda* over Tall Sedge of *Schoenus rigens* in grey sand
MD	Dense Low Forest A of *Melaleuca preissiana* over Open Scrub of *Kunzea glabrescens* over Dense Tall Sedges of *Lepidosperma longitudinale* and/or *Dielsia stenostachya* and/or *Hypolaena exsulca* in black silty sand.
ML	Heath A of *Melaleuca viminea* and *Melaleuca incana* subsp. *incana* over Open Herbs dominated by **Hypochaeris glabra* and **Lotus subbiflorus* over Tall Sedges dominated by *Baumea juncea* and *Lepidosperma longitudinale* in damp grey sand.
ME	Open Low Woodland A of *Melaleuca preissiana* over Dense Tall Grass of **Ehrharta calycina*, **Eragrostis curvula* and **Ehrharta longiflora* in low lying grey sand over Open Herbs dominated by **Arctotheca calendula* in low lying grey sand.
Ms	Dense Herbs dominated by **Lotus subbiflorus* over Open Tall Sedges of *Meeboldina scariosa* and *Baumea articulata* in damp flat area.
Pc	Open Low Grass of *Pennisetum clandestinum* over Open Herbs dominated by **Lotus subbiflorus* over Very Open Sedges of **Cyperus tenellus* in very damp grey sand.
	Cleared areas, homes and surrounds or planted non-endemic trees

Where a quadrat was placed in the vegetation at the Lot being described the quadrat number is recorded. However where the vegetation was the same as that described in a different Lot the above vegetation abbreviation is used (in red lettering). The condition is also recorded (in yellow numbering).

Vegetation at Lot 3

Higher ground: Dense Thicket of *Kunzea glabrescens* over Tall Sedge of *Schoenus rigens* in grey sand. **Vegetation unit Kg.** Vegetation condition: Degraded

Lower ground: Dense Low Forest A of *Melaleuca preissiana* over Open Scrub of *Kunzea glabrescens* over Dense Tall Sedges of *Lepidosperma longitudinale* and/or *Dielsia stenostachya* and/or *Hypolaena exsulca* in black silty sand. **Vegetation unit EA**. Quadrat F11. Vegetation condition good to degraded

Remainder of the Lot was cleared or with planted non-endemic trees. Vegetation condition completely degraded

Vegetation at Lots 5, 6 and 7 Wright Road

Regenerating Low Woodland A of *Melaleuca preissiana* over Open Scrub of *Kunzea glabrescens* over Herbs dominated by *Mitrasacme paradoxa* and **Hypochaeris glabra* over Open to Dense Low Sedges of *Dielsia stenostachya* and *Hypolaena exsulca* in black sandy loam. **Vegetation unit MD**. Quadrat F12. Vegetation condition very good to degraded.

Heath A dominated by *Melaleuca viminea* over Open Herbs dominated by **Lotus subbiflorus* and **Hypochaeris glabra* Open Tall Sedges of *Lepidosperma longitudinale* and *Baumea juncea* in black sandy loam **Vegetation unit ML**. Quadrat F13. Vegetation condition very good.

Dense Low Forest A of *Melaleuca preissiana* and *Taxandria linearifolia* over Dense Tall Sedges of *Lepidosperma longitudinale* in black sand. **Vegetation Unit Mp**. Quadrat F14. Vegetation condition very good.

Dense Herbs dominated by **Lotus subbiflorus* over Very Open Tall Sedges of *Baumea articulata* and *Meeboldina scariosa* in black sand. **Vegetation unit Ms**. Quadrat F15. Vegetation condition degraded to completely degraded.

No remnant native vegetation. All trees were planted. Vegetation condition completely degraded


F09
C4
F10
C4
C5-6
14
15
Scattered trees
C6
Scattered
trees
C6
3
Lot 15

Vegetation at Lot 15

Dense Thicket of *Kunzea glabrescens* over Dwarf Scrub C dominated by *Hypocalymma angustifolium* and *Lechenaultia floribunda* over Tall Sedge of *Schoenus rigens* in grey sand. **Vegetation unit Kg.** This was represented by quadrat F09. Vegetation condition was good.

Low Woodland A of *Banksia attenuata*, *Banksia menziesii*, *Allocasuarina fraseriana*, *Nuytsia floribunda* and *Eucalyptus todtiana* over Heath B of mixed taxa dominated by *Xanthorrhoea preissii* over Open Tall Grass dominated by **Ehrharta calycina* over Open Herbs dominated by *Dasypogon bromeliifolius* or *Phlebocarya ciliata* in grey sand. **Vegetation unit Bt.** This was represented by quadrat F10. As indicated on the aerial the vegetation varied between good and degraded to completely degraded.

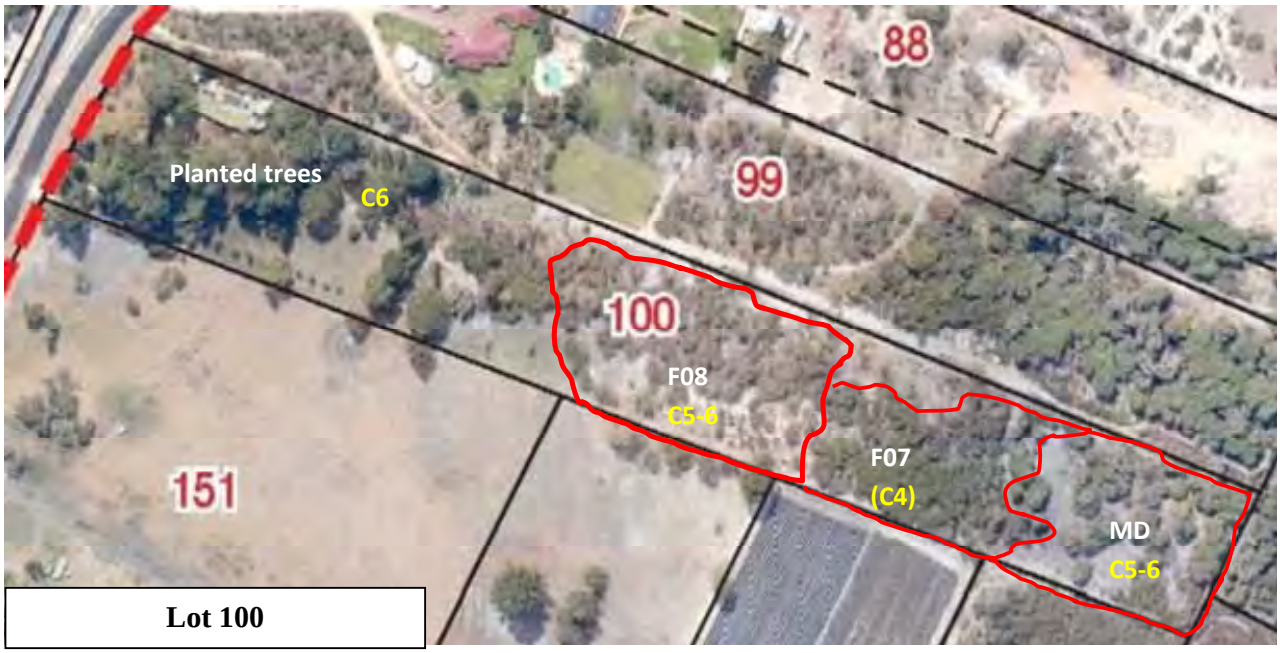
The remainder of the lot had planted trees or was cleared. The vegetation condition was completely degraded.

Lots 88 and 99

Vegetation at Lots 88 and 99

Dense Low Forest A of *Melaleuca preissiana* over Open Scrub of *Kunzea glabrescens* over Dense Tall Sedges of *Lepidosperma longitudinale* and/or *Dielsia stenostachya* and/or *Hypolaena exsulca* in black silty sand. **Vegetation unit MD.** This was represented by quadrat F05 placed in Lot 99. The vegetation condition of this vegetation unit in Lot 99 was very good to good but in Lot 88 it was degraded to completely degraded.

Low Woodland A of *Banksia attenuata*, *Banksia menziesii*, *Allocasuarina fraseriana*, *Nuytsia floribunda* and *Eucalyptus marginata* subsp. *marginata* over Low Scrub B dominated by *Xanthorrhoea preissii* or Dwarf Scrub C dominated by *Hibbertia hypericoides* over Tall Grass dominated by **Avena barbata and *Ehrharta calycina* i*n grey sand. **Vegetation unit BM.** The quadrat F06 was placed between the residence and the road where the vegetation was in good condition. The second location adjacent to F05 was in a degraded to completely degraded condition.



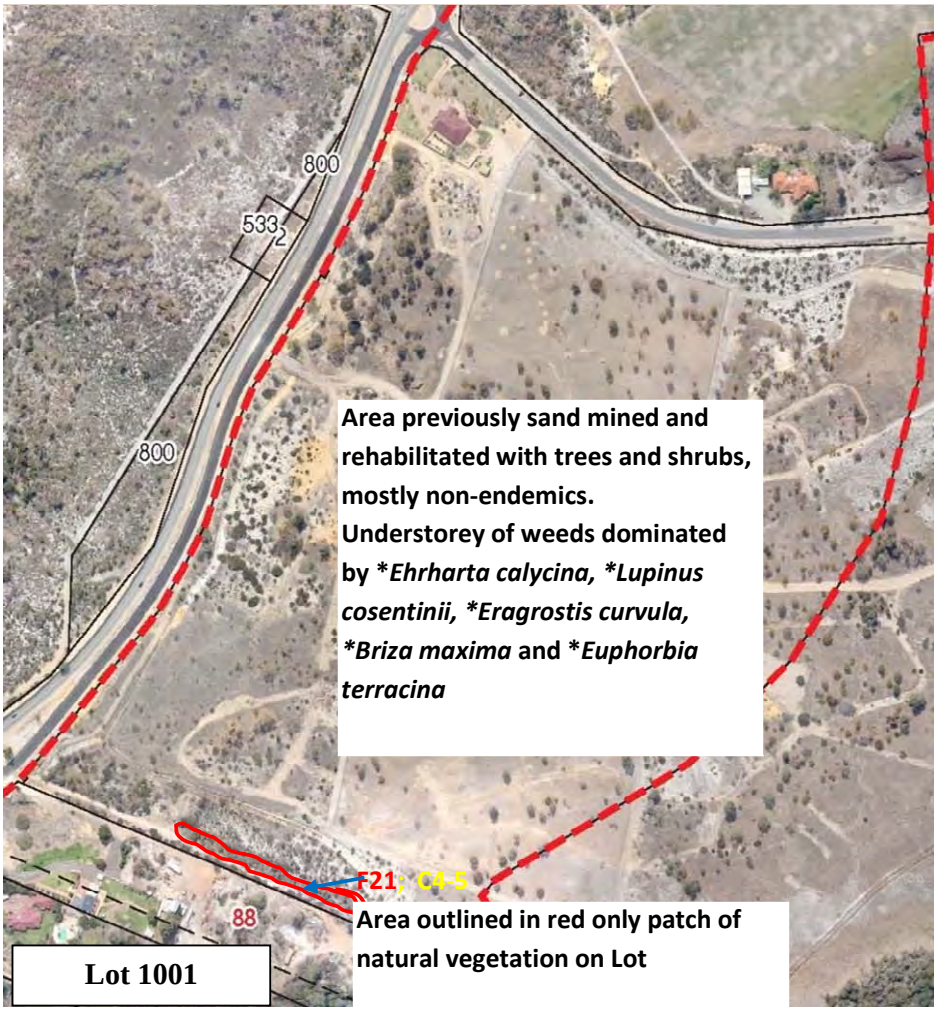
Vegetation at Lot 100

Dense Low Forest A of *Melaleuca preissiana* over Open Scrub of *Kunzea glabrescens* over Dense Tall Sedges of *Lepidosperma longitudinale* and/or *Dielsia stenostachya* and/or *Hypolaena exsulca* in black silty sand. **Vegetation unit MD**. The vegetation condition varied between degraded to completely degraded.

Low Woodland A of *Melaleuca preissiana* over Dense Thicket of *Kunzea glabrescens* over Herbs dominated by *Dasypogon bromeliifolius* in grey sand. **Vegetation unit MK**. It was represented by quadrat F07 but at this Lot the trees of *Melaleuca preissiana* were scattered and not a dominant stratum of the vegetation. The vegetation condition was good.

Open Low Woodland of *Banksia attenuata* over Scrub of *Kunzea glabrescens* over Dense Tall Grass of **Ehrharta calycina* over Open Herbs dominated by **Hypochaeris glabra* in pale grey sand. **Vegetation unit BK.** This was represented by quadrat F08. The vegetation condition was degraded to completely degraded. There were many dead trees of *Banksia attenuata* and *Kunzea glabrescens.*

The remainder of the Lot had planted trees, especially around the house.



Vegetation at Lot 1001

This was the largest area of the lots surveyed but was rehabilitating after sand extraction. Only a small area of remnant vegetation remained adjoining Lot 88.

Low Woodland A of *Banksia attenuata*, *Banksia menziesii*, *Allocasuarina fraseriana*, *Nuytsia floribunda* and *Eucalyptus marginata* subsp. *marginata* over Open Low Scrub B dominated by *Xanthorrhoea preissii* and *Macrozamia riedlei* over Tall Grass dominated by **Avena barbata and* **Ehrharta calycina* and Open Herbs dominated by **Gladiolus caryophyllaceus* in grey sand. **Vegetation unit BM**. The vegetation condition varied between good and degraded.

The remainder of the Lot consisted of non-endemic trees and shrubs with a few of the endemic flora re-establishing over introduced grasses and herbs. The vegetation condition was completely degraded.

Vegetation at Lots 9006 and 9101

Open Low Woodland A of *Melaleuca preissiana* over Dense Tall Grass of **Ehrharta calycina*, **Eragrostis curvula* and **Ehrharta longiflora* in low lying grey sand over Open Herbs dominated by **Arctotheca calendula* in low lying grey sand. **Vegetation unit ME.** This was represented by quadrat F18 which had scattered *Melaleuca preissiana* trees over weeds. The vegetation condition was completely degraded except for small area along the boundary with Lot 737 where the vegetation was degraded.

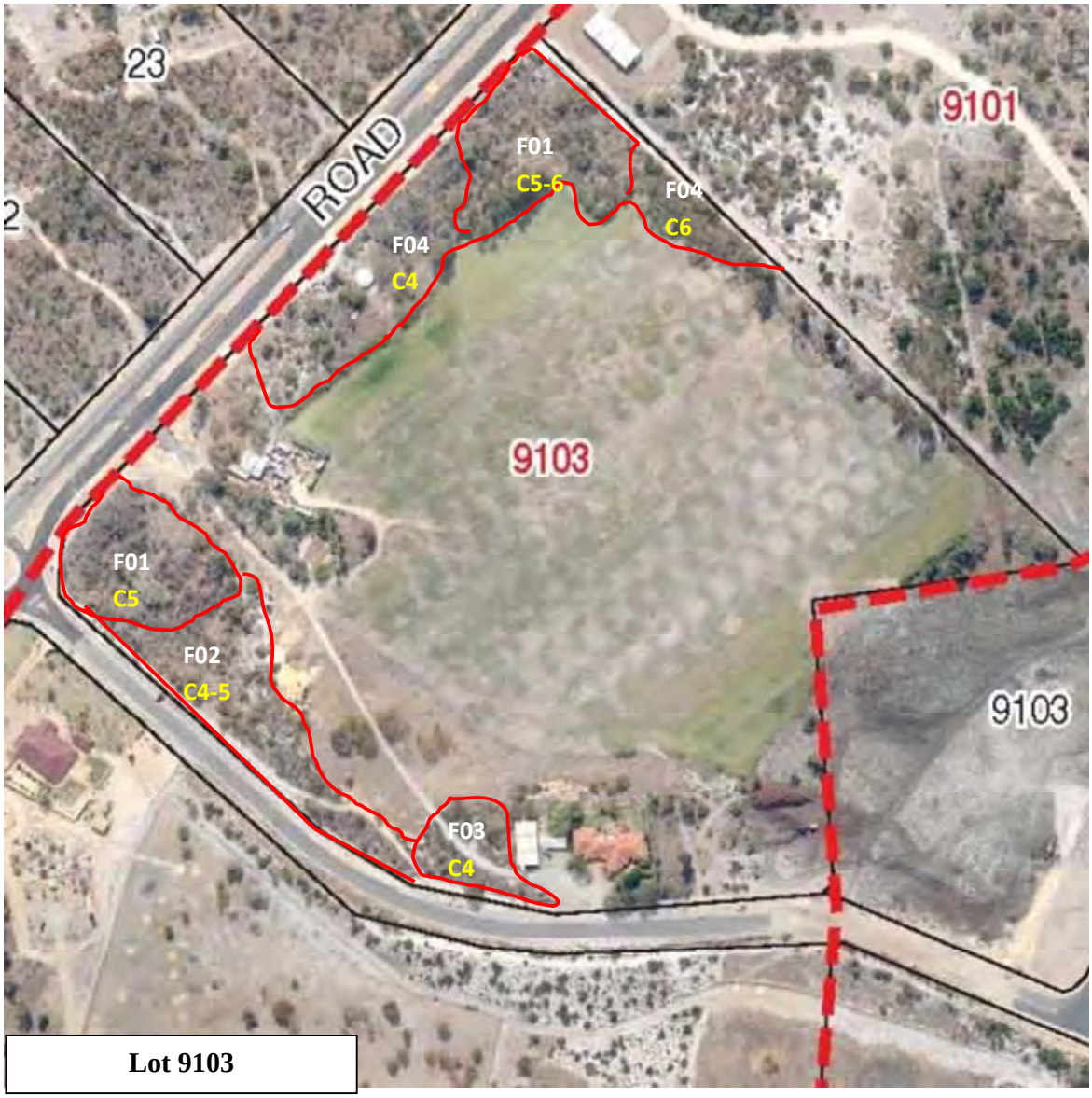
Low Forest of *Eucalyptus rudis* subsp. *rudis* over Open Herbs dominated by**Lotus subbiflorus* over Open Tall Sedges of *Juncus pallidus* in black sandy loam. **Vegetation unit Er.** This vegetation was

represented by quadrat F17 and surrounded a small dam. The vegetation condition varied between degraded and completely degraded.

Open Low Grass of *Pennisetum clandestinum* over Open Herbs dominated by **Lotus subbiflorus* over Very Open Sedges of **Cyperus tenellus* in very damp grey sand. It consisted of a series of wetlands with a few sedges but mainly weeds. **Vegetation unit Pc.** This vegetation was represented by quadrat F16. The vegetation condition was degraded to completely degraded.

Low Woodland A of *Melaleuca preissiana* and *Melaleuca rhaphiophylla* over Scrub of *Astartea scoparia* and *Melaleuca teretifolia* over Tall Grass dominated by *Eragrostis elongata* and* *Ehrharta longiflora* over Open Herbs dominated by **Lotus subbiflorus* in grey sand. **Vegetation unit MM**. It was represented by quadrat F19. The vegetation condition varied between good and degraded.

Low Forest A of *Eucalyptus todtiana, Banksia attenuata, Banksia menziesii* and *Allocasuarina fraseriana* over Scrub of *Kunzea glabrescens* and *Adenanthos cygnorum* subsp. *cygnorum* over Open Tall Grass dominated by **Ehrharta calycina* in grey sand. **Vegetation unit Bt**. It was represented by quadrat F20. The vegetation varied between good and degraded.



Vegetation at Lot 9103

Low Woodland A of *Melaleuca preissiana* over Dense Thicket of *Kunzea glabrescens* over Herbs dominated by *Dasypogon bromeliifolius* (mainly dead). Nearly all the Banksias and Kunzeas are dead and about 95% of the *Dasypogon bromeliifolius*. **Vegetation unit MK**. It was represented by quadrat F01. The vegetation condition was degraded to completely degraded.

Low Woodland A of *Banksia attenuata, Banksia menziesii* and occasional trees of *Eucalyptus marginata* subsp. *marginata* over Low Scrub B of *Xanthorrhoea preissii* over Dwarf Scrub C dominated by *Hibbertia hypericoides* over Herbs dominated by *Burchardia umbellata* in grey sand. **Vegetation unit BM**. It was represented by quadrat F02 and was in good condition.

Low Open Woodland A of *Banksia attenuata* over Dwarf Scrub C of mixed taxa dominated by *Hibbertia hypericoides* over Open Tall Grass dominated by **Ehrharta calycina* over Open Herbs dominated by *Burchardia umbellata* and *Chamaescilla umbellata* in yellow grey sand. **Vegetation unit ML.** This was represented by quadrat F03 which recorded a good vegetation condition.

Low Forest A of *Eucalyptus todtiana* and *Banksia attenuata* over Dwarf Scrub C dominated by *Hibbertia hypericoides* over Tall Grass dominated by **Ehrharta calycina* over Herbs of mixed taxa dominated by *Gladiolus caryophyllaceus* in grey sand. **Vegetation unit Bt.** This was represented by quadrat F04. It recorded a good vegetation condition.

APPENDIX B - DBCA NATURE MAP SEARCH REPORT

NatureMap
Mapping Western Australia's biodiversity

NatureMap Species Report

Created By Guest user on 19/03/2020

Kingdom Plantae
Conservation Status Conservation Taxon (T, X, IA, S, P1-P5)
Current Names Only Yes
Core Datasets Only Yes
Method 'By Circle'
Centre 115° 54' 27" E,32° 07' 31" S
Buffer 10km

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
1.	3237	*Acacia benthamii*		P2	
2.	3373	*Acacia horridula*		P3	
3.	14932	*Acacia lasiocarpa var. bracteolata long peduncle variant (G.J. Keighery 5026)*		P1	
4.	14131	*Acacia oncinophylla subsp. patulifolia*		P4	
5.	141	*Aponogeton hexatepalus (Stalked Water Ribbons)*		P4	
6.	7849	*Asteridea gracilis*		P3	
7.	38481	*Austrostipa jacobsiana*		T	
8.	4444	*Boronia tenuis (Blue Boronia)*		P4	
9.	3178	*Byblis gigantea (Rainbow Plant)*		P3	
10.	1596	*Caladenia huegelii (Grand Spider Orchid)*		T	
11.	13653	*Calytrix breviseta subsp. breviseta*		T	
12.	13656	*Calytrix simplex subsp. simplex*		P1	
13.	13999	*Conospermum undulatum*		T	
14.	16245	*Cyathochaeta teretifolia*		P3	
15.	7485	*Dampiera triloba*		P3	
16.	10796	*Diuris drummondii (Tall Donkey Orchid)*		T	
17.	1637	*Diuris purdiei (Purdie's Donkey Orchid)*		T	
18.	4763	*Dodonaea hackettiana (Hackett's Hopbush)*		P4	
19.	1639	*Drakaea elastica (Glossy-leaved Hammer Orchid)*		T	
20.	13635	*Drakaea micrantha*		T	
21.	3115	*Drosera occidentalis (Western Sundew)*		P4	
22.	17150	*Eremophila glabra subsp. chlorella*		T	
23.	41801	*Eryngium pinnatifidum subsp. Palustre (G.J. Keighery 13459)*		P3	
24.	6686	*Halgania corymbosa*		P3	
25.	11074	*Hydrocotyle striata*		P1	
26.	20462	*Jacksonia gracillima*		P3	
27.	4027	*Jacksonia sericea (Waldjumi)*		P4	
28.	19272	*Johnsonia pubescens subsp. cygnorum*		P2	
29.	4035	*Kennedia beckxiana (Cape Arid Kennedia)*		P4	
30.	45081	*Lasiopetalum glutinosum subsp. glutinosum*		P3	
31.	942	*Lepidosperma rostratum*		T	
32.	33638	*Meionectes tenuifolia*		P3	
33.	33742	*Microtis quadrata*		P4	
34.	36200	*Ornduffia submersa*		P4	
35.	11557	*Phlebocarya pilosissima subsp. pilosissima*		P3	
36.	5237	*Pimelea calcicola*		P3	
37.	8163	*Pithocarpa corymbulosa (Corymbose Pithocarpa)*		P3	
38.	42022	*Poranthera moorokatta*		P2	
39.	11615	*Ptilotus sericostachyus subsp. roseus*		P1	
40.	974	*Schoenus benthamii*		P3	
41.	980	*Schoenus capillifolius*		P3	
42.	1008	*Schoenus pennisetis*		P3	
43.	19704	*Stenanthemum sublineare*		P2	
44.	18564	*Stylidium aceratum*		P3	
45.	7756	*Stylidium longitubum (Jumping Jacks)*		P4	
46.	25800	*Stylidium paludicola*		P3	
47.	48297	*Styphelia filifolia*		P3	
48.	18590	*Synaphea sp. Fairbridge Farm (D. Papenfus 696)*		T	
49.	1717	*Thelymitra variegata (Queen of Sheba)*		P2	
50.	1317	*Thysanotus anceps*		P3	
51.	1334	*Thysanotus glaucus*		P4	

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
52.	13783	*Thysanotus sp. Badgingarra (E.A. Griffin 2511)*		P2	
53.	44444	*Tripterococcus sp. Brachylobus (A.S. George 14234)*		P4	
54.	14714	*Verticordia lindleyi subsp. lindleyi*		P4	

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

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

APPENDIX C - EPBC PROTECTED MATTERS SEARCH REPORT

Australian Government
Department of the Environment and Energy

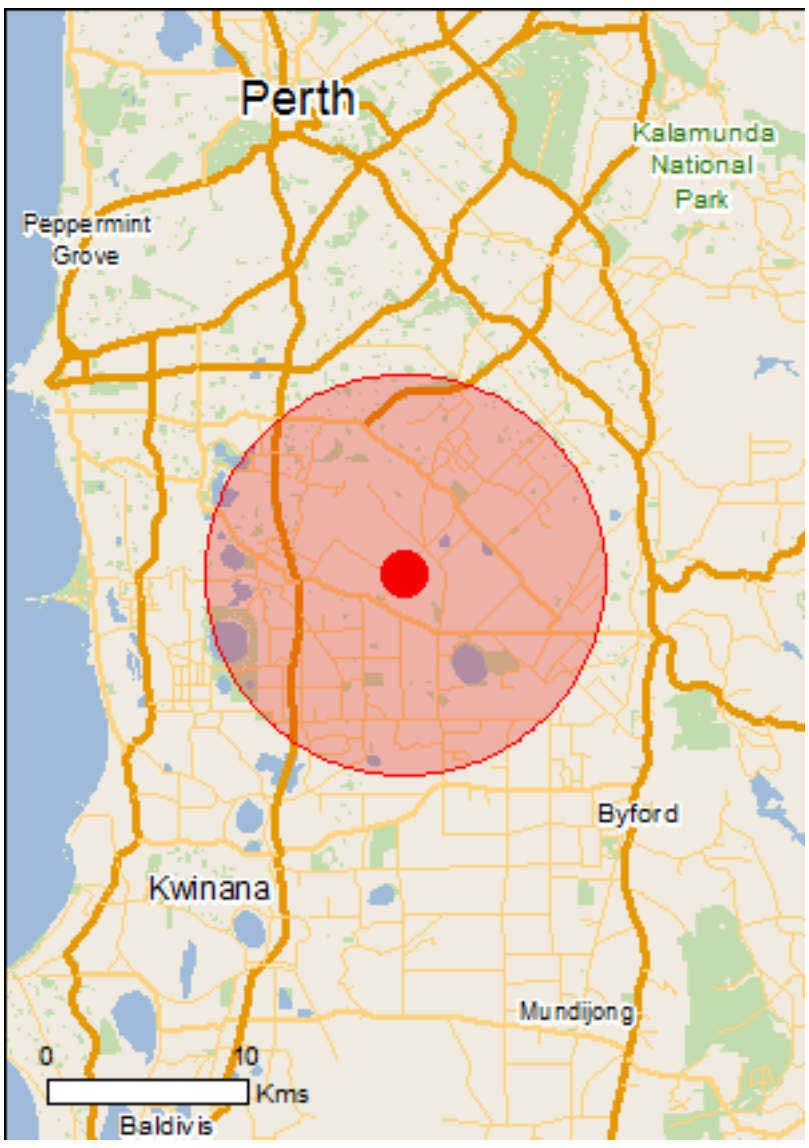
EPBC Act Protected Matters Report

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.

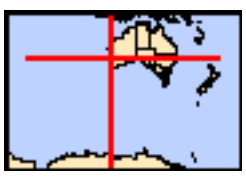
Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 19/03/20 15:57:33



Coordinates
Buffer: 10.0Km



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	2
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	4
Listed Threatened Species:	38
Listed Migratory Species:	20

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. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

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:	1
Commonwealth Heritage Places:	None
Listed Marine Species:	30
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

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

State and Territory Reserves:	10
Regional Forest Agreements:	None
Invasive Species:	42
Nationally Important Wetlands:	3
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar) [Resource Information]

Name	Proximity
Forrestdale and thomsons lakes	Within Ramsar site
Peel-yalgorup system	30 - 40km upstream

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
Banksia Woodlands of the Swan Coastal Plain ecological community	Endangered	Community likely to occur within area
Clay Pans of the Swan Coastal Plain	Critically Endangered	Community likely to occur within area
Subtropical and Temperate Coastal Saltmarsh	Vulnerable	Community likely to occur within area
Tuart (Eucalyptus gomphocephala) Woodlands and Forests of the Swan Coastal Plain ecological community	Critically Endangered	Community likely to occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calyptorhynchus banksii naso Forest Red-tailed Black-Cockatoo, Karrak [67034]	Vulnerable	Species or species habitat known to occur within area
Calyptorhynchus baudinii Baudin's Cockatoo, Long-billed Black-Cockatoo [769]	Endangered	Roosting known to occur within area
Calyptorhynchus latirostris Carnaby's Cockatoo, Short-billed Black-Cockatoo [59523]	Endangered	Species or species habitat known to occur within area
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat likely to occur within area

Name	Status	Type of Presence
Pachyptila turtur subantarctica Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat likely to occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat known to occur within area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Species or species habitat known to occur within area
Insects		
Leioproctus douglasiellus a short-tongued bee [66756]	Critically Endangered	Species or species habitat known to occur within area
Neopasiphae simplicior A native bee [66821]	Critically Endangered	Species or species habitat likely to occur within area
Mammals		
Bettongia penicillata ogilbyi Woylie [66844]	Endangered	Species or species habitat may occur within area
Dasyurus geoffroii Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat known to occur within area
Pseudocheirus occidentalis Western Ringtail Possum, Ngwayir, Womp, Woder, Ngoor, Ngoolangit [25911]	Critically Endangered	Species or species habitat likely to occur within area
Setonix brachyurus Quokka [229]	Vulnerable	Species or species habitat may occur within area
Other		
Westralunio carteri Carter's Freshwater Mussel, Freshwater Mussel [86266]	Vulnerable	Species or species habitat known to occur within area
Plants		
Andersonia gracilis Slender Andersonia [14470]	Endangered	Species or species habitat may occur within area
Austrostipa jacobsiana [87809]	Critically Endangered	Species or species habitat known to 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
Diuris drummondii Tall Donkey Orchid [4365]	Vulnerable	Species or species habitat known to occur within area
Diuris micrantha Dwarf Bee-orchid [55082]	Vulnerable	Species or species habitat known to occur within area
Diuris purdiei Purdie's Donkey-orchid [12950]	Endangered	Species or species habitat known to occur within area
Drakaea elastica Glossy-leafed Hammer Orchid, Glossy-leaved Hammer Orchid, Warty Hammer Orchid [16753]	Endangered	Species or species habitat known to occur within area

Name	Status	Type of Presence
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 may occur within area
Eremophila glabra subsp. chlorella [84927]	Endangered	Species or species habitat likely to occur within area
Eucalyptus x balanites Cadda Road Mallee, Cadda Mallee [87816]	Endangered	Species or species habitat likely to occur within area
Goodenia arthrotricha [12448]	Endangered	Species or species habitat likely to occur within area
Grevillea curviloba subsp. incurva Narrow curved-leaf Grevillea [64909]	Endangered	Species or species habitat may occur within area
Grevillea thelemanniana Spider Net Grevillea [32835]	Critically Endangered	Species or species habitat may occur within area
Lepidosperma rostratum Beaked Lepidosperma [14152]	Endangered	Species or species habitat likely to occur within area
Macarthuria keigheryi Keighery's Macarthuria [64930]	Endangered	Species or species habitat likely to occur within area
Synaphea sp. Fairbridge Farm (D. Papenfus 696) Selena's Synaphea [82881]	Critically Endangered	Species or species habitat likely to occur within area
Synaphea sp. Serpentine (G.R. Brand 103) [86879]	Critically Endangered	Species or species habitat may occur within area
Thelymitra dedmaniarum Cinnamon Sun Orchid [65105]	Endangered	Species or species habitat may occur within area
Thelymitra stellata Star Sun-orchid [7060]	Endangered	Species or species habitat likely to 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
Migratory Terrestrial Species		
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Calidris acuminata Sharp-tailed Sandpiper [874]		Roosting known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area
Calidris ruficollis Red-necked Stint [860]		Roosting known to occur within area
Calidris subminuta Long-toed Stint [861]		Roosting known to occur within area
Charadrius dubius Little Ringed Plover [896]		Roosting known to occur within area
Gallinago megala Swinhoe's Snipe [864]		Roosting likely to occur within area
Gallinago stenura Pin-tailed Snipe [841]		Roosting likely to occur within area
Limosa limosa Black-tailed Godwit [845]		Roosting known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat likely to occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Roosting likely to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Philomachus pugnax Ruff (Reeve) [850]		Roosting known to occur within area
Tringa glareola Wood Sandpiper [829]		Roosting known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Roosting known to 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 -

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		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to 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 may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Roosting known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area
Calidris ruficollis Red-necked Stint [860]		Roosting known to occur within area
Calidris subminuta Long-toed Stint [861]		Roosting known to occur within area
Charadrius dubius Little Ringed Plover [896]		Roosting known to occur within area
Charadrius ruficapillus Red-capped Plover [881]		Roosting known to occur within area
Gallinago megala Swinhoe's Snipe [864]		Roosting likely to occur within area
Gallinago stenura Pin-tailed Snipe [841]		Roosting likely to occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Himantopus himantopus Pied Stilt, Black-winged Stilt [870]		Roosting known to occur within area

Name	Threatened	Type of Presence
Limosa limosa Black-tailed Godwit [845]		Roosting known to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat likely to occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Roosting likely to occur within area
Pachyptila turtur Fairy Prion [1066]		Species or species habitat likely to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Philomachus pugnax Ruff (Reeve) [850]		Roosting known to occur within area
Recurvirostra novaehollandiae Red-necked Avocet [871]		Roosting known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat known to occur within area
Thinornis rubricollis Hooded Plover [59510]		Species or species habitat known to occur within area
Tringa glareola Wood Sandpiper [829]		Roosting known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Roosting known to occur within area

Extra Information

State and Territory Reserves	[Resource Information]
Name	State
Balannup Lake	WA
Forrestdale Lake	WA
Gibbs Road	WA
Harry Waring Marsupial Reserve	WA
Piara	WA
Thomsons Lake	WA
Unnamed WA48291	WA
Unnamed WA49299	WA
Unnamed WA49561	WA
Wandi	WA

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		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		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
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Turdus merula Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
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
Funambulus pennantii Northern Palm Squirrel, Five-striped Palm Squirrel [129]		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

Name	Status	Type of Presence
Rattus norvegicus Brown Rat, Norway Rat [83]		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
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 aethiopicus Asparagus Fern, Ground Asparagus, Basket Fern, Sprengi's Fern, Bushy Asparagus, Emerald Asparagus [62425]		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 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
Chrysanthemoides monilifera subsp. monilifera Boneseed [16905]		Species or species habitat likely to occur within area
Genista linifolia Flax-leaved Broom, Mediterranean Broom, Flax Broom [2800]		Species or species habitat likely to occur within area
Genista monspessulana Montpellier Broom, Cape Broom, Canary Broom, Common Broom, French Broom, Soft Broom [20126]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Olea europaea Olive, Common Olive [9160]		Species or species habitat may occur within area
Opuntia spp. Prickly Pears [82753]		Species or species habitat likely to occur

Name	Status	Type of Presence within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Sagittaria platyphylla Delta Arrowhead, Arrowhead, Slender Arrowhead [68483]		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
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		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
Tamarix aphylla Athel Pine, Athel Tree, Tamarisk, Athel Tamarisk, Athel Tamarix, Desert Tamarisk, Flowering Cypress, Salt Cedar [16018]		Species or species habitat likely to occur within area
Reptiles		
Hemidactylus frenatus Asian House Gecko [1708]		Species or species habitat likely to occur within area

Nationally Important Wetlands	[Resource Information]
Name	State
Forrestdale Lake	WA
Gibbs Road Swamp System	WA
Thomsons Lake	WA

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 and National Heritage properties, Wetlands of International and National 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.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

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

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

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

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

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

Coordinates

-32.1252 115.90763

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:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian 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, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

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

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

Department of the Environment
GPO Box 787
Canberra ACT 2601 Australia
+61 2 6274 1111

APPENDIX D - FLORA SPECIES BY SITE

*denotes introduced (weed) species

Family	Species	PR02	PR01	PR04	PR03	PR05
Anarthriaceae	*Lyginia imberbis*			x	x	x
Apiaceae	*Platysace compressa*	x				
Asparagaceae	*Laxmannia squarrosa*			x		
	Lomandra ?caespitosa				x	
	Lomandra sericea				x	
	Lomandra sp.	x				
Asteraceae	* *Ursinia anthemoides*			x		
Casuarinaceae	*Allocasuarina fraseriana*	x				x
Colchicaceae	*Burchardia congesta*	x	x		x	
Cyperaceae	*Lepidosperma squamatum*				x	
	Schoenus curvifolius		x		x	
	Schoenus sp.					x
Dasypogonaceae	*Dasypogon bromeliifolius*	x	x		x	x
Dilleniaceae	*Hibbertia hypericoides*	x		x	x	
Ericaceae	*Conostephium* sp.				x	
	Leucopogon conostephioides			x		
	Styphelia xerophylla			x	x	
Fabaceae	*Acacia pulchella*	x	x	x	x	x
	Acacia stenoptera			x		
	Bossiaea eriocarpa	x	x		x	
	Gompholobium tomentosum	x	x	x	x	
	Hovea trisperma				x	
	Jacksonia furcellata	x	x		x	x
	Jacksonia ?gracillima (P3)	x				
	Kennedia prostrata	x				
Goodeniaceae	*Dampiera linearis*	x			x	
	Lechenaultia floribunda			x	x	
	Scaevola repens			x		
Haloragaceae	*Gonocarpus pithyoides*	x				
Iridaceae	* *Gladiolus caryophyllaceus*	x	x	x	x	x
	Patersonia occidentalis				x	
Lamiaceae	*Hemiandra pungens*			x		x
Myrtaceae	* *Leptospermum laevigatum*				x	
	Calytrix sp.				x	
	Eucalyptus marginata	x				
	Eucalyptus todtiana				x	x
	Hypocalymma robustum	x				
	Kunzea glabrescens		x		x	x
	Melaleuca preissiana	x	x			
	Melaleuca seriata		x			
	Melaleuca thymoides		x		x	
	Scholtzia involucrata			x		
Poaceae	* *Avena barbata*		x			
	* *Briza maxima*	x				
	* *Ehrharta calycina*	x	x	x	x	x
Proteaceae	*Adenanthos cygnorum*	x		x		x
	Banksia attenuata		x		x	
	Banksia ilicifolia				x	
	Banksia menziesii	x	x		x	
	Petrophile linearis				x	
	Stirlingia latifolia			x	x	
Restionaceae	*Loxocarya cinerea*	x	x		x	x

Family	Species	PR02	PR01	PR04	PR03	PR05
Rutaceae	*Boronia ramosa*			x		
Stylidiaceae	*Stylidium repens*				x	
Xanthorrhoeaceae	*Xanthorrhoea gracilis*	x	x			
	Xanthorrhoea preissii	x				x
Zamiaceae	*Macrozamia riedlei*	x				

APPENDIX E - VEGETATION RELEVÉ DATA

Site PR01

Date:	25.03.20
Botanist:	Kellie Bauer-Simpson
NW Corner Coordinates:	396730mE; 6445159mN
Slope:	Flat
Landform:	Flat
Soil Colour:	Grey
Soil Type:	Sand
Litter:	90
Bare Ground:	1
Fire Age:	5 - 10yrs
Vegetation Condition:	Good
Disturbances/Impacts:	Weeds, rabbits, possible dieback and historic clearing
Vegetation Unit:	EmBaLW(-B)

Figure D1 Site PR01

Site PR02

Date:	25.03.20
Botanist:	Kellie Bauer-Simpson
NW Corner Coordinates:	396748mE; 6445101mN
Slope:	Flat
Landform:	Flat
Soil Colour:	Grey
Soil Type:	Sandy loam
Litter:	80
Bare Ground:	5
Fire Age:	>10 years
Vegetation Condition:	Good
Disturbances/Impacts:	Weeds, rabbits, possible dieback and historic clearing
Vegetation Unit:	EmBaLW

Figure D2 Site PR02

Site PR03

Date:	25.03.20
Botanist:	Kellie Bauer-Simpson
NW Corner Coordinates:	396896mE; 6445310mN
Slope:	Flat
Landform:	Flat
Soil Colour:	Grey
Soil Type:	Sandy loam
Litter:	80
Bare Ground:	5
Fire Age:	5 - 10 years
Vegetation Condition:	Good
Disturbances/Impacts:	Weeds, possible dieback and rabbits
Vegetation Unit:	BaEtLW

Figure D3 Site PR03

Site PR04

Date:	25.03.20
Botanist:	Kellie Bauer-Simpson
NW Corner Coordinates:	396884mE; 6445307mN
Slope:	Mild
Landform:	Flat
Soil Colour:	Pale grey
Soil Type:	Sand
Litter:	5
Bare Ground:	90
Fire Age:	5 – 10 years
Vegetation Condition:	Degraded – Completely Degraded
Disturbances/Impacts:	Weeds, erosion, rabbits, loss of structure and historic clearing
Vegetation Unit:	AcOS

Figure D4 Site PR04

Site PR05

Date:	25.03.20
Botanist:	Kellie Bauer-Simpson
NW Corner Coordinates:	396991mE; 6445344mN
Slope:	Mild
Landform:	Flat
Soil Colour:	Grey
Soil Type:	Sand
Litter:	75
Bare Ground:	10
Fire Age:	5 – 10 years
Vegetation Condition:	Degraded
Disturbances/Impacts:	Weeds, rabbits, loss of structure and historic clearing
Vegetation Unit:	BaEtLW(-B)

Figure D5 Site PR05

APPENDIX F - STRUCTURAL VEGETATION CLASSIFICATIONS (MUIR 1977)

Life Form/Height Class	Canopy Cover			
	Dense 70-100%	**Mid-dense 30-70%**	**Sparse 10-30%**	**Very sparse 2-10%**
Trees >30m Trees 15-30m Trees 5-15m Trees <5m	Dense tall forest Dense forest Dense low forest A Dense low forest B	Tall forest Forest Low forest A Low forest B	Tall woodland Woodland Low woodland A Low woodland B	Open tall woodland Open woodland Open low woodland A Open low woodland B
Mallee Tree Form Mallee Shrub form	Dense tree mallee Dense shrub mallee	Tree mallee Shrub mallee	Open tree mallee Open shrub mallee	Very open tree mallee Very open shrub mallee
Shrubs >2m Shrubs 1.5-2m Shrubs 1-1.5m Shrubs 0.5-1m Shrubs <0.5m	Dense thicket Dense heath A Dense heath B Dense low heath C Dense low heath D	Thicket Heath A Heath B Low heath C Low heath D	Scrub Low scrub A Low scrub B Dwarf scrub C Dwarf scrub D	Open scrub Open low scrub A Open low scrub B Open dwarf scrub C Open dwarf scrub D
Mat plants Hummock grass Bunch grass >0.5m Bunch grass <0.5m Herbaceous spp.	Dense mat plants Dense hummock grass Dense tall grass Dense low grass Dense herbs	Mat plants Mid-dense hummock grass Tall grass Low grass Herbs	Open mat plants Hummock grass Open tall grass Open low grass Open herbs	Very open mat plants Open hummock grass Very open tall grass Very open low grass Very open herbs
Sedges >0.5m Sedges <0.5m	Dense tall sedges Dense low sedges	Tall sedges Low sedges	Open tall sedges Open low sedges	Very open tall sedges Very open low sedges
Ferns Mosses, Liverwort	Dense ferns Dense mosses	Ferns Mosses	Open ferns Open mosses	Very open ferns Very open mosses

Appendix 4 Fauna Assessment Report (Harewood, 2018)

Fauna Assessment

West Piara Waters

Forrestdale

June 2018
Version 2

On behalf of:
CoTerra
Level 3, 25 Prowse Street
WEST PERTH WA 6005

Prepared by:
Greg Harewood
Zoologist
PO Box 755
BUNBURY WA 6231
M: 0402 141 197
E: gharewood@iinet.net.au

TABLE OF CONTENTS

TABLES

FIGURES

APPENDICES

Acronyms/Abbreviations:

ALA: Atlas of Living Australia www.ala.org.au

BA: Birdlife Australia (Formerly RAOU, Birds Australia).

BC Bill: *Biodiversity Conservation Bill (2015)*. WA Government.

°C: Degrees Celsius.

CALM: Department of Conservation and Land Management (now DBCA), WA Government.

CAMBA: China Australia Migratory Bird Agreement 1998.

CBD: Central Business District.

DBCA: Department of Biodiversity, Conservation and Attractions (formerly DPaW, DEC, CALM, DoE), WA Government

DBH: Diametre at Breast Height – tree measurement.

DEC: Department of Environment and Conservation (now DBCA), WA Government.

DEH: Department of Environment and Heritage (now DotEE), Australian Government.

DEP: Department of Environment Protection (now DER), WA Government.

DER: Department of Environment Regulation (now DWER), WA Government.

DEWHA: Department of the Environment, Water, Heritage and the Arts (now DotEE), Australian Government

DMP: Department of Mines and Petroleum (formerly DoIR), WA Government.

DoE: Department of Environment (now DER/DBCA), WA Government.

DoP: Department of Planning, WA Government.

DotE: Department of the Environment (now DotEE), Australian Government.

DotEE: Department of the Environment and Energy (formerly SEWPaC, DWEHA, DEH & DotE), Australian Government.

DoIR: Department of Industry and Resources (now DMP), WA Government.

DoW: Department of Water (now DWER), WA Government.

DPaW: Department of Parks and Wildlife (now DBCA), WA Government.

DWER: Department of Water and Environmental Regulation (formed by the amalgamation of OEPA, DoW and DER), WA Government.

EP Act: *Environmental Protection Act 1986*, WA Government.

EPA: Environmental Protection Authority, WA Government.

EPBC Act: *Environment Protection and Biodiversity Conservation Act 1999,* Australian Government.

ha: Hectare (10,000 square metres).

IBRA: Interim Biogeographic Regionalisation for Australia.

IUCN: International Union for the Conservation of Nature and Natural Resources – commonly known as the World Conservation Union.

JAMBA: Japan Australia Migratory Bird Agreement 1981.

km: Kilometre.

m: Metre.

MKSEA: Maddington Kenwick Strategic Employment Area.

mm: Millimetre.

P: Priority - DBCA fauna conservation ranking.

POS: Public Open Space.

ROKAMBA: Republic of Korea-Australia Migratory Bird Agreement 2007.

S: Schedule - Western Australian *Wildlife Conservation Act (1950)* Threatened Fauna Category.

SEWPaC: Department of Sustainability, Environment, Water, Population and Communities (now DotEE), Australian Government.

SRE: Short Range Endemic.

SSC: Species Survival Commission, International.

WA: Western Australia.

WAM: Western Australian Museum, WA Government.

WAPC: Western Australian Planning Commission, WA Government.

WC Act: *Wildlife Conservation Act 1950*, WA Government.

SUMMARY

This report details the results of a fauna assessment of various freehold allotments within and area of land referred to as West Piara Waters located in the City of Armadale (subject site). The subject site covers approximately 124 ha, most of which is cleared or parkland cleared though some areas of remnant native vegetation remain (Figures 1 & 2).

It is understood that outline development plans are being prepared to support future development across the subject site. A range of investigations, including this fauna survey, have been undertaken in order to fully understand the suite of environmental values across the area.

The scope of works was to conduct a level 1 fauna survey as defined by the Environmental Protection Authority (EPA 2016). Because black cockatoos are known to frequent the area a targeted assessment of the sites significance to these species has also been carried out. The assessment has therefore included a literature review ("desktop study") and several daytime reconnaissance surveys.

Remnant native vegetation within the subject site (28% of the total area) is now mainly represented by wetland vegetation dominated by paperbark and/or flooded gum low forests or woodland over native understorey, herblands, sedgelands, introduced weeds or grasslands (~21.3% of the total area). A small number of manmade dams and drains, some with a coverage of *Typha orientalis* are also present.

Remnant upland vegetation is present as small groves of woodland/forest comprised of tree species in various densities and combinations including banksia, sheoak, coastal blackbutt and jarrah over native understorey, introduced weeds and/or grasslands (~6.7% of the subject site)

The balance of the subject site (~72.00% of the total area) is either totally cleared or parkland cleared with scattered trees, mostly planted non-endemic eucalyptus species, with a small number of endemics, some of which have also been planted (e.g. tuarts).

Overall fauna habitat values at the subject site have been severely compromised by the removal of most of the original native vegetation and the degradation of remnant patches. Most areas lack any natural attributes and are now only utilised by generally common and widespread fauna species with non-specific requirements which allow them to persist in disturbed/highly disturbed habitats. As a consequence, the fauna diversity of the subject site is well below levels present prior to historical disturbances having occurred.

Despite the lack of biodiversity the site still retains some value for a small number of species of conservation significance, in particular black cockatoos (foraging and roosting opportunities) and the quenda though the groves of remnant vegetation present are limited in extent, fragmented, generally in a degraded condition and subject to ongoing decline.

The black cockatoo habitat tree assessment identified a total of 181 trees with a DBH of ≥50cms within the subject site. The majority of these trees (164, 90.6%) are planted non-endemic eucalypts. It is not known if these tree species have the propensity to develop hollows for black cockatoos.

No trees were identified as potentially containing hollows of any size. Additional details on each habitat tree observed can be found in Appendix D.

Foraging debris (all in the form of chewed blackbutt and sheoak fruits) left by black cockatoos was observed at a small number of locations within the subject site during the survey period. This foraging activity was attributed to the forest red-tailed black cockatoo but some (chewed blackbutt fruits) may have been caused by Carnaby's as they also utilise this resource.

It is difficult to calculate the actual extent of quality natural foraging habitat within the subject site given it is largely comprised of patchy, fragmented vegetation of variable quality, but it is unlikely to total more than about 8.2 ha (i.e. areas mapped as containing *banksia* – see Figure 3).

No black cockatoo roosting activity within the subject site was noted during the survey period.

Based on available vegetation mapping it is estimated that there is approximately 11,500 ha of native vegetation within 12 km the subject site (~22% of total area) much of which is likely to represent black cockatoo habitat of some type. Bush forever sites make up about 75% of this area of remnant vegetation.

Opportunistic fauna observations are listed in Appendix B. A total of 29 native fauna species were observed (or positively identified from foraging evidence, scats, tracks, skeletons or calls) within the subject site during the survey period. Five introduced species (horse, red fox, rabbit, laughing turtle dove, rainbow lorikeet) were also recorded.

Most of the fauna species recorded were common, widespread bird species.

Only one fauna species of conservation significance was recorded during the survey period (the forest red-tailed black cockatoo – foraging evidence).

With respect to native vertebrate fauna, 9 mammals (includes eight bat species), 118 bird, 20 reptile, and nine frog species have previously been recorded in the general area, some of which have the potential to occur in or utilise sections of the subject site at times, a conclusion largely based on the presence of apparently suitable habitat.

Of the 156 native animals that are listed as potentially occurring in the area, four are considered to be endangered/vulnerable or in need of special protection under State and/or Commonwealth legislation, these being the three species of black cockatoo and the peregrine falcon. In addition, the Priority 4 quenda and Perth lined lerista may also occur, given the presence of some suitable habitat for both species.

With respect to vertebrate fauna in general, no significant impacts are anticipated as a consequence of development at the site taking place. In cases where some impact is anticipated, the degree of the impact is only expected to be low and relates to the loss of small areas of fragmented and largely degraded habitat. As most species are common and widespread no overall change in their conservation status is anticipated, despite a possible localised reduction in habitat extent.

Based on available information it is considered, at this stage, very unlikely that impacts on black cockatoos (or any other *EPBC Act* listed threatened or migratory species) which may occur as a result of development at any scale within the subject site will be of a scale considered "significant impact" as defined by the Commonwealth DotEE (DotE 2013). The conclusions drawn with respect to this matter should be reviewed once development plans are finalised.

Subject to the proposal going forward it is recommended at that a fauna management plan be prepared for implementation during initial site works with the aim of minimising impacts on fauna and fauna habitat as much as reasonable and practicable in particular the quenda which is likely to be occupying much of the denser wetland vegetation.

1. INTRODUCTION

This report details the results of a fauna assessment of various freehold allotments within and area of land referred to a West Piara Waters located in the City of Armadale (subject site). The subject site is situated about 20 kilometres south the Perth central business district in south west Western Australia and is centred at approximately 32.12921°S and 115.90505°E (Figure 1).

The subject site covers approximately 124 ha, most of which is cleared or parkland cleared though some areas of remnant native vegetation remain (Figure 2).

2. DEVELOPMENT PROPOSAL

It is understood that outline development plans are being prepared to support future development across the subject site. A range of investigations, including this fauna survey, have been undertaken in order to fully understand the suite of environmental values across the area. The findings of this fauna survey and other investigations will be used to inform and support the development, with the primary aim of minimising potential environmental impacts as much as reasonable and practicable.

It is also anticipated that the information presented will be used by regulatory authorities to assess the potential impact of the proposal on fauna and fauna habitats as part of finalising the outline development plan and for future subdivision development approval processes.

3. SCOPE OF WORKS

The scope of works is to conduct a Level 1 fauna survey as defined by the EPA (EPA 2016). Because the general area is known to be utilised by black cockatoos the scope of the survey work has been expanded to include a Level 2 (EPA 2016) assessment of the sites significance to these species as well. The fauna assessment has therefore included:

1. Level 1 fauna assessment (in accordance with EPA (2016) guidelines);
2. Targeted searches for black cockatoo habitat/site use (habitat trees, existing and potential nest hollows, foraging and roosting habitat);
3. Identification of any other potentially occurring significant fauna species and their habitat; and
4. Report summarising methods, results and discussion on likely constraints on development within the subject site.

Note: For the purposes of this proposal the term Black Cockatoo is in reference to Baudin's Black Cockatoo *Calyptorhynchus baudinii*, Carnaby's Black Cockatoo *Calyptorhynchus latirostris* and the Forest Red-tailed Black Cockatoo *Calyptorhynchus banksii naso.*

4. METHODS

4.1 POTENTIAL FAUNA INVENTORY - LITERATURE REVIEW

4.1.1 Database Searches

Searches of the following databases were undertaken to aid in the compilation of a list of conservation significant fauna potentially occurring within the subject site:

- DBCA's NatureMap Database Search (combined data from DBCA, ALA, WAM, BA and consultant's reports) (DBCA 2018b); and
- Protected Matters Search Tool (DotEE 2018).

It should be noted that lists produced during the abovementioned database searches contain observations/inferred distributions from a broader area than the subject site and therefore may include species that would only ever occur as vagrants due to a lack of suitable habitat or the presence of only marginal habitat within the subject site itself. The databases also often included or are based on very old records and in some cases the species in question have become locally or regionally extinct.

Information from these sources should therefore be taken as indicative only and local knowledge and information also needs to be taken into consideration when determining what actual species may be present within the specific area being investigated.

4.1.2 Previous Fauna Surveys in the Area

Fauna surveys, assessments and reviews have been undertaken in nearby areas in the past, though not all are publicly available and could not be referenced. The most significant of those available have been used as the primary reference material for compiling a list of fauna species of conservation significance most likely to occur in the general area.

Those reports referred to included, but were not limited to:

- ATA Environmental (2006). Vertebrate Fauna Assessment Brookdale Redevelopment Area. Unpublished report for the Armadale Redevelopment Authority.
- ENV Australia (2005). Southern River Precinct 3 - Environmental Review. Unpublished report for the City of Gosnells.
- ENV (2009). Jandakot Airport Fauna Survey. Unpublished report for Jandakot Airport Holdings Pty Ltd.
- Phoenix Environmental Sciences (2011). Vertebrate Fauna Survey for the Roe Highway Extension Project. Unpublished report for South Metro Connect.

- Turpin, J. and Bamford, M. (2009). Keane Road Strategic Link Armadale, Fauna Assessment. Unpublished report for EnviroWorks Consulting.

As with the databases searches some reports refer to species that would not occur in the subject site due to a lack of suitable habitat (extent and/or quality) and this fact was taken into consideration when compiling the potential fauna species list. It should also be noted that the NatureMap database is likely to include some records from previous fauna surveys in the area including some of those listed above.

4.1.3 Existing Publications

The following represent the main publications used to identify and refine the potential fauna species list for the subject site:

- Anstis, M. (2013). Tadpoles and Frogs of Australia. New Holland Publishers, Sydney.
- Barrett, G., Silcocks, A., Barry, S., Cunningham, R. and Poulter, R. (2003). The New Atlas of Australian Birds. Royal Australasian Ornithologists Union, Victoria.
- Bush, B., Maryan, B., Browne-Cooper, R. & Robinson, D. (2007). Reptiles and Frogs in the Bush: Southwestern Australia. UWA Press, Nedlands.
- Bush, B., Maryan, B., Browne-Cooper, R. & Robinson, D. (2010). Field Guide to Reptiles and Frogs of the Perth Region. UWA Press, Nedlands.
- Churchill, S. (2008). Australian Bats. Second Edition, Allen & Unwin.
- Cogger, H.G. (2014). Reptiles and Amphibians of Australia. 7th Edition. CSIRO Publishing.
- Johnstone, R.E. and Storr, G.M. (1998). Handbook of Western Australian Birds: Volume 1 – Non-passerines (Emu to Dollarbird). Western Australian Museum, Perth Western Australia.
- Johnstone, R.E. and Storr, G.M. (2004). Handbook of Western Australian Birds: Volume 2 – Passerines (Blue-winged Pitta to Goldfinch). Western Australian Museum, Perth Western Australia.
- Menkhorst, P. and Knight, F. (2011). A Field Guide to the Mammals of Australia. Oxford University Press, Melbourne.
- Morgan, D.L., Beatty, S.J., Klunzinger, M.W, Allen, M.G. and Burnham, Q.E (2011). Field Guide to the Freshwater Fishes, Crayfishes and Mussels of South Western Australia. Published by SERCUL.
- Storr, G.M., Smith, L.A. and Johnstone R.E. (1983). Lizards of Western Australia II: Dragons and Monitors. WA Museum, Perth.

- Storr, G.M., Smith, L.A. and Johnstone R.E. (1990). Lizards of Western Australia III: Geckos and Pygopods. WA Museum, Perth.
- Storr, G.M., Smith, L.A. and Johnstone R.E. (1999). Lizards of Western Australia I: Skinks. Revised Edition, WA Museum, Perth.
- Storr, G.M., Smith, L.A. and Johnstone R.E. (2002). Snakes of Western Australia. Revised Edition, WA Museum, Perth.
- Tyler M.J. & Doughty P. (2009). Field Guide to Frogs of Western Australia, Fourth Edition, WA Museum, Perth.
- Van Dyck, S., Gynther, I. & Baker, A. Eds (2013). Field Companion to The Mammals of Australia. Queensland Museum.
- Wilson, S. and Swan, G. (2013). A Complete Guide to Reptiles of Australia. Reed, New Holland, Sydney.
- Woinarski, J., Burbidge, A. & Harrison, P. (2014). The Action Plan for Australian Mammals 2012. CSIRO Publishing.

4.1.4 Fauna of Conservation Significance

The conservation significance of fauna species has been assessed using data from the following sources:

- *Environment Protection and Biodiversity Conservation Act 1999* (*EPBC Act*). Administered by the Australian Government DotEE;
- *Wildlife Conservation Act 1950* (*WC Act*). Administered by the Western Australian DBCA (Govt. of WA 2018);
- Red List produced by the SSC of the World Conservation Union (also known as the IUCN Red List - the acronym derived from its former name of the International Union for Conservation of Nature and Natural Resources). The Red List has no legislative power in Australia but is used as a framework for State and Commonwealth categories and criteria; and
- DBCA Priority Fauna list. A non-statutory list maintained by the DBCA for management purposes (DBCA 2018a).

The *EPBC Act* also requires the compilation of a list of migratory species that are recognised under international treaties including the:

- Japan Australia Migratory Bird Agreement 1981 (JAMBA);
- China Australia Migratory Bird Agreement 1998 (CAMBA);

- Republic of Korea-Australia Migratory Bird Agreement 2007 (ROKAMBA); and
- Bonn Convention 1979 (The Convention on the Conservation of Migratory Species of Wild Animals).

(Note – Some species listed under JAMBA are also protected under Schedule 5 of the *WC Act*.)

Most but not all migratory bird species listed in the annexes to these bilateral agreements are protected in Australia as matters of national environmental significance (MNES) under the *EPBC Act*. Fauna listed as marine under the *EPBC Act* are not considered as a matter of national environmental significance.

The conservation status of all vertebrate fauna species listed as occurring or possibly occurring in the vicinity of the subject site has been assessed using the most recent lists published in accordance with the above-mentioned instruments and is indicated as such in the fauna listings of this report. A full listing of conservation codes is provided in Appendix A.

A number of other species not listed in official lists can also be considered of local or regional conservation significance. These include species that have a restricted range, those that occur in breeding colonies and those at the limit of their range.

While not classified as rare, threatened or vulnerable under any State or Commonwealth legislation, a number of birds have been listed as species of significance on the Swan Coastal portion of the Perth Metropolitan Region (Bush Forever - Government of Western Australia 1998 and 2000). The bird species are often referred to as “Bush Forever Decreaser Species”.

The three categories used for birds within the Bush Forever documents are:

- Habitat specialists with reduced distribution on the Swan Coastal Plain (code Bh)
- Wide ranging Species with reduced populations on the Swan Coastal Plain. (code Bp)
- Extinct in the Perth region (code B_e)

The presence of Bush Forever species should be taken into some consideration when determining the fauna values of an area. Bush Forever decreaser species are indicated as such within the species list held in Appendix B.

4.1.5 Invertebrate Fauna of Conservation Significance

It can be difficult to identify significant invertebrate species (e.g. short range endemics (SREs) as there are uncertainties in determining the range-restrictions of many species due to lack of surveys, lack of taxonomic resolutions within target taxa and problems in identifying certain life stages. Where invertebrates are collected during surveys, a high

percentage are likely to be unknown, or for known species there can be limited knowledge or information on their distribution (Harvey 2002).

For this project, the assessment for conservation significant invertebrates has been limited to those listed by the DBCA and *EPBC Act* database searches (which rely on distribution records and known habitat preferences). No assessment of the potential for SREs to be present has been made.

4.1.6 Likelihood of Occurrence – Fauna of Conservation Significance

Fauna of conservation significance identified during the literature review as previously being recorded in the general area were assessed and ranked for their likelihood of occurrence within the subject site itself. The rankings and criteria used were:

- Would Not Occur: There is no suitable habitat for the species in the subject site and/or there is no documented record of the species in the general area since records have been kept and/or the species is generally accepted as being locally/regionally extinct (supported by a lack of recent records).
    - Locally Extinct: Populations no longer occur within a small part of the species natural range, in this case within 10 or 20 km of the subject site. Populations do however persist outside of this area.
    - Regionally Extinct: Populations no longer occur in a large part of the species natural range, in this case within the Perth section of the Swan Coastal Plain and nearby Darling Range. Populations do however persist outside of this area.
- Unlikely to Occur: The subject site is outside of the currently documented distribution for the species in question, or no suitable habitat (type, quality and extent) was identified as being present during the field assessment. Individuals of some species may occur occasionally as vagrants/transients especially if suitable habitat is located nearby but the subject site itself would not support individuals or a population the species.
- Possibly Occurs: The subject site is within the known distribution of the species in question and habitat of at least marginal quality was identified as being present during the field assessment, supported in some cases by recent records being documented in literature from within or near the subject site. In some cases, while a species may be classified as possibly being present at times, habitat may be marginal (e.g. poor quality, fragmented, limited in extent) and therefore the frequency of occurrence and/or population levels may be low.
- Known to Occur: The species in question was positively identified as being present (for sedentary species) or as using the subject site as habitat for some other purpose (for non-sedentary/mobile species) during the field survey. This information may have been obtained by direct observation of individuals or by way of secondary

evidence (e.g. foraging debris, tracks and scats). In some cases, while a species may be classified as known to occur, habitat may be marginal (e.g. poor quality, fragmented, limited in extent) and therefore the frequency of occurrence and/or population levels may be low.

4.1.7 Taxonomy and Nomenclature

Taxonomy and nomenclature for vertebrate fauna species used in this report is generally taken from the DBCA's WA Fauna Census Database which is assumed to follow Aplin and Smith (2001) for amphibians and reptiles and Johnstone (2001) for birds. Jackson and Groves (2015) has been used for mammals.

Common names are taken from the Western Australia Museum (WAM) recognised primary common name listings when specified, though where common names are not provided they have been acquired from other publications. Sources include Cogger (2014), Wilson and Swan (2017), Van Dyck & Strahan (2013), Christidis and Boles (2008), Bush *et al.* (2010), Bush *et al.* (2007), Tyler & Doughty (2009), and Glauret (1961). Not all common names are generally accepted.

4.2 SITE SURVEYS

Daytime reconnaissance surveys of the subject site were carried out by Greg Harewood (Zoologist) on the 6 and 9 April 2018. It should be noted that access to some lots was restricted and therefore direct observations where limited in these areas.

4.2.1 Fauna Habitat Assessment

The vegetation communities identified during the botanical survey of the site carried out by Bennett Environmental Consulting (BEC 2011) have been used as the basis for a classification of areas into broad fauna habitat types. This information has been supplemented with observations made during the more recent fauna assessment.

The main aim of the habitat assessment was to determine if it was likely that any species of conservation significance would be utilising the areas that may be impacted on as a consequence of development at the subject site. The habitat information obtained was also used to aid in finalising the overall potential fauna list.

As part of the literature review, available information on the habitat requirements of the species of conservation significance listed as possibly occurring in the area was researched. During the field survey the habitats within the subject site were assessed and specific elements identified, if present, to determine the likelihood of listed threatened species utilising the area and its significance to them.

4.2.2 Black Cockatoo Habitat Assessment

The following methods were employed during the black cockatoo habitat assessment to comply with the defined scope of works and are based on guidelines published by the DotEE (Commonwealth of Australia 2012) which states that surveys for Carnaby's, Baudin's and forest red-tailed black cockatoo habitat should:

- be done by a suitably qualified person with experience in vegetation or cockatoo surveys, depending on the type of survey being undertaken;
- maximise the chance of detecting the species' habitat and/or signs of use;
- determine the context of the site within the broader landscape—for example, the amount and quality of habitat nearby and in the local region (for example, within 10 km);
- account for uncertainty and error (false presence and absences); and
- include collation of existing data on known locations of breeding and feeding birds and night roost locations.

Habitat used by black cockatoos have been placed into three categories by the DotEE (Commonwealth of Australia 2012) these being:

- Breeding Habitat;
- Foraging Habitat; and
- Night Roosting Habitat.

So as to comply with the requested scope of works and in line with the published guidelines the following was carried out.

4.2.2.1 Black Cockatoo Breeding Habitat

The black cockatoo breeding habitat assessment involved the identification of all suitable breeding trees species within the subject site that had a DBH of equal to or over 50cm. The DBH of each tree was estimated using a pre-made 50 cm "caliper".

Target tree species included marri, jarrah, flooded gum or any other *Corymbia/Eucalyptus* species of a suitable size that may have been present. Peppermints, *banksia*, sheoak and *melaleuca* tree species (for example) were not assessed as they typically do not develop hollows that are used by black cockatoos.

The location of each tree identified as being over the threshold DBH was recorded with a GPS and details on tree species, number and size of hollows (if any) noted. Trees observed to contain hollows (of any size/type) were marked with "H" using spray paint for easy future reference.

For the purposes of this assessment a tree containing a potential cockatoo nest hollow was defined as:

Generally, any tree which is alive or dead that contains one or more visible hollows (cavities within the trunk or branches) suitable for occupation by a black cockatoo for the purpose of nesting/breeding. Hollows that had an entrance greater than about 10cm in diameter and would allow the entry of a black cockatoo into a suitably orientated and sized branch/trunk were recorded as a "potential black cockatoo nest hollow".

Identified hollows were examined using binoculars for evidence of actual use by black cockatoos (e.g. chewing around hollow entrance, scarring and scratch marks on trunks and branches). Trees with possible nest hollows were also scratched and raked with a large stick/pole in attempt to flush any sitting birds from hollows and calls of chicks were also listened for. It should be noted that the survey may have been conducted outside of the main breeding season of one or more of the three species of black cockatoo.

4.2.2.2 Black Cockatoo Foraging Habitat

The location and nature of black cockatoo foraging evidence (e.g. chewed fruits around base of trees) observed during the reconnaissance survey was recorded. The nature and extent of potential foraging habitat present was also documented irrespective of the presence of any actual foraging evidence.

4.2.2.3 Black Cockatoo Roosting Habitat

Direct and indirect evidence of black cockatoos roosting in trees was within the subject site was noted if observed (e.g. branch clippings, droppings or moulted feathers).

4.2.3 Opportunistic Fauna Observations

Opportunistic observations of fauna species were made during the field survey. Methods involved traversing a series of transects across the subject site during the day while searching microhabitats such as logs, rocks, leaf litter and observations of bird species with binoculars. Secondary evidence of a species presence such as tracks, scats, skeletal remains, foraging evidence or calls were also noted if observed/heard.

5. SURVEY CONSTRAINTS

No seasonal sampling has been carried out as part of this fauna assessment. The conclusions presented are based upon field data and the environmental monitoring and/or testing carried out over a limited period of time and are therefore merely indicative of the environmental condition of the site at the time of the field assessments. It should also be recognised that site conditions can change with time.

Some fauna species are reported as potentially occurring based on there being suitable habitat (quality and extent) within the subject site or immediately adjacent. With respect to opportunistic observations, the possibility exists that certain species may not have been detected during field investigations due to:

- seasonal inactivity during the field survey;
- species present within micro habitats not surveyed;
- cryptic species able to avoid detection; and
- transient wide-ranging species not present during the survey period.

Lack of observational data on some species should therefore not necessarily be taken as an indication that a species is absent from the site or does not utilise it for some purpose at times.

The habitat requirements and ecology of many of the species known to occur in the wider area are often not well understood or documented. It can therefore be difficult to exclude species from the potential list based on an apparent lack of a specific habitat or microhabitat within the subject site. As a consequence of this limitation the potential fauna list produced is most likely an overestimation of those species that actually utilise the subject site for some purpose. Some species may be present in the general area but may only use the subject site itself on rare occasions or as vagrants/transients.

In recognition of survey limitations, a precautionary approach has been adopted for this assessment. Any fauna species that would possibly occur within the subject site (or immediately adjacent), as identified through ecological databases, publications, discussions with local experts/residents and the habitat knowledge of the Author, has been assumed to potentially occur in the subject site.

During the black cockatoo habitat survey trees with hollows were searched for. It should be noted that identifying hollows suitable for fauna species from ground level has limitations. Generally the full characteristics of any hollow seen are not fully evident (e.g. internal dimensions). It is also difficult to locate all hollows within all trees as some are not observable from ground level.

As previously indicated access to some lots was restricted and therefore direct observations where limited in these areas.

6. RESULTS

6.1 POTENTIAL FAUNA INVENTORY – LITERATURE REVIEW

A list of vertebrate fauna species considered most likely to occur in the subject site has been compiled from information obtained during the literature review and is presented in Appendix B. This listing was refined after information gathered during the site reconnaissance survey was assessed. The results of some previous fauna surveys carried out in the general area are summarised in this listing as are the DBCA NatureMap database search results (with species considered unlikely to occur being omitted). The raw database search results from NatureMap (DBCA 2018b) and the Protected Matters Search Tool (DotEE 2018) are contained within Appendix C.

The list of potential fauna takes into consideration that firstly, the species in question is not known to be locally extinct and secondly, that suitable habitat for each species, as identified during the habitat assessment, is present within the subject site, though compiling an accurate list has limitations (see Section 5 above) and therefore as discussed, the listing is very likely to be an overestimation of the fauna species actually present onsite at any one time.

With respect to native vertebrate fauna, nine mammal (including eight bat species), 118 bird, 20 reptile and nine frog species have previously been recorded in the wider area, some of which have the potential to occur in or utilise sections of the subject site at times. Thirteen species of introduced animals could also frequent the area.

Of the 156 native vertebrate animals that are listed as potentially occurring, four are considered to be endangered/vulnerable or in need of special protection under State and/or Federal law. In addition, one DBCA priority species is also listed as potentially occurring. These particular species are discussed in further detail in the following sections of the report.

6.2 SITE SURVEYS

6.2.1 Fauna Habitat Assessment

The subject site is situated is centrally located within a part of the Swan Coastal Plain in an area that has largely been historically cleared of vegetation, primarily for livestock grazing and subsequently residential developments.

Remnant native vegetation within the subject site (28% of the total area) is now mainly represented by wetland vegetation dominated by paperbark and/or flooded gum low forests or woodland over native understorey, herblands, sedgelands, introduced weeds or grasslands (~21.3% of the total area). A small number of manmade dams and drains, some with a coverage of *Typha orientalis* are also present.

Remnant upland vegetation is present as small groves of woodland/forest comprised of tree species in various densities and combinations including banksia, sheoak, coastal blackbutt and jarrah over native understorey, introduced weeds and/or grasslands (~6.7% of the subject site)

The balance of the subject site (~72.00% of the total area) is either totally cleared or parkland cleared with scattered trees, mostly planted non-endemic eucalyptus species, with a small number of endemics, some of which have also been planted (e.g. tuarts).

The subject site shows some subtle topographic highs (low dunes) but has no significant topographical features and is characterised by being almost flat with elevations ranging from about 27mAHD in the lowest area to about 35 mAHD on dune crests. Soils within the subject site are mainly represented by grey Bassendean Sands with peaty/loamy sand in wetland areas.

Descriptions and examples images of the main fauna habitats/dominant vegetation present within the subject site are provided in Table 1. The location and extent of the identified habitat elements is shown in Figure 3 (based on BEC 2011).

Table 1: Main Fauna Habitats within the Subject Site

Fauna Habitat Description	Example Image
Wetland Habitats (26.3 ha – 21.3%)	
Low Forest of Flooded Gum over Open Herbs and Open Tall Sedges on black sandy loam. Total Area = ~1.7 ha (~1.4%)	
Dense Low Forest/Low Woodland of Paperbark (occasional Flooded Gum in some areas) over Scrub/Dense Thicket of *Kunzea* over Herbs/Dense Sedges/Tall Grass on damp grey to black sand/loamy sand. Total Area = ~7.9 ha (~6.4%)	

Fauna Habitat Description	Example Image
Open Low Woodland of Paperbark in paddock area over Dense Tall Grass over Herbs on grey sand. Total Area = ~12.4ha (~10.1%)	
Dense Thicket of *Kunzea glabrescens* over Dwarf Scrub and Tall Sedges on grey sand. Total Area = ~1.1 ha (~0.9%)	
Heath of *Melaleuca viminea* and *Melaleuca incanaover* Open Herbs and Tall Sedges on damp grey sand. Total Area = ~0.9 ha (~0.7%)	
Dense Herbs over Open Tall Sedges on damp sandy loam. Total Area = ~1.1 ha (~0.9%)	

Fauna Habitat Description	Example Image
Open Low Grass over Open Herbs and Very Open Sedges on damp grey sand. Total Area = ~1.2 ha (~1.0%)	
Dams (some with coverage of *Typha*) Total Area = ~0.8 ha (~0.6%)	
Upland Habitats (8.2 ha – 6.7%)	
Low Woodland/Open Low Woodland of *Banksia*, Sheoak, *Nuytsia floribunda* and Coastal Blackbutt or Jarrah over Dwarf Scrub, Heath, Grass and/or Herbs on grey sand. Total Area = ~8.2 ha (~6.7%)	
Non-native/hardstand (88.9ha – 72.0%)	
Heavily disturbed areas comprising open paddocks covered in grassland/weeds with scattered planted vegetation, houses, sheds or areas of hardstand or bare ground. Total Area = ~88.9 ha (~72.0%)	

Overall fauna habitat values at the subject site have been severely compromised by the removal of most of the original native vegetation and the degradation of remnant patches. Most areas lack any natural attributes and are now only utilised by generally common and widespread fauna species with non-specific requirements which allow them to persist in disturbed/highly disturbed habitats. As a consequence, the fauna diversity of the subject site is well below levels present prior to historical disturbances having occurred.

Despite the lack of biodiversity the site still retains some value for a small number of species of conservation significance, in particular black cockatoos (foraging and roosting opportunities) and the quenda though the groves of remnant vegetation present are limited in extent, fragmented, generally in a degraded condition and subject to ongoing decline.

6.2.2 Black Cockatoo Habitat Assessment

6.2.2.1 Black Cockatoo Habitat Tree Assessment

Trees considered potentially suitable for black cockatoos to use as nesting habitat (subject to a suitable hollow being present and other factors) which were found within the subject site are comprised of the following species:

- Flooded Gum – *Eucalyptus rudis;*
- Jarrah – *Eucalyptus marginata*;
- Coastal Blackbutt - *Eucalyptus todtiana;*
- Tuart – *Eucalyptus gomphocephala* (planted specimens only);
- Dead unidentifiable species;
- Unknown non-endemic eucalyptus (planted).

A summary of the potential black cockatoo breeding trees (using DotEE criteria i.e. any suitable tree species with a DBH ≥ 50cm (Commonwealth of Australia 2012)) observed within the subject site is provided in Table 2 below and their location shown in Figure 4.

Table 2: Summary of potential cockatoo breeding habitat trees (DBH ≥50cm)

Total Number of Habitat Trees	Number of Trees with No Hollows Observed	Number of Trees with Hollows Considered Unsuitable for Nesting Black Cockatoos	Number of Trees with Hollows Considered Possibly Suitable for Nesting Black Cockatoos	Tree Species					
				Flooded Gum	Jarrah	Tuart (planted)	Blackbutt Planted	Non-Endemic Euc (Planted)	Dead - Unknown
181	181	0	0	6	4	3	2	164	2

The assessment identified a total of 181 trees with a DBH of ≥50cms within the subject site. The majority of these trees (164, 90.6%) are planted non-endemic eucalypts. It is not known if these tree species have the propensity to develop hollows for black cockatoos.

No trees were identified as potentially containing hollows of any size. Additional details on each habitat tree observed can be found in Appendix D.

There appears to be a paucity of black cockatoo breeding data for the general area. This could simply be a consequence of a lack of survey work or a lack of publicly available data.

The most likely species to breed in the vicinity is the forest red-tailed black cockatoo and it is known to breed in some nearby suburbs (e.g. Gosnells - Tony Kirkby pers. comm.). Carnaby's black cockatoo also commonly occurs in the local area but as a regular (non-breeding) seasonal migrant. Baudin's black cockatoo has a strong preference for the Darling Range and Darling Scarp but has been known to move out on to the eastern edge of the Swan Coastal Plain. Of the three species, this is the least likely to occur and the least likely to breed within the local area.

Based on available vegetation mapping it is estimated that there is approximately 11,500 ha of native vegetation within 12 km the subject site (~22% of total area) some of which is likely to contain potential breeding habitat. Bush forever sites make up about 75% of this area of remnant vegetation.

6.2.2.2 Black Cockatoo Foraging Habitat Assessment

Following is a list of the main flora species recorded within the subject site during the flora (BEC 2011) and fauna assessment that are known to be used as a food source by one or more species of black cockatoo:

- Jarrah – *Eucalyptus marginata* - Seeds;
- Coastal Blackbutt - *Eucalyptus todtiana* – Seeds;
- Tuart – *Eucalyptus gomphocephala* - Flowers, seeds, nectar;
- Flooded Gum – *Eucalyptus rudis*- Flowers, nectar;
- *Banksia* species – *B attenuata*, *B. Ilicifolia, B. menziesii* - Flowers, seeds;
- Sheoak – *Allocasuarina fraseriana* - Seeds;
- Balga – *Xanthorrhoea preissii* - Flowers, seeds;
- Orange Wattle - *Acacia saligna* – Bark, grubs;
- Grey Stinkwood - *Jacksonia furcellata* – Seeds;
- Peppermint Tree - *Agonis flexuosa* – Bark, grubs;

- Corkscrew Grass or Storksbill (exotic) - *Erodium botrys* – Seeds;
- Wild Radish (exotic) - *Raphanus raphanistrum* – Seeds.

It should be noted that some of the above-mentioned species (e.g. flooded gum, tuart, peppermint, balga bush) are only foraged upon to a small degree compared to more favoured plant species (e.g. *banksia*). The overall abundance of some species is also relatively low (e.g. the number of jarrah and sheoak trees present is small). These plant species therefore do not contribute significantly to the total foraging resource present which is mainly represented by areas mapped as containing banksia. Marri (*Corymbia calophylla*), a plant species favoured by all three species of black cockatoos is absent from the subject site.

Foraging debris (all in the form of chewed blackbutt and sheoak fruits) left by black cockatoos was observed at a small number of locations within the subject site during the survey period. This foraging activity was attributed to the forest red-tailed black cockatoo but some (chewed blackbutt fruits) may have been caused by Carnaby's as they also utilise this resource.

Based on available vegetation mapping it is estimated that there is approximately 11,500 ha of native vegetation within 12 km the subject site (~22% of total area) much of which is likely to represent foraging habitat of some type. Bush forever sites make up about 75% of this area of remnant vegetation.

It is difficult to calculate the actual extent of quality natural foraging habitat within the subject site given it is largely comprised of patchy, fragmented vegetation of variable quality, but it is unlikely to total more than about 8.2 ha (i.e. areas mapped as containing *banksia* – see Figure 3). This area represents less than 0.07% of the remnant native vegetation within 12 km of the subject site.

6.2.2.3 Black Cockatoo Roosting Habitat Assessment

No black cockatoo roosting activity within the subject site was noted during the survey period. A review of the 2017 Great Cocky Count database shows no documented roost sites within the subject site, the closest being about 500m north. This site was in use by six forest red-tailed black cockatoos during the 2017 count and 45 white tailed black cockatoos (most probably Carnaby's) during the 2015 Great Cocky Count. Another 22 documented sites (but not necessarily in current use) occur with 6 km of the subject site.

6.2.3 Opportunistic Fauna Observations

Opportunistic fauna observations are listed in Appendix B. A total of 29 native fauna species were observed (or positively identified from foraging evidence, scats, tracks, skeletons or calls) within the subject site during the survey period. Five introduced species (horse, red fox, rabbit, laughing turtle dove, rainbow lorikeet) were also recorded.

Most of the fauna species recorded were common, widespread bird species.

Only one fauna species of conservation significance was recorded during the survey period (the forest red-tailed black cockatoo – foraging evidence).

6.3 FAUNA INVENTORY – SUMMARY

6.3.1 Vertebrate Fauna

Table 3 summarises the number of fauna species potentially occurring within or utilising at times the subject site, based on results from the literature review and observations made during the field assessment. A complete list of fauna possibly inhabiting or frequenting the subject site is located in Appendix B.

Table 3: Summary of Potential Vertebrate Fauna Species (as listed in Appendix B)

Group	Total number of Potential species	Potential number of Specially Protected species	Potential number of Migratory species	Potential number of Priority species	Number of species Observed: Field Survey 2018
Amphibians	9	0	0	0	0
Reptiles	20	0	0	1	1
Birds	124[6]	4	0	0	29[2]
Non-Volant Mammals	8[7]	0	0	1	4[3]
Volant Mammals (Bats)	8	0	0	0	0
Total	**169[13]**	**4**	**0**	**2**	**34[5]**

Superscript = number of introduced species included in total.

Not all species listed as potentially occurring within the subject site in existing databases and publications (i.e. *EPBC Act* Threatened Fauna and Migratory species lists, DBCA's NatureMap database, various reports and publications) are shown in the expected listing in Appendix B. Some species have been excluded from this list based largely on the lack of suitable habitat within the subject site and in the general area or known local extinction, even if suitable habitat is present.

Despite the omission of some species it should be noted that the list provided is still very likely an over estimation of the fauna species utilising the subject site (either on a regular or infrequent basis) as a result of the precautionary approach adopted for the assessment. At

any one time only a subset of the listed potential species are likely to be present within the bounds of the subject site.

As most of the subject site is cleared the majority represents unsuitable habitat for many of the potential species listed. Most, if present, would be confined to the small areas of remnant native bushland and even in these areas only a subset of the species listed are likely to be present at any one time.

6.3.2 Vertebrate Fauna of Conservation Significance

A review of the *EPBC Act* threatened fauna list, DBCA's Threatened Fauna Database and Priority List, unpublished reports and scientific publications identified a number of specially protected, priority or migratory vertebrate fauna species as potentially occurring in the general vicinity of the subject site. Of these species, most that have no potential whatsoever to utilise the subject site for any purpose have been omitted from the potential list (Appendix B), principally due to lack of suitable habitat (including extent and/or quality) or known local extinction.

In summary, one vertebrate fauna species of conservation significance was positively identified as utilising the subject site for some purpose during the survey period, this being:

- *Calyptorhynchus banksii naso* Forest Red-tailed Black Cockatoo – S3 (*WC Act*), Vulnerable (*EPBC Act*)
  Some foraging evidence attributed to this species was found during field survey (chewed sheoak fruits and possibly chewed coastal blackbutt fruits). The small areas of remnant native vegetation containing jarrah, coastal blackbutt and sheoak within the subject site represents foraging habitat for this species. No actual nest sites were found however larger trees ($\geq$50cm DBH) can be considered potential breeding habitat. No evidence of roosting observed.

Based on the habitats present and current documented distributions it is considered possible that the following species of conservation significance may use the subject site for some purpose at times, though, as no conclusive evidence of any using the subject site at the time of the field survey was found, the status of some in the area remains uncertain.

- *Lerista lineata* Perth Lined Lerista – P3 (DBCA Priority Species)
  Habitat appears to be suitable for this species to persist and it has been recorded nearby (ENV 2009, Phoenix 2010). Known to inhabit gardens (Nevill 2005, Bush *et al.* 2010) so may persist in degraded areas and landscaped gardens subsequent to development.

- *Calyptorhynchus latirostris* Carnaby`s Black Cockatoo – S2 (*WC Act*), Endangered (*EPBC Act*)
  Some foraging evidence which could possibly be attributed to this species was found during field survey (chewed blackbutt fruits) but this could not be distinguished from the forest red-tailed black cockatoo which also feeds on the same fruits and leaves similar traces. The small areas of remnant native vegetation containing jarrah,

coastal blackbutt and banksia within the subject site represents foraging habitat for this species. No actual nest sites were found however larger native endemic trees (≥50cm DBH) can be considered potential breeding habitat. No evidence of roosting observed.

- *Calyptorhynchus baudinii* Baudin`s Black Cockatoo – S2 *(WC Act),* Endangered (*EPBC Act*)
  This species is only infrequently recorded on this section of the coastal plain. No evidence of this species utilising the subject site was observed. The small areas of remnant native vegetation containing *banksia* within the subject site represents foraging habitat for this species. No actual nest sites were found however larger native endemic trees (≥50cm DBH) can be considered potential breeding habitat. No evidence of roosting observed.

- *Isoodon fusciventer* Quenda – P4 (DBCA Priority Species)
  No evidence of this species being present was observed however the areas of paperbark containing dense undergrowth represent suitable habitat for this species and therefore it must be considered a potential species. Most of the subject site is however unsuitable for this species to use as habitat given it is almost totally cleared.

- *Falco peregrinus* Peregrine Falcon – S7 (*WC Act*)
  This species potentially utilises some sections of the subject site as part of a much larger home range. Uncommon across all of its range but may occur at least occasionally. The subject site appears not to contain any suitable nest sites for this species.

As previously indicated a number of other species of conservation significance, while possibly present in the wider area (e.g. larger bush remnants, forested areas of the nearby Darling Range), are not listed as potential species due to known localised extinction (and no subsequent recruitment from adjoining areas), lack of suitable habitat and/or the presence of feral predators. Details on conservation significant species and reasons for the omission of some from the potential listing are provided in Table 4.

Thirty five bird species that potentially frequent or occur in the subject site are noted as Bush Forever Decreaser Species in the Perth Metropolitan Region (six were sighted/identified as having used the within the subject site during the survey). Decreaser species are a significant issue in biodiversity conservation in the Perth section of the Swan Coastal Plain as there have been marked reductions in range and population levels of many sedentary bird species as a consequence of disturbance and land clearing (Dell & Hyder-Griffiths 2002).

6.3.3 Invertebrate Fauna of Conservation Significance

Six invertebrate species of conservation significance appeared in the DBCA or *EPBC Act* database searches (DBCA 2018b, DotEE 2018), these being an unnamed cricket (*Throscodectes xiphos*), the graceful sunmoth (*Synemon gratiosa*), three short tongued

native bees (*Leioproctus contrarius, Leioproctus douglasiellus* and *Neopasiphae simplicior*) and Carter's freshwater mussel (*Westralunio carteri*).

None of these species are considered likely to persist within the subject site either due to a total absence of suitable habitat or the presence of only small areas of generally degraded habitat (poor quality, limited extent and highly fragmented) considered unsuitable to support or maintain population/s of the species in question.

7. FAUNA VALUES

7.1 CONSERVATION SIGNIFICANCE OF THE SUBJECT SITE

The conservation significance of the subject site has been determined by applying site specific criteria such as:

- Fauna species and/or habitat present within the subject site that is poorly represented in the general vicinity;
- Fauna habitat within the subject site supporting species of conservation or other significance; and
- Fauna habitat within the subject site in better condition than other similar locations in the general vicinity.

The majority of the subject site is cleared (~72%) and as a consequence the diversity of fauna species has been significantly reduced from its original natural levels. Habitat degradation as a result of partial clearing, altered fire regimes and the presence of introduced predators is also likely to have had a significant effect on species diversity in the remnants that remain. Because of these factors most of the site has very little conservation significance to fauna in general. This is to a certain extent supported by the fact that none of the vegetation remaining on site was selected for inclusion in bush forever while some nearby remnants were (Government of Western Australia 2000a).

The site does have some value principally as foraging habitat for black cockatoos but the extent of this vegetation, relative to that present in nearby reserved/national park areas, is relatively small. Some of the larger remnants are also likely to provide habitat for of native fauna species of conservation significance (e.g. quenda) in a largely cleared landscape and the retention and ongoing management of these areas should be considered during development planning, though most are of a very small size and the high degree of fragmentation limits their long-term viability.

7.2 VALUE OF THE SUBJECT SITE AS AN ECOLOGICAL LINKAGE/WILDLIFE CORRIDOR

Wildlife or ecological corridors are considered to provide avenues for the movement of individuals and populations of both flora and fauna. An ecological corridor is defined as 'habitat that permits the movement of organisms between ecological isolates' and linkage with adjacent bushland areas is therefore a natural attribute of high priority in the assessment of any sites significance. These corridors can be important for the survival of species as they provide access to feeding and breeding locations as well as access to other populations and therefore to a wider gene pool (Newmark 1993).

Within Bush Forever Volume 1 (Figure 6 - Government of Western Australia 2000a) conceptual "greenway" corridors are shown. The subject site is not shown as forming part of any recognised greenway corridor though several are shown nearby running along road reserves or through bush forever sites which lie to the west and south.

More recent mapping (PBP 2007) also shows several regional ecological linkages (e.g. Link 47) passing near the subject site but not supporting it to any significant degree.

8. POTENTIAL IMPACTS AND DEVELOPMENT CONSIDERATIONS

8.1 POTENTIAL IMPACTS OF DEVELOPMENT

In general, the most significant impacts to fauna of any development include:

- Loss of vegetation/fauna habitat that may be used for foraging, breeding, roosting, or dispersal (includes loss of hollow bearing trees);
- Fragmentation of vegetation/fauna habitat which may restrict the movement of some fauna species;
- Modifications to surface hydrology, siltation of creek lines;
- Changes to fire regimes;
- Pollution (e.g. oil spills);
- Noise/light/dust;
- Spread of plant pathogens (e.g. dieback) and weeds;
- Potential increase in the number of predatory introduced species (e.g. cats);
- Death or injury of fauna during clearing and construction; and

- An increase in fauna road kills subsequent to development.

The exact extent of development within the subject site is not known at this stage. However, assuming that the area is developed for residential purposes in a similar fashion to nearby developments (e.g Piara Waters) it is expected that the majority of the remnant vegetation would be removed. Based on this assumption, possible impacts on specific species of conservation significance previously recorded in the general area is provided in the table below.

Table 4: Likelihood of Occurrence and Possible Impacts – Fauna Species of Conservation Significance (continues on following pages).

Common Name	Genus & Species	Conservation Status (See Appendix A for codes)	Habitat Present	Likelihood of Occurrence	Maximum Possible Impacts
Graceful Sun Moth	*Synemon gratiosa*	P4	No/Marginal	Unlikely to Occur.	No impact anticipated.
Unnamed Cricket	*Throscodectes xiphos*	P1	No/Marginal	Unlikely to Occur.	No impact anticipated.
Unnamed Bee	*Leioproctus contrarius*	P3	No/Marginal	Unlikely to Occur.	No impact anticipated.
Short-tongued Bee	*Neopasiphae simplicior*	S2, CR	No/Marginal	Unlikely to Occur.	No impact anticipated.
Unnamed Bee	*Leioproctus douglasiellus*	S2, CR	No/Marginal	Unlikely to Occur.	No impact anticipated.
Carter's Freshwater Mussel	*Westralunio carteri*	S3, VU	No	Would Not Occur.	No impact.
Perth Lined Lerista	*Lerista lineata*	P3	Yes/Marginal	Possibly Occurs.	Loss/modification of very small areas of degraded habitat. Significant impact not likely.
Darling Range Heath Ctenotus	*Ctenotus delli*	P4	No	Would Not Occur.	No impact.
Coastal Plains Skink	*Ctenotus ora*	P3	No/Marginal	Unlikely to Occur.	No impact anticipated.
Black-striped Snake	*Neelaps calonotos*	P3	No/Marginal	Unlikely to Occur.	No impact anticipated.
Southern Death Adder	*Acanthophis antarcticus*	P3	No	Would Not Occur.	No impact.
Malleefowl	*Leipoa ocellata*	S3, VU	No	Would Not Occur. - species locally extinct.	No Impact.
Australasian Bittern	*Botaurus poiciloptilus*	S2, EN	No/Marginal	Unlikely to Occur.	No impact anticipated.
Little Bittern	*Ixobrychus minutus*	P4	No/Marginal	Unlikely to Occur.	No impact anticipated.
Hooded Plover	*Charadrius rubricollis*	P4	No	Would Not Occur.	No impact.
Glossy Ibis	*Plegadis falcinellus*	S5, Mig	No/Marginal	Unlikely to Occur.	No impact anticipated.
Painted Snipe	*Rostratula benghalensis*	S2, Mig, EN	No	Would Not Occur.	No impact.

Common Name	Genus & Species	Conservation Status (See Appendix A for codes)	Habitat Present	Likelihood of Occurrence	Maximum Possible Impacts
Migratory Shorebirds/Wetland/Seabird Species	Various	S5, Mig, Various	No	Would Not Occur.	No impact.
Blue-billed Duck	*Oxyura australis*	P4	No/Marginal	Unlikely to Occur.	No impact anticipated.
Osprey	*Pandion haliaetus*	S5, Mig	No	Would Not Occur.	No impact.
Peregrine Falcon	*Falco peregrinus*	S7	Yes	Possible but only rarely.	Loss/modification of very small areas of degraded habitat. Significant impact not likely.
Masked Owl (SW population)	*Tyto n. novaehollandiae*	P3	No	Would Not Occur.	No impact.
Fork-tailed Swift	*Apus pacificus*	S5, Mig	Yes	Unlikely to Occur, Flyover only on very rare occasions.	No impact.
Grey Wagtail	*Motacilla cinerea*	S5, Mig	No	Would Not Occur.	No impact.
Carnaby`s Black Cockatoo	*Calyptorhynchus latirostris*	S2, EN	Yes	Possibly Occurs.	Loss/modification of small areas of habitat. Significant impact not likely.
Baudin`s Black Cockatoo	*Calyptorhynchus baudinii*	S2, EN	Yes/Marginal	Possibly occurs but only rarely.	Loss/modification of small areas of habitat. Significant impact not likely.
Forest Red-tailed Black Cockatoo	*Calyptorhynchus banksii naso*	S3, VU	Yes	Known to Occur.	Loss/modification of small areas of habitat. Significant impact not likely.
Chuditch	*Dasyurus geoffroii*	S3, VU	No	Would Not Occur. Locally extinct	No impact.
Quenda	*Isoodon fusciventer*	P4	Yes	Possibly Occurs.	Loss/modification of small areas of habitat. Potential for individuals to eb killed or injured during clearing.
Numbat	*Myrmecobius fasciatus*	S3, VU	No	Would Not Occur - species locally extinct.	No Impact.
Western Ringtail Possum	*Pseudocheirus occidentalis*	S1, CR	No	Would Not Occur - species locally extinct.	No Impact.
Quokka	*Setonix brachyurus*	S3, VU	No	Would Not Occur - species locally extinct.	No Impact.
Tammar	*Macropus eugenii derbianus*	P4	No	Would Not Occur - species locally extinct.	No Impact.
Western Brush Wallaby	*Macropus irma*	P4	No	Would Not Occur.	No impact.
Western False Pipistrelle	*Falsistrellus mackenziei*	P4	No	Unlikely to Occur.	No impact anticipated.
Water Rat	*Hydromys chrysogaster*	P4	No	Unlikely to Occur.	No impact anticipated.

8.2 CONSIDERATIONS FOR PLANNING AND DEVELOPMENT

With respect to vertebrate fauna in general, no significant impacts are anticipated as a consequence of development at the site. In cases where some impact is anticipated, the degree of the impact is only expected to be low and relates to the loss of small areas of habitat. As most species are common and widespread no overall change in their conservation status is anticipated, despite a possible localised reduction in habitat extent. There are substantial areas of similar habitat in nearby areas including some nature reserves/regional parks and most if, not all species likely to utilise the subject site will persist in these locations despite any future development.

The assessment does indicate that any considerations required during ongoing development planning would be limited to the presence of habitat used or potentially used by some threatened fauna species in particular those listed under the *EPBC Act*, namely the three species of black cockatoo.

The total number of "habitat" trees (181), most of which are planted non-endemic species and the quality and extent of what could be regarded as foraging habitat (~8.2 ha) is also relatively low compared to the likely quality and extent of remnant native vegetation within 12 km of the subject site (~11,500 ha).

With this in mind it is considered highly unlikely that impacts on black cockatoos that may occur as a result of development at any scale would be considered a "significant impact" as defined by the Commonwealth DotEE (DotE 2013).

While the retention of areas of vegetation potentially utilised by black cockatoos should be considered during the planning process, based on the assessment above it is not likely to represent a constraint to development.

This conclusion is primarily based on the fact that most of the subject site is totally cleared or almost totally cleared of natural vegetation and therefore don't contain significant areas of potential cockatoo habitat. Where some habitat is present it is limited in extent and patchy in distribution. Also, as previously indicated there are significant areas (~11,500 ha) of potential black cockatoo habitat with 12km of the subject site.

While some trees present within the subject site qualify as "potential breeding habitat" using DotEE criteria (Commonwealth of Australia 2012) the probability of any one tree actually developing hollows that would then be used by black cockatoos for breeding can be considered to be extremely low. The area is also unlikely to be considered of specific importance for the recovery of black cockatoos in the long term. For example the population growth of the Carnaby's black-cockatoo is primarily limited by factors associated with breeding, and consequently priority areas for the recovery of the species are currently focused on known breeding sites (Cale 2003).

9. CONCLUSION

The fauna assessment within the subject site was undertaken for the purposes of categorising the fauna assemblages and identifying fauna habitats present. A targeted assessment of black cockatoo habitat within the area was also carried out.

With respect to native vertebrate fauna, 9 mammals (includes eight bat species), 118 bird, 20 reptile, and nine frog species have previously been recorded in the general area, some of which have the potential to occur in or utilise sections of the subject site at times, a conclusion largely based on the presence of apparently suitable habitat.

Of the 156 native animals that are listed as potentially occurring in the area, four are considered to be endangered/vulnerable or in need of special protection under State and/or Commonwealth legislation, these being the three species of black cockatoo and the peregrine falcon. In addition, the Priority 4 quenda and Perth lined lerista may also occur, given the presence of some suitable habitat for both species.

With respect to vertebrate fauna in general, no significant impacts are anticipated as a consequence of development at the site taking place. In cases where some impact is anticipated, the degree of the impact is only expected to be low and relates to the loss of small areas of fragmented and largely degraded habitat. As most species are common and widespread no overall change in their conservation status is anticipated, despite a possible localised reduction in habitat extent.

Based on available information it is considered, at this stage, unlikely that impacts on black cockatoos (or any other *EPBC Act* listed threatened or migratory species) which may occur as a result of development within the subject site will be considered “significant impact” as defined by the Commonwealth DotEE (DotE 2013). The conclusions drawn with respect to this matter should be reviewed once development plans are finalised.

Subject to the proposal going forward it is recommended at that a fauna management plan be prepared for implementation during initial site works with the aim of minimising impacts on fauna and fauna habitat as much as reasonable and practicable in particular the quenda which is likely to be occupying much of the denser wetland vegetation.

.

10. REFERENCES

(not necessarily cited)

Allen, G.R., Midgley, S.H., Allen, M. (2003). Freshwater Fishes of Australia. Western Australian Museum, Perth, Western Australia.

Anstis, M. (2013). Tadpoles and Frogs of Australia. New Holland Publishers, Sydney.

Aplin, K.P. and Smith, L.A. (2001). Checklist of the frogs and reptiles of Western Australia, Records of the Western Australian Museum Supplement No. 63, 51-74.

ATA Environmental (2006). Vertebrate Fauna Assessment Brookdale Redevelopment Area. Unpublished report for the Armadale Redevelopment Authority.

Barrett, G., Silcocks, A., Barry, S., Cunningham, R. and Poulter, R. (2003). The New Atlas of Australian Birds. Royal Australasian Ornithologists Union, Victoria.

Bennett Environmental Consulting Pty Ltd (2011). Botanical Assessment of Selected Lots Along Warton Road, Armadale Road and Wright Road, Forrestdale. Unpublished report for the CoTerra Environment.

Bush, B., Maryan, B., Browne-Cooper, R. & Robinson, D. (2007). Reptiles and Frogs in the Bush: Southwestern Australia. UWA Press, Nedlands.

Bush, B., Maryan, B., Browne-Cooper, R. & Robinson, D. (2010). Reptiles and Frogs of the Perth Region. UWA Press, Nedlands.

Cale, B. (2003). Carnaby's Black Cockatoo (Calyptorhynchus latirostris) Recovery Plan 2002-2012. CALM, Wanneroo.

Christidis, L. and Boles, W.E. (2008). Systematics and Taxonomy of Australian Birds. CSIRO Publishing, Melbourne.

Cogger, H.G. (2014). Reptiles and Amphibians of Australia. 7th Edition. CSIRO Publishing.

Commonwealth of Australia (2012). EPBC Act Referral guidelines for three threatened black cockatoo species: Carnaby's cockatoo (endangered) *Calyptorhynchus latirostris*, Baudin's cockatoo (vulnerable) *Calyptorhynchus baudinii*, Forest red-tailed black cockatoo (vulnerable) *Calyptorhynchus banksii naso*.

Dell, J. (2000). A draft summary assessment of the fauna values of the Kemerton Bushland. Unpublished report for the Conservation Branch, Policy Division, Department of Environmental Protection.

Department of Biodiversity, Conservation and Attractions (DBCA) (2018a). Threatened and Priority Fauna Rankings. 15 February 2018.

Department of Biodiversity, Conservation and Attractions (DBCA) (2018b). NatureMap Database search. “By Circle" - 115° 54' 19" E, 32° 07' 44" S (plus 10km buffer), accessed 18/04/2018.

Department of Conservation and Land Management (CALM) (2005). Fauna Note No. 05/2005 Carnaby’s Cockatoo, Written by Tamra Chapman, Belinda Cale and Marion Massam. CALM, Wanneroo.

Department of Environment and Conservation (DEC) (2007a). Karrak-watch: A summary of information about the Forest red-tailed black cockatoo, http://www.dec.wa.gov.au/our-environment/science-and-research/animal-conservation-research/2384-karrak-watch-the-forest-red-tailed-black-cockatoo.html

Department of Environment and Conservation (DEC) (2007b). Forest Black Cockatoo (Baudin’s Cockatoo - *Calyptorhynchus baudinii)* and Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) Recovery Plan. DEC.

Department of Environment and Conservation (DEC) (2012a). Chuditch (*Dasyurus geoffroii*) Recovery Plan. Wildlife Management Program No. 54. Department of Environment and Conservation, Perth, Western Australia.

Department of Environment and Conservation (DEC) (2012b). Carnaby’s cockatoo (*Calyptorhynchus latirostris*) Recovery Plan. Department of Environment and Conservation, Perth, Western Australia.

Department of the Environment (DotE) (2013). Matters of National Environmental Significance. Significant Impact Guidelines 1.1, EPBC Act 1999.

Department of the Environment and Energy (DotEE) (2018). *EPBC Act* Protected Matters Report: Point Search -32.12921 115.90505 (1km Buffer) Available from: http://www.environment.gov.au. Accessed 26/05/2018.

ENV Australia (2005). Southern River Precinct 3 - Environmental Review. Unpublished report for the City of Gosnells.

EPA (2016). Technical Guidance – Terrestrial Vertebrate Fauna Surveys (replaces EPA (2004). Guidance for the Assessment of Environmental Factors No 56: Terrestrial Surveys for Environmental Impact Assessment, but not yet updated).

Glauret, L. (1961). A Handbook of the Lizards of Western Australia. Handbook 6, Western Australian Naturalists Club, Perth.

Government of Western Australia (1998). Perth Bushplan

Government of Western Australia (2000a). Bush Forever Volume 1. Policies, Principles and Processes. Department of Environmental Protection Perth, Western Australia.

Government of Western Australia (2000b). Bush Forever Volume 2. Directory of Bush Forever Sites. Department of Environmental Protection Perth, Western Australia.

Government of Western Australia (2018). Wildlife Conservation Act 1950. Wildlife Conservation (Specially Protected Fauna) Notice 2017. Government Gazette, WA. 16 January 2018.

Harvey, M.S., Dell, J. How R.A.., & Waldock, J.M. (1997). Ground Fauna of Bushland Remnants on the Ridge Hill Shelf and Pinjarra Plain Landforms, Perth. Report to the Australian Heritage Commission. NEP Grant N95/49. 56 pp.

Harvey, M. S. (2002). Short-range endemism among the Australian fauna: some examples from non-marine environments. Invertebrate Systematics 16: 555-570.

Harvey, M.S., Dell, J. How, R.A.., & Waldock, J.M. (1987). Ground Fauna of Bushland Remnants on the Ridge Hill Shelf and Pinjarra Plain Landforms, Perth. Report to the Australian Heritage Commission. NEP Grant N95/49. 56 pp.

Heddle, E.M., Loneragan, O.W. and Havel, J.J. (1980). Vegetation of the Darling System, In: Atlas of Natural Resources, Darling System, Western Australia Department of Conservation and Environment, Perth, Western Australia.

Higgins, P. J. (Ed.) (1999). Handbook of Australian, New Zealand and Antarctic Birds. Volume 4: Parrots to Dollarbird. Oxford University Press, Melbourne, Australia.

How, R.A (1995). Objection Assessment of Fauna Values for Perth Airport. Unpublished report for the Australian Heritage Commission.

How, R.A, Harvey, M.S., Dell J., & Waldock, J.M. (1996). Ground Fauna of Urban Bushland Remnants in Perth. Report to the Australian Heritage Commission. NEP Grant N93/04. 103 pp.

How, R., Cooper, N. K. and Bannister, J. L. (2001). Checklist of the mammals of Western Australia, Records of the Western Australian Museum Supplement No. 63, 91-98.

Jackson, S. & Groves, C. (2015). Taxonomy of Australian mammals. CSIRO Publishing.

Johnstone, R.E. (2001). Checklist of the birds of Western Australia, Records of the Western Australian Museum Supplement No. 63, 75-90.

Johnstone, R. E. (2008). Assessment of Potential Impact to Carnaby's Cockatoo and Baudin's Cockatoo for Southern Seawater Desalination Plant Binningup to Harvey. Prepared for URS Australia Pty Ltd.

Johnstone, R. E. & Kirkby, T. (2008). Distribution, status, social organisation, movements and conservation of Baudin's Cockatoo (*Calyptorhynchus baudinii*) in South-west Western Australia. Records of the WA Museum 25: 107-118 (2008).

Johnstone, R. E. & Kirkby, T. (2011). Carnaby's Cockatoo (*Calyptorhynchus latirostris*), Baudin's Cockatoo (*Calyptorhynchus baudinii*) and the Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) on the Swan Coastal Plain (Lancelin–Dunsborough), Western Australia. Studies on distribution, status, breeding, food, movements and historical changes. Report for the Department of Planning, Western Australia.

Johnstone R.E. & C, Kirkby, T. & Biota Environmental Sciences Pty Ltd (2006). Perth – Bunbury Highway (Kwinana Freeway Extension and Peel Deviation). Targeted Threatened Fauna Survey. Unpublished report for Main Roads Western Australia.

Johnstone, R.E. and Storr, G.M. (1998). Handbook of Western Australian Birds: Volume 1 – Non-passerines (Emu to Dollarbird). Western Australian Museum, Perth Western Australia.

Johnstone, R. E. and Storr, G.M. (2004). Handbook of Western Australian Birds: Volume 2 – Passerines (Blue-winged Pitta to Goldfinch). Western Australian Museum, Perth Western Australia.

Johnstone, R.E. & C (2004). Review of Baudin's Cockatoo and Forest Red-Tailed Black Cockatoo in South Western Australia with Special Reference to Collie Area – In Bluewater's Power Station PER May 2004 – Appendix C.

Menkhorst, P. and Knight, F. (2011). A Field Guide to the Mammals of Australia. Oxford University Press, Melbourne.

Morcombe, M. (2004). Field Guide to Australian Birds. Steve Parish Publishing, Archerfield, Queensland.

Morgan, D.L., Beatty, S.J., Klunzinger, M.W, Allen, M.G. and Burnham, Q.E (2011). Field Guide to the Freshwater Fishes, Crayfishes and Mussels of South Western Australia. Published by SERCUL.

Nevill, S. (ed) (2005). Guide to the Wildlife of the Perth Region. Simon Nevill Publications, Perth.

Newmark, W.D. (1993). The Role and Design of Wildlife Corridors with Examples from Tanzania., Ambio 22, 500-504.

Pizzey, G & Knight, F. (2012). The field guide to the birds of Australia. 9th Edition. Harper Collins, Sydney.

Simpson, K. and Day, N. (2010). Field Guide to the Birds of Australia. Penguin Books, Ringwood.

Storr, G.M., Smith, L.A. and Johnstone R.E. (1983). Lizards of Western Australia II: Dragons and Monitors. WA Museum, Perth.

Storr, G.M., Smith, L.A. and Johnstone R.E. (1990). Lizards of Western Australia III: Geckos and Pygopods. WA Museum, Perth.

Storr, G.M., Smith, L.A. and Johnstone R.E. (1999). Lizards of Western Australia I: Skinks. Revised Edition, WA Museum, Perth.

Storr, G.M., Smith, L.A. and Johnstone R.E. (2002). Snakes of Western Australia. Revised Edition, WA Museum, Perth.

Tyler M.J., Smith L.A. and Johnstone R.E. (2000). Frogs of Western Australia, Revised Edition, WA Museum, Perth.

Turpin, J. and Bamford, M. (2009). Keane Road Strategic Link Armadale, Fauna Assessment. Unpublished report for EnviroWorks Consulting.

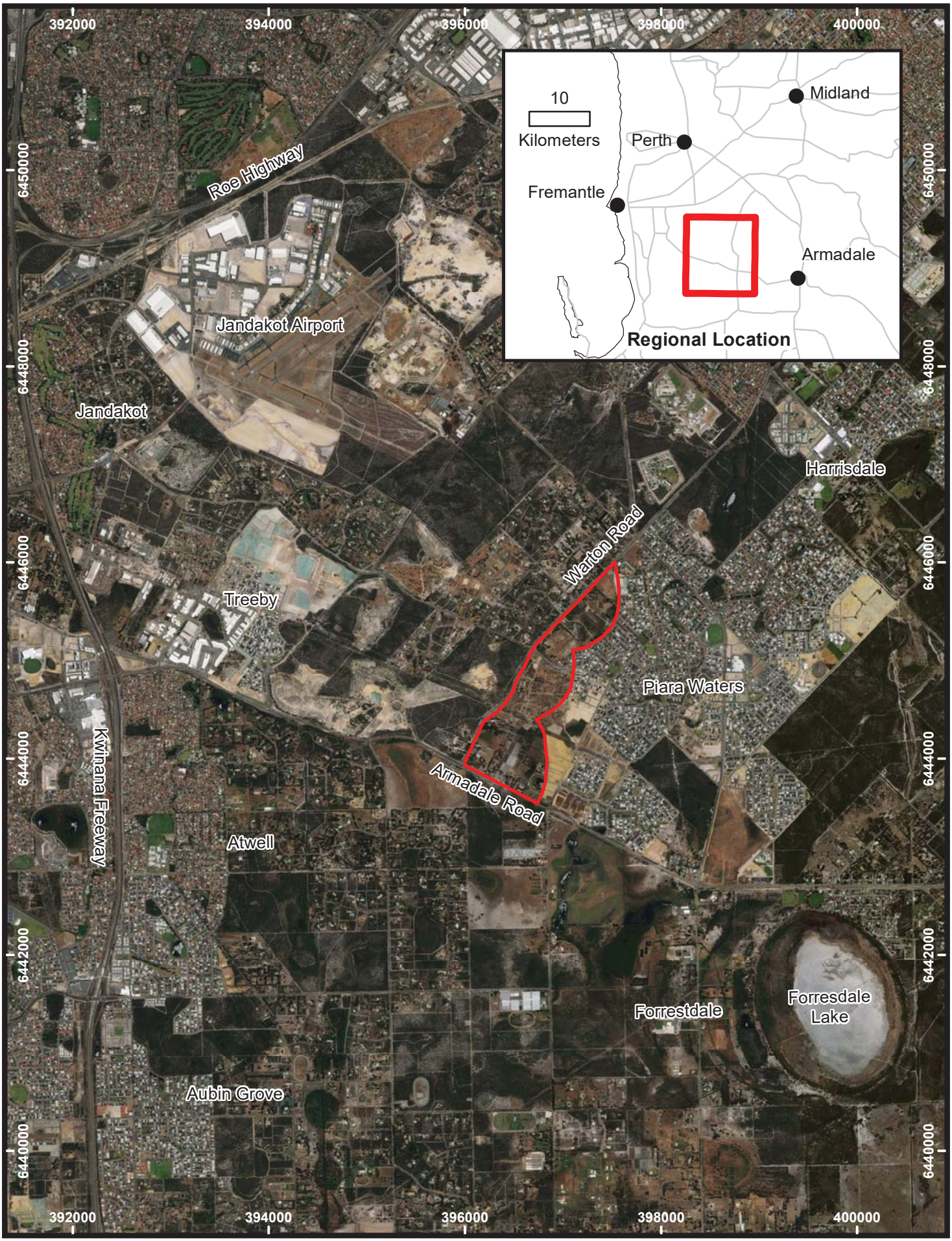
Van Dyck, S., Gynther, I. & Baker, A. Eds (2013). Field Companion to The Mammals of Australia. Queensland Museum.

Van Dyck, S. & Strahan, R. Eds (2008). The Mammals of Australia. Third edition Queensland Museum.

Wilson, S. and Swan, G. (2013). A Complete Guide to Reptiles of Australia. Reed, New Holland, Sydney.

Woinarski, J., Burbidge, A. & Harrison, P. (2014). The Action Plan for Australian Mammals 2012. CSIRO Publishing.

FIGURES



Legend

Subject Site Boundary

0 1 2

Kilometres

Fauna Survey

West Piara Waters
Piara Waters

Subject Site and Surrounds

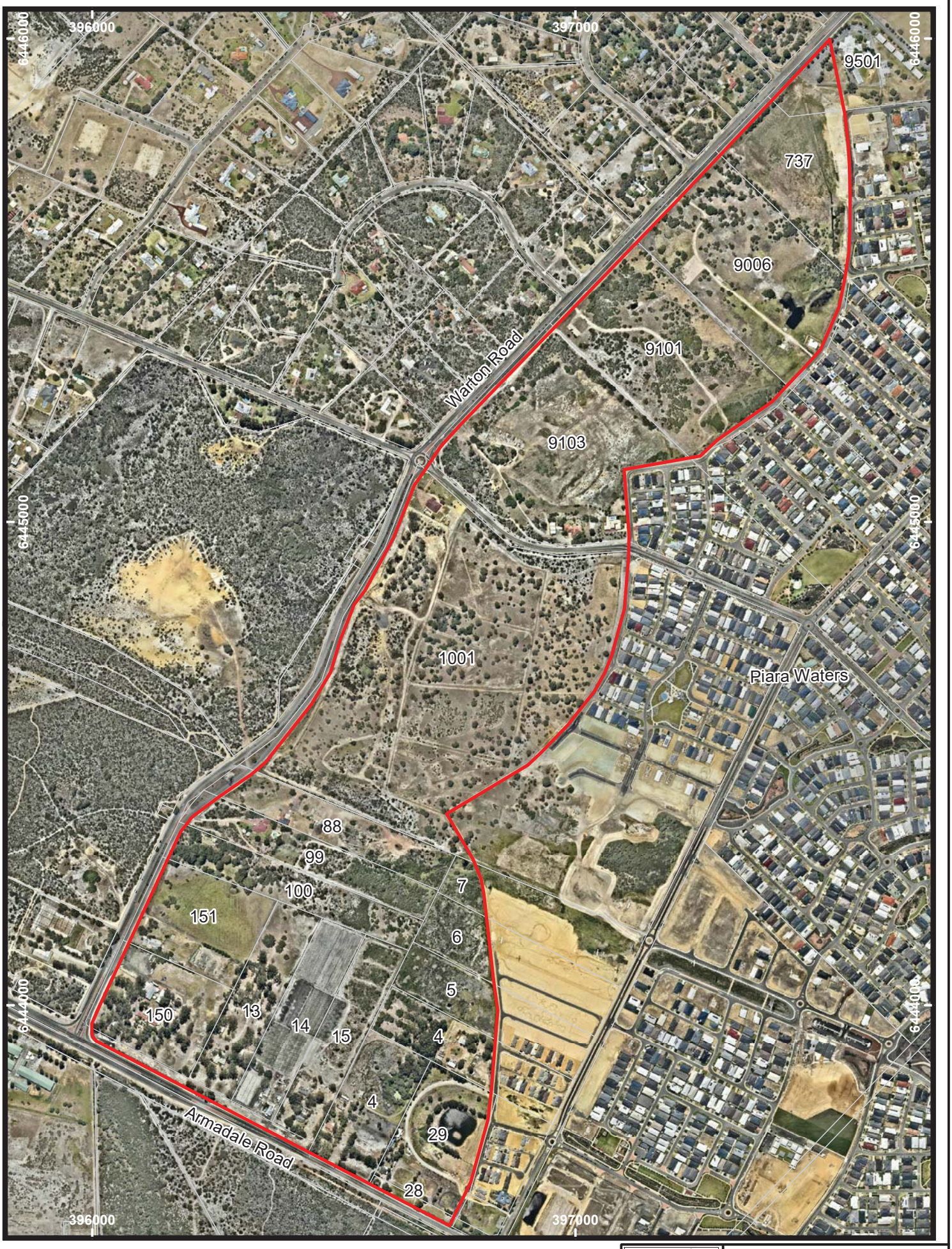
Drawn: G Harewood

Date: May 2018

Scale: 1:50,000

Projection/Coordinate System: UTM/MGA Zone 50

Figure: 1



Legend

Subject Site Boundary

0 100 200 300 400 500

Metres

Fauna Survey

Drawn: G Harewood

Date: May 2018

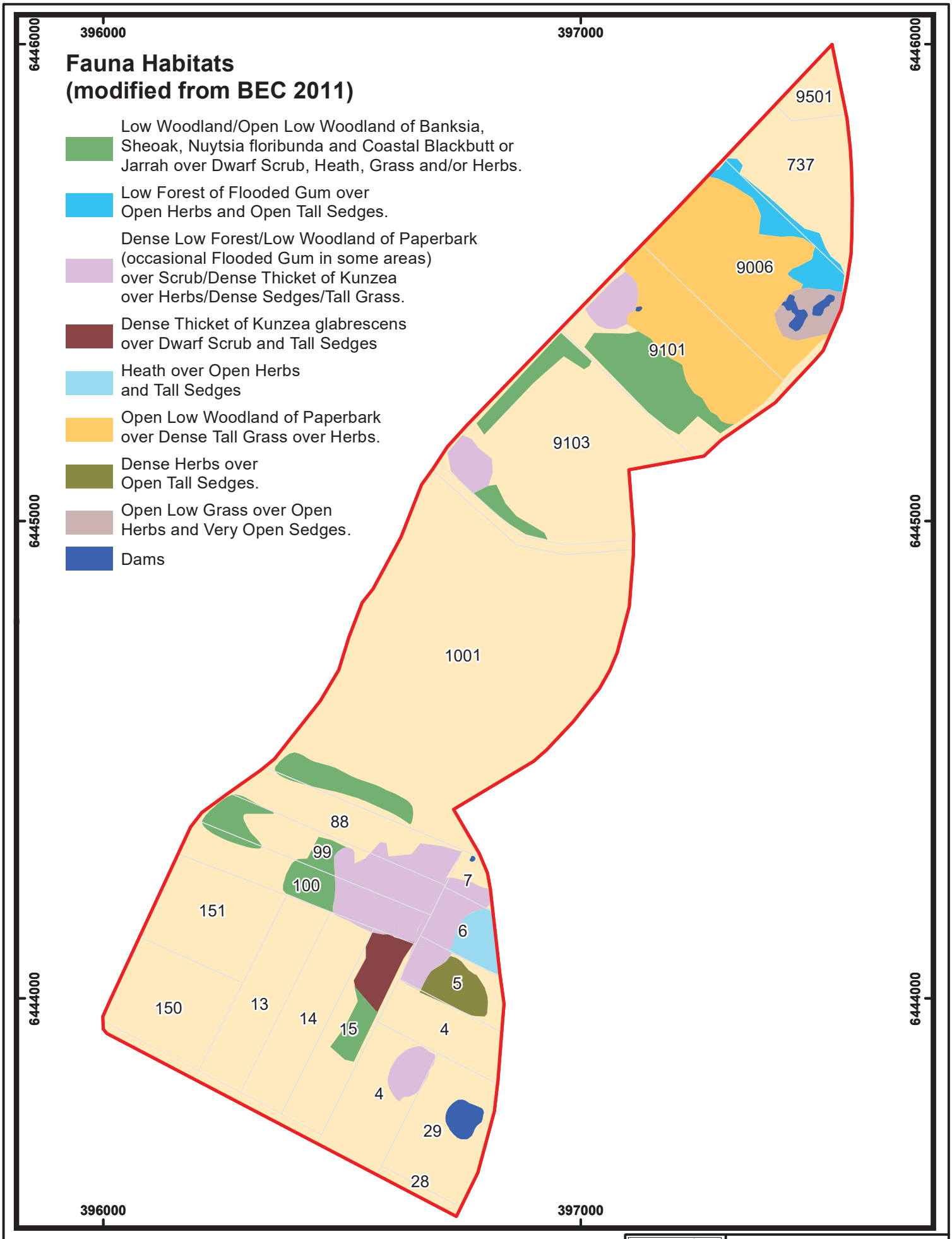
Scale: 1:10,000

Projection/Coordinate System: UTM/MGA Zone 50

West Piara Waters
Piar Waters

Subject Site Air Photo

Figure: 2



Legend

Subject Site Boundary

N

0 100 200 300 400 500

Metres

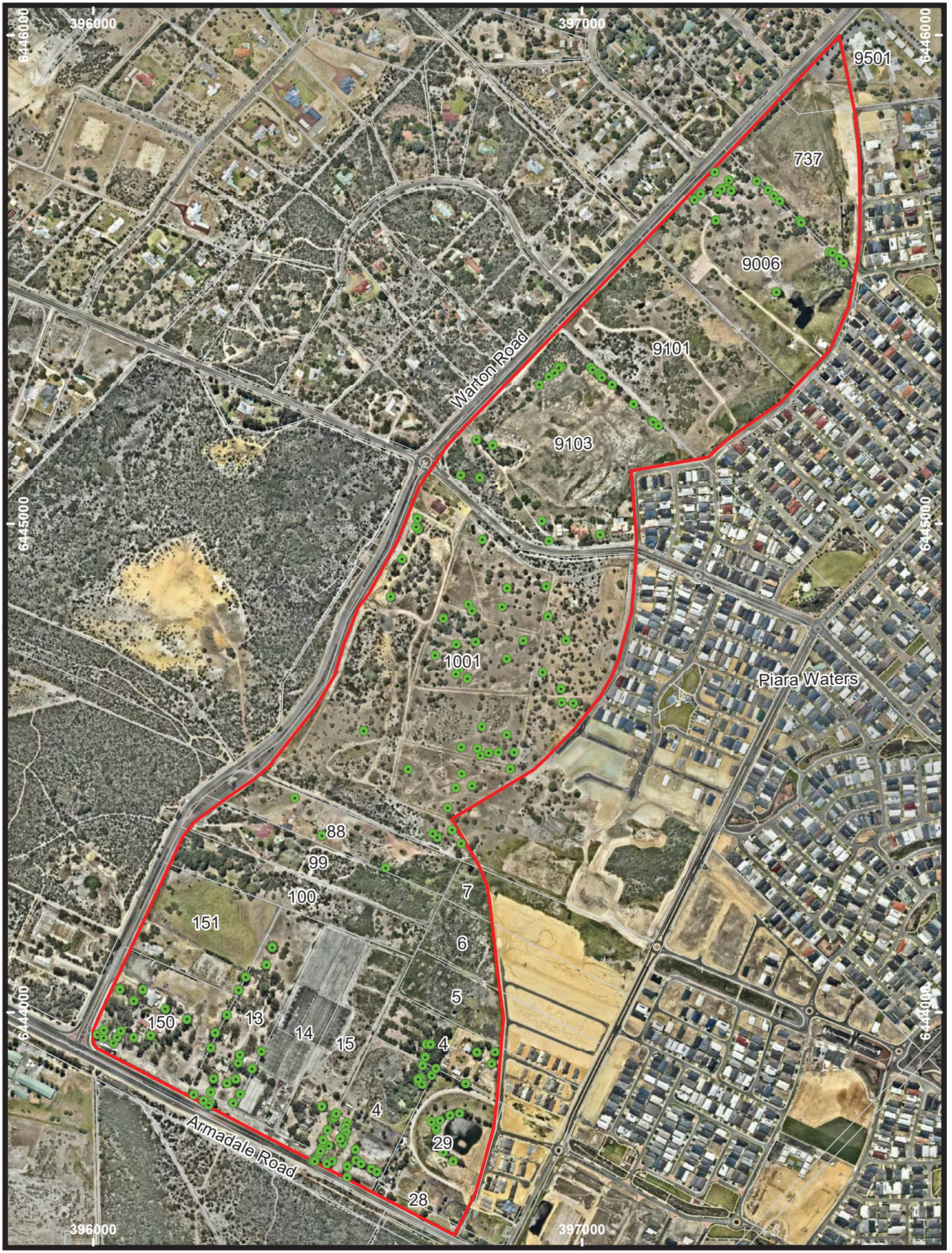
Fauna Survey

West Piar Waters
Piar Waters

Fauna Habitats

Drawn: G Harewood
Date: May 2018
Scale: 1:10,000
Projection/Coordinate System: UTM/MGA Zone 50

Figure: 3



Legend

- Subject Site Boundary
- Habitat Tree
  No hollows observed

0 100 200 300 400 500
Metres

Fauna Survey

West Piara Waters
Piar Waters

Habitat Trees (DBH >50cm)

Drawn: G Harewood	
Date: May 2018	
Scale: 1:10,000	
Projection/Coordinate System: UTM/MGA Zone 50	Figure: 4

APPENDIX A

CONSERVATION CATEGORIES

***EPBC Act (1999)* Threatened Fauna Categories**

Threatened fauna may be listed under Section 178 of the *Environment Protection and Biodiversity Conservation Act 1999* (*EPBC Act*) in any one of the following categories:

Category	Code	Description
Extinct	E	There is no reasonable doubt that the last member of the species has died.
*Extinct in the wild	EW	A species (a) is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or (b) has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
*Critically Endangered	CE	A species is facing an extremely high risk of extinction in the wild in the immediate future.
*Endangered	EN	A species: (a) is not critically endangered; and (b) is facing a very high risk of extinction in the wild in the near future.
*Vulnerable	VU	A species (a) is not critically endangered or endangered; and (b) is facing a high risk of extinction in the wild in the medium-term future.
Conservation Dependent	CD	A species is the focus of a specific conservation program the cessation of which would result in the species becoming vulnerable, endangered or critically endangered
*Migratory	Migratory	(a) all migratory species that are: (i) native species; and (ii) from time to time included in the appendices to the Bonn Convention; and (b) all migratory species from time to time included in annexes established under JAMBA, CAMBA and ROKAMBA; and (c) all native species from time to time identified in a list established under, or an instrument made under, an international agreement approved by the Minister.
Marine	Ma	Species in the list established under s248 of the *EPBC Act*

Note: Only species in those categories marked with an asterix are matters of national environmental significance (NES) under the *EPBC Act*.

Wildlife Conservation (Specially Protected Fauna) Notice 2017 Categories

Published as Specially Protected under the *Wildlife Conservation Act 1950*, and listed under Schedules 1 to 7 of the Wildlife Conservation (Specially Protected Fauna) Notice.

The assessment of the conservation status of these species is based on their national extent and ranked according to their level of threat using IUCN Red List categories and criteria as detailed below.

Category	Code	Description
Schedule 1 Critically Endangered species	CR	Threatened species considered to be facing an extremely high risk of extinction in the wild.
Schedule 2 Endangered species	EN	Threatened species considered to be facing a very high risk of extinction in the wild.
Schedule 3 Vulnerable species	VU	Threatened species considered to be facing a high risk of extinction in the wild.
Schedule 4 Presumed extinct species	EX	Species which have been adequately searched for and there is no reasonable doubt that the last individual has died.
Schedule 5 Migratory birds protected under an international agreement	IA	Birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and the Bonn Convention, relating to the protection of migratory birds.
Schedule 6 Fauna that is of special conservation need as conservation dependent fauna	CD	Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened.
Schedule 7 Other specially protected fauna.	OS	Fauna otherwise in need of special protection to ensure their conservation.

Western Australian DBCA Priority Fauna Categories

Possibly threatened species that do not meet survey criteria, or are otherwise data deficient, are added to the Priority Fauna under Priorities 1, 2 or 3. These three categories are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as threatened flora or fauna.

Species that are adequately known, are rare but not threatened, or meet criteria for near threatened, or that have been recently removed from the threatened species or other specially protected fauna lists for other than taxonomic reasons, are placed in Priority 4. These species require regular monitoring.

Assessment of Priority codes is based on the Western Australian distribution of the species, unless the distribution in WA is part of a contiguous population extending into adjacent States, as defined by the known spread of locations.

Category	Code	Description
Priority 1 Poorly Known Species.	P1	Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.
Priority 2 Poorly Known Species.	P2	Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.
Priority 3 Poorly Known Species.	P3	Species that are known from several locations and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.
Priority 4 Rare, Near Threatened and other species in need of monitoring.	P4	(a) Rare: Species 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 species are usually represented on conservation lands. (b) Near Threatened: Species that are considered to have been adequately surveyed and that are close to qualifying for Vulnerable, but are not listed as Conservation Dependent. (c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

*Species includes all taxa (plural of taxon - a classificatory group of any taxonomic rank, e.g. a family, genus, species or any infraspecific category i.e. subspecies or variety, or a distinct population).

IUCN Red List Threatened Species Categories

The *IUCN Red List of Threatened Species*™ is a checklist of taxa that have undergone an extinction risk assessment using the *IUCN Red List Categories and Criteria*.

Categories are summarized below.

Category	Code	Description
Extinct	EX	Taxa for which there is no reasonable doubt that the last individual has died.
Extinct in the Wild	EW	Taxa which is known only to survive in cultivation, in captivity or and as a naturalised population well outside its past range and it has not been recorded in known or expected habitat despite exhaustive survey over a time frame appropriate to its life cycle and form.
Critically Endangered	CR	Taxa facing an extremely high risk of extinction in the wild.
Endangered	EN	Taxa facing a very high risk of extinction in the wild.
Vulnerable	VU	Taxa facing a high risk of extinction in the wild.
Near Threatened	NT	Taxa which has been evaluated but does not qualify for CR, EN or VU now but is close to qualifying or likely to qualify in the near future.
Least Concern	LC	Taxa which has been evaluated but does not qualify for CR, EN, VU, or NT but is likely to qualify for NT in the near future.
Data Deficient	DD	Taxa for which there is inadequate information to make a direct or indirect assessment of its risk of extinction based on its distribution and/or population status.
Not Evaluated	NE	Taxa which has not been evaluated.

A full list of categories and their meanings are available at:

http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria

APPENDIX B

OBSERVED AND POTENTIAL VERTEBRATE FAUNA LISTING

Fauna Observed or Potentially in Subject Site

West Piara Waters - Forrestdale

Approximate centroid = 32.12921°S 115.90505°E

Compiled by Greg Harewood - May 2018
Recorded (Sighted/Heard/Signs/Captured) = X

A = Harewood, G. (2018). Fauna Assessment - West Piar Waters - Forresdale. Unpublished report for Coterra Environement.
B = Phoenix Environmental Sciences (2011). Vertebrate Fauna Survey for the Roe Highway Extension Project. Unpublished report for South Metro Connect.
C = ENV (2009). Jandakot Airport Fauna Survey. Unpublished report for Jandakot Airport Holdings Pty Ltd.
D = Turpin, J. and Bamford, M. (2009). Keane Road Strategic Link Armadale, Fauna Assessment. Unpublished report for the EnviroWorks Consulting.
E = ATA Environmental (2006). Vertebrate Fauna Assessment Brookdale Redevelopment Area. Unpublished report for the Armadale Redevelopment Authority.
F = ENV Australia (2005). Southern River Precinct 3 - Environmental Review. Unpublished report for the City of Gosnells.
G = DBCA (2018). NatureMap Database search. “By Circle” 115° 54' 19" E, 32° 07' 44" S – Subject Site (plus 10 km buffer). 18 April 2018.

Class **Family** *Species*	Common Name	Conservation Status	A	B	C	D	E	F	G
Amphibia									
Myobatrachidae Ground or Burrowing Frogs									
Crinia georgiana	Quacking Frog	LC		X	X		X		X
Crinia glauerti	Clicking Frog	LC		X			X	X	X
Crinia insignifera	Squelching Froglet	LC		X		X	X	X	X
Geocrinia leai	Ticking Frog	LC							X
Heleioporus eyrei	Moaning Frog	LC		X			X	X	X
Limnodynastes dorsalis	Western Banjo Frog	LC		X	X	X	X	X	X
Myobatrachus gouldii	Turtle Frog	LC		X					X

WC Act Status - S1 to S7, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, DBCA Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, Bush Forever Decreaser Species - Bh = habitat specialists, Bp = wide ranging species, Be = extinct in Perth Coastal Plain Region. IUCN Red List Category Definitions LC = Least Concern - see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others.

Class **Family** *Species*	Common Name	Conservation Status	A	B	C	D	E	F	G
Hylidae Tree or Water-Holding Frogs									
Litoria adelaidensis	Slender Tree Frog	LC		X	X	X	X	X	X
Litoria moorei	Motorbike Frog	LC		X			X	X	X
Reptilia									
Gekkonidae Geckoes									
Christinus marmoratus	Marbled Gecko			X			X		X
Pygopodidae Legless Lizards									
Aprasia repens	Sandplain Worm Lizard			X			X		X
Lialis burtonis	Burton’s Legless Lizard			X			X	X	X
Agamidae Dragon Lizards									
Pogona minor	Western Bearded Dragon			X	X			X	X

WC Act Status - S1 to S7, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, DBCA Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, Bush Forever Decreaser Species - Bh = habitat specialists, Bp = wide ranging species, Be = extinct in Perth Coastal Plain Region. IUCN Red List Category Definitions LC = Least Concern - see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others.

Class **Family** *Species*	Common Name	Conservation Status	A	B	C	D	E	F	G
Scincidae Skinks									
Acritoscincus trilineatum	Southwestern Cool Skink			X	X		X	X	
Cryptoblepharus buchananii	Fence Skink			X	X		X	X	X
Ctenotus australis	Western Ctenotus		X	X			X	X	X
Ctenotus fallens	West Coast Ctenotus			X					X
Ctenotus impar	Odd-striped Ctenotus								X
Egernia kingii	King's Skink								X
Egernia napoleonis	Salmon-bellied Skink			X					X
Hemiergis quadrilineata	Two-toed Mulch Skink			X	X				X
Lerista elegans	West Coast Four-toed Lerista			X	X		X	X	X
Lerista lineata	Perth Lined Lerista	P3		X					X
Menetia greyii	Dwarf Skink			X	X		X	X	X
Morethia lineoocellata	West Coast Pale-flecked Morethia			X			X		X
Tiliqua rugosa	Bobtail			X	X	X	X	X	X
Typhlopidae Blind Snakes									
Ramphotyphlops australis	Southern Blind Snake						X		

WC Act Status - S1 to S7, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, DBCA Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, Bush Forever Decreaser Species - Bh = habitat specialists, Bp = wide ranging species, Be = extinct in Perth Coastal Plain Region. IUCN Red List Category Definitions LC = Least Concern - see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others.

Class **Family** *Species*	Common Name	Conservation Status	A	B	C	D	E	F	G
Elapidae Elapid Snakes									
Notechis scutatus	Tiger Snake			X			X	X	X
Pseudonaja affinis	Dugite			X	X		X	X	X
Aves									
Phasianidae Quails, Pheasants									
Coturnix pectoralis	Stubble Quail	LC	X					X	X
Coturnix ypsilophora	Brown Quail	LC			X		X		X

WC Act Status - S1 to S7, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, DBCA Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, Bush Forever Decreaser Species - Bh = habitat specialists, Bp = wide ranging species, Be = extinct in Perth Coastal Plain Region. IUCN Red List Category Definitions LC = Least Concern - see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others.

Class **Family** *Species*	Common Name	Conservation Status	A	B	C	D	E	F	G
Anatidae Geese, Swans, Ducks									
Anas castanea	Chestnut Teal	LC		X					X
Anas gracilis	Grey Teal	LC		X			X	X	X
Anas platyrhynchos	Mallard	Introduced						X	X
Anas rhynchotis	Australasian Shoveler	Bh LC		X					X
Anas superciliosa	Pacific Black Duck	LC	X	X	X	X	X	X	X
Aythya australis	Hardhead	Bh LC							X
Biziura lobata	Musk Duck	Bh LC		X					X
Chenonetta jubata	Australian Wood Duck	LC				X	X	X	X
Cygnus atratus	Black Swan	LC		X					X
Malacorhynchus membranaceus	Pink-eared Duck	Bh LC		X					X
Tadorna tadornoides	Australian Shelduck	LC		X		X	X	X	X
Podicipedidae Grebes									
Poliocephalus poliocephalus	Hoary-headed Grebe	LC		X					X
Tachybaptus novaehollandiae	Australasian Grebe	LC	X						X

WC Act Status - S1 to S7, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, DBCA Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, Bush Forever Decreaser Species - Bh = habitat specialists, Bp = wide ranging species, Be = extinct in Perth Coastal Plain Region. IUCN Red List Category Definitions LC = Least Concern - see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others.

Class **Family** *Species*	Common Name	Conservation Status	A	B	C	D	E	F	G
Phalacrocoracidae Cormorants									
Phalacrocorax melanoleucos	Little Pied Cormorant	LC		X					X
Phalacrocorax sulcirostris	Little Black Cormorant	LC							X
Pelecanidae Pelicans									
Pelecanus conspicillatus	Australian Pelican	LC		X					X
Ardeidae Herons, Egrets, Bitterns									
Ardea alba	Great Egret	CA JA		X					
Ardea garzetta	Little Egret	LC							X
Ardea ibis	Cattle Egret	CA JA							X
Ardea novaehollandiae	White-faced Heron	LC	X	X			X	X	X
Ardea pacifica	White-necked Heron	LC					X	X	X
Nycticorax caledonicus	Rufous Night Heron	Bp LC		X					X
Threskiornithidae Iibises, Spoonbills									
Platalea flavipes	Yellow-billed Spoonbill	LC		X				X	X
Threskiornis molucca	Australian White Ibis	LC		X	X		X	X	
Threskiornis spinicollis	Straw-necked Ibis	LC	X	X	X	X		X	X

WC Act Status - S1 to S7, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, DBCA Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, Bush Forever Decreaser Species - Bh = habitat specialists, Bp = wide ranging species, Be = extinct in Perth Coastal Plain Region. IUCN Red List Category Definitions LC = Least Concern - see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others.

Class **Family** *Species*	Common Name	Conservation Status	A	B	C	D	E	F	G
Accipitridae Kites, Goshawks, Eagles, Harriers									
Accipiter cirrocephalus	Collared Sparrowhawk	Bp LC			X				X
Accipiter fasciatus	Brown Goshawk	Bp LC		X				X	X
Aquila audax	Wedge-tailed Eagle	Bp LC		X				X	X
Aquila morphnoides	Little Eagle	Bp LC			X				
Circus approximans	Swamp Harrier	LC		X					X
Circus assimilis	Spotted Harrier	LC							X
Elanus caeruleus	Black-shouldered Kite	LC		X	X			X	X
Haliastur sphenurus	Whistling Kite	Bp LC		X			X		X
Hamirostra isura	Square-tailed Kite	Bp LC							
Falconidae Falcons									
Falco berigora	Brown Falcon	Bp LC					X		X
Falco cenchroides	Australian Kestrel	LC	X	X	X	X	X	X	X
Falco longipennis	Australian Hobby	LC		X	X				X
Falco peregrinus	Peregrine Falcon	S7 Bp LC							X

WC Act Status - S1 to S7, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, DBCA Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, Bush Forever Decreaser Species - Bh = habitat specialists, Bp = wide ranging species, Be = extinct in Perth Coastal Plain Region. IUCN Red List Category Definitions LC = Least Concern - see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others.

Class **Family** *Species*	Common Name	Conservation Status	A	B	C	D	E	F	G
Rallidae Rails, Crakes, Swamphens, Coots									
Fulica atra	Eurasian Coot	LC		X					X
Gallinula tenebrosa	Dusky Moorhen	Bh LC		X					X
Gallinula ventralis	Black-tailed Native-hen	LC		X					
Gallirallus philippensis	Buff-banded Rail	LC							X
Porphyrio porphyrio	Purple Swamphen	LC	X	X					X
Turnicidae Button-quails									
Turnix varia	Painted Button-quail	Bp LC							
Recurvirostridae Stilts, Avocets									
Himantopus himantopus	Black-winged Stilt	LC		X					X
Charadriidae Lapwings, Plovers, Dotterels									
Charadrius melanops	Black-fronted Dotterel	LC	X	X					
Vanellus tricolor	Banded Lapwing	LC			X				X
Laridae Gulls, Terns									
Larus novaehollandiae	Silver Gull	LC		X					X

WC Act Status - S1 to S7, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, DBCA Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, Bush Forever Decreaser Species - Bh = habitat specialists, Bp = wide ranging species, Be = extinct in Perth Coastal Plain Region. IUCN Red List Category Definitions LC = Least Concern - see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others.

Class **Family** *Species*	Common Name	Conservation Status	A	B	C	D	E	F	G
Columbidae Pigeons, Doves									
Columba livia	Domestic Pigeon	Introduced		X				X	X
Ocyphaps lophotes	Crested Pigeon	LC	X	X	X	X	X	X	X
Phaps chalcoptera	Common Bronzewing	Bh LC	X		X	X	X	X	X
Streptopelia chinensis	Spotted Turtle-Dove	Introduced		X	X		X	X	X
Streptopelia senegalensis	Laughing Turtle-Dove	Introduced	X	X	X	X	X	X	X

WC Act Status - S1 to S7, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, DBCA Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, Bush Forever Decreaser Species - Bh = habitat specialists, Bp = wide ranging species, Be = extinct in Perth Coastal Plain Region. IUCN Red List Category Definitions LC = Least Concern - see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others.

Class **Family** *Species*	Common Name	Conservation Status	A	B	C	D	E	F	G
Psittacidae Parrots									
Cacatua roseicapilla	Galah	LC	X	X	X	X	X	X	X
Cacatua sanguinea	Little Corella	LC		X	X			X	X
Calyptorhynchus banksii naso	Forest Red-tailed Black-Cockatoo	S3 VU Bp LC	X	X	X		X	X	X
Calyptorhynchus baudinii	Baudin's Black-Cockatoo	S2 EN Bp EN A3cde							
Calyptorhynchus latirostris	Carnaby's Black-Cockatoo	S2 EN Bp EN A2bcde		X	X		X	X	X
Glossopsitta porphyrocephala	Purple-crowned Lorikeet	LC							
Neophema elegans	Elegant Parrot	LC		X			X		X
Platycercus icterotis icterotis	Western Rosella (western ssp)	Bp LC							X
Platycercus spurius	Red-capped Parrot	LC		X	X	X	X	X	X
Platycercus zonarius	Australian Ringneck	LC		X	X				X
Platycercus zonarius semitorquatus	Australian Ringneck Parrot	LC	X			X	X	X	
Polytelis anthopeplus	Regent Parrot	LC					X		X
Trichoglossus haematodus	Rainbow Lorikeet	Introduced	X	X	X	X	X	X	X

WC Act Status - S1 to S7, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, DBCA Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, Bush Forever Decreaser Species - Bh = habitat specialists, Bp = wide ranging species, Be = extinct in Perth Coastal Plain Region. IUCN Red List Category Definitions LC = Least Concern - see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others.

Class **Family** *Species*	Common Name	Conservation Status	A	B	C	D	E	F	G
Cuculidae Parasitic Cuckoos									
Cacomantis flabelliformis	Fan-tailed Cuckoo	LC			X		X		X
Chrysococcyx basalis	Horsfield's Bronze Cuckoo	LC			X	X	X	X	
Chrysococcyx lucidus	Shining Bronze Cuckoo	LC		X	X	X	X	X	X
Cuculus pallidus	Pallid Cuckoo	LC				X			
Strigidae Hawk Owls									
Ninox novaeseelandiae	Boobook Owl	LC		X			X		
Tytonidae Barn Owls									
Tyto alba	Barn Owl	LC					X		X
Podargidae Frogmouths									
Podargus strigoides	Tawny Frogmouth	LC					X		X
Caprimulgidae Nightjars									
Eurostopodus argus	Spotted Nightjar	LC							X
Aegothelidae Owlet-nightjars									
Aegotheles cristatus	Australian Owlet-nightjar	LC		X					X

WC Act Status - S1 to S7, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, DBCA Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, Bush Forever Decreaser Species - Bh = habitat specialists, Bp = wide ranging species, Be = extinct in Perth Coastal Plain Region. IUCN Red List Category Definitions LC = Least Concern - see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others.

Class **Family** *Species*	Common Name	Conservation Status	A	B	C	D	E	F	G
Halcyonidae Tree Kingfishers									
Dacelo novaeguineae	Laughing Kookaburra	Introduced		X			X	X	X
Todiramphus sanctus	Sacred Kingfisher	LC		X			X	X	X
Meropidae Bee-eaters									
Merops ornatus	Rainbow Bee-eater	JA LC		X			X	X	X
Maluridae Fairy Wrens, GrassWrens									
Malurus splendens	Splendid Fairy-wren	Bh LC	X	X	X	X	X	X	X
Acanthizidae Thornbills, Geryones, Fieldwrens & Whitefaces									
Acanthiza apicalis	Broad-tailed Thornbill	Bh LC	X	X		X	X	X	X
Acanthiza chrysorrhoa	Yellow-rumped Thornbill	Bh LC		X	X	X	X	X	X
Gerygone fusca	Western Gerygone	LC	X	X	X	X	X	X	X
Sericornis frontalis	White-browed Scrubwren	Bh LC		X		X	X	X	X
Smicrornis brevirostris	Weebill	Bh LC	X	X		X	X		X
Pardalotidae Pardalotes									
Pardalotus punctatus	Spotted Pardalote	LC		X					X
Pardalotus striatus	Striated Pardalote	LC		X	X		X	X	X

WC Act Status - S1 to S7, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, DBCA Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, Bush Forever Decreaser Species - Bh = habitat specialists, Bp = wide ranging species, Be = extinct in Perth Coastal Plain Region. IUCN Red List Category Definitions LC = Least Concern - see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others.

Class **Family** *Species*	Common Name	Conservation Status	A	B	C	D	E	F	G
Meliphagidae Honeyeaters, Chats									
Acanthorhynchus superciliosus	Western Spinebill	LC		X	X	X		X	X
Anthochaera carunculata	Red Wattlebird	LC	X	X	X	X	X	X	X
Anthochaera lunulata	Western Little Wattlebird	Bp LC		X	X	X	X	X	X
Epthianura albifrons	White-fronted Chat	LC			X				X
Lichenostomus virescens	Singing Honeyeater	LC	X	X	X	X	X	X	
Lichmera indistincta	Brown Honeyeater	LC	X	X	X	X	X	X	X
Manorina flavigula	Yellow-throated Miner	LC							X
Phylidonyris melanops	Tawny-crowned Honeyeater	Bp LC				X			
Phylidonyris nigra	White-cheeked Honeyeater	Bp LC		X	X	X		X	
Phylidonyris novaehollandiae	New Holland Honeyeater	Bp LC	X	X	X	X		X	X
Petroicidae Australian Robins									
Microeca fascinans	Jacky Winter	LC							X
Petroica multicolor	Scarlet Robin	Bh LC					X		
Neosittidae Sitellas									
Daphoenositta chrysoptera	Varied Sittella	Bh LC		X					X

WC Act Status - S1 to S7, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, DBCA Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, Bush Forever Decreaser Species - Bh = habitat specialists, Bp = wide ranging species, Be = extinct in Perth Coastal Plain Region. IUCN Red List Category Definitions LC = Least Concern - see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others.

Class **Family** *Species*	Common Name	Conservation Status	A	B	C	D	E	F	G
Pachycephalidae Crested Shrike-tit, Crested Bellbird, Shrike Thrushes, Whistlers									
Colluricincla harmonica	Grey Shrike-thrush	Bh LC		X	X	X	X	X	X
Pachycephala pectoralis	Golden Whistler	Bh LC			X	X			
Pachycephala rufiventris	Rufous Whistler	LC		X	X	X	X	X	X
Dicruridae Monarchs, Magpie Lark, Flycatchers, Fantails, Drongo									
Grallina cyanoleuca	Magpie-lark	LC	X	X	X	X	X	X	X
Rhipidura fuliginosa	Grey Fantail	LC	X	X		X	X	X	
Rhipidura leucophrys	Willie Wagtail	LC	X	X	X	X	X	X	X
Campephagidae Cuckoo-shrikes, Trillers									
Coracina novaehollandiae	Black-faced Cuckoo-shrike	LC		X	X	X	X	X	X
Lalage tricolor	White-winged Triller	LC					X	X	
Artamidae Woodswallows, Butcherbirds, Currawongs									
Artamus cinereus	Black-faced Woodswallow	Bp LC						X	X
Artamus cyanopterus	Dusky Woodswallow	Bp LC		X					X

WC Act Status - S1 to S7, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, DBCA Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, Bush Forever Decreaser Species - Bh = habitat specialists, Bp = wide ranging species, Be = extinct in Perth Coastal Plain Region. IUCN Red List Category Definitions LC = Least Concern - see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others.

Class **Family** *Species*	Common Name	Conservation Status	A	B	C	D	E	F	G
Cracticidae Currawongs, Magpies & Butcherbirds									
Cracticus tibicen	Australian Magpie	LC	X	X	X	X	X	X	X
Cracticus torquatus	Grey Butcherbird	LC	X	X	X	X	X	X	X
Corvidae Ravens, Crows									
Corvus coronoides	Australian Raven	LC	X	X	X	X	X	X	X
Motacillidae Old World Pipits, Wagtails									
Anthus australis	Australian Pipit	LC				X	X		
Dicaeidae Flowerpeckers									
Dicaeum hirundinaceum	Mistletoebird	LC					X		X
Hirundinidae Swallows, Martins									
Hirundo ariel	Fairy Martin	LC							
Hirundo neoxena	Welcome Swallow	LC		X			X	X	X
Hirundo nigricans	Tree Martin	LC		X	X	X	X	X	

WC Act Status - S1 to S7, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, DBCA Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, Bush Forever Decreaser Species - Bh = habitat specialists, Bp = wide ranging species, Be = extinct in Perth Coastal Plain Region. IUCN Red List Category Definitions LC = Least Concern - see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others.

Class **Family** *Species*	Common Name	Conservation Status	A	B	C	D	E	F	G
Sylviidae Old World Warblers									
Acrocephalus australis	Australian Reed Warbler	LC		X					X
Cincloramphus cruralis	Brown Songlark	LC							
Cincloramphus mathewsi	Rufous Songlark	LC							
Megalurus gramineus	Little Grassbird	LC							X
Zosteropidae White-eyes									
Zosterops lateralis	Silvereye	LC	X	X	X	X	X	X	X
Mammalia									
Peramelidae Bandicoots									
Isoodon fusciventer	Quenda	P4 LC		X	X	X	X	X	X
Molossidae Freetail Bats									
Austronomus australis	White-striped Freetail-bat	LC		X	X				
Ozimops kitcheneri	South Western Freetail Bat	LC		X					

WC Act Status - S1 to S7, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, DBCA Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, Bush Forever Decreaser Species - Bh = habitat specialists, Bp = wide ranging species, Be = extinct in Perth Coastal Plain Region. IUCN Red List Category Definitions LC = Least Concern - see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others.

Class **Family** *Species*	Common Name	Conservation Status	A	B	C	D	E	F	G
Vespertilionidae Ordinary Bats									
Chalinolobus gouldii	Gould's Wattled Bat	LC		X	X		X		X
Chalinolobus morio	Chocolate Wattled Bat	LC							
Nyctophilus geoffroyi	Lesser Long-eared Bat	LC		X			X		X
Nyctophilus gouldi	Gould's Long-eared Bat	LC							
Nyctophilus major major	Western Long-eared Bat	LC							
Vespadelus regulus	Southern Forest Bat	LC		X	X				X
Muridae Rats, Mice									
Mus musculus	House Mouse	Introduced		X	X		X	X	X
Rattus rattus	Black Rat	Introduced		X	X		X		X
Canidae Dogs, Foxes									
Canis lupus familiaris	Dog	Introduced				X	X		X
Vulpes vulpes	Red Fox	Introduced	X	X	X	X	X	X	X
Felidae Cats									
Felis catus	Cat	Introduced		X	X	X	X	X	X

WC Act Status - S1 to S7, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, DBCA Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, Bush Forever Decreaser Species - Bh = habitat specialists, Bp = wide ranging species, Be = extinct in Perth Coastal Plain Region. IUCN Red List Category Definitions LC = Least Concern - see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others.

Class **Family** *Species*	Common Name	Conservation Status	A	B	C	D	E	F	G
Equidae Horses									
Equus caballus	Horse	Introduced	X			X	X		
Leporidae Rabbits, Hares									
Oryctolagus cuniculus	Rabbit	Introduced	X	X	X	X	X	X	X

WC Act Status - S1 to S7, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, DBCA Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, Bush Forever Decreaser Species - Bh = habitat specialists, Bp = wide ranging species, Be = extinct in Perth Coastal Plain Region. IUCN Red List Category Definitions LC = Least Concern - see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others.

APPENDIX C

DBCA NATUREMAP & PROTECTED MATTERS SEARCH TOOL RESULTS

NatureMap
Mapping Western Australia's biodiversity

NatureMap - Piara Waters

Created By Greg Harewood on 18/04/2018

Kingdom	Animalia
Current Names Only	Yes
Core Datasets Only	Yes
Method	'By Circle'
Centre	115° 54' 19" E,32° 07' 44" S
Buffer	10km
Group By	Species Group

Species Group	Species	Records
Amphibian	11	922
Bird	243	63079
Fish	13	13
Invertebrate	115	643
Mammal	28	1512
Reptile	61	1815
TOTAL	**471**	**67984**

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
Amphibian					
1.	25398	*Crinia georgiana (Quacking Frog)*			
2.	25399	*Crinia glauerti (Clicking Frog)*			
3.	25400	*Crinia insignifera (Squelching Froglet)*			
4.	25404	*Geocrinia leai (Ticking Frog)*			
5.	25410	*Heleioporus eyrei (Moaning Frog)*			
6.	25412	*Heleioporus psammophilus (Sand Frog)*			
7.	25415	*Limnodynastes dorsalis (Western Banjo Frog)*			
8.	25378	*Litoria adelaidensis (Slender Tree Frog)*			
9.	25388	*Litoria moorei (Motorbike Frog)*			
10.	25420	*Myobatrachus gouldii (Turtle Frog)*			
11.	25433	*Pseudophryne guentheri (Crawling Toadlet)*			
Bird					
12.	24260	*Acanthiza apicalis (Broad-tailed Thornbill, Inland Thornbill)*			
13.	24261	*Acanthiza chrysorrhoa (Yellow-rumped Thornbill)*			
14.	24262	*Acanthiza inornata (Western Thornbill)*			
15.	24560	*Acanthorhynchus superciliosus (Western Spinebill)*			
16.	25535	*Accipiter cirrocephalus (Collared Sparrowhawk)*			
17.	24281	*Accipiter cirrocephalus subsp. cirrocephalus (Collared Sparrowhawk)*			
18.	25536	*Accipiter fasciatus (Brown Goshawk)*			
19.	24283	*Accipiter fasciatus subsp. didimus (Brown Goshawk)*			
20.	24282	*Accipiter fasciatus subsp. fasciatus (Brown Goshawk)*			
21.	25755	*Acrocephalus australis (Australian Reed Warbler)*			
22.	24831	*Acrocephalus australis subsp. gouldi (Australian Reed Warbler)*			
23.	41323	*Actitis hypoleucos (Common Sandpiper)*		IA	
24.	25544	*Aegotheles cristatus (Australian Owlet-nightjar)*			
25.	24301	*Aegotheles cristatus subsp. cristatus (Australian Owlet-nightjar)*			
26.	24310	*Anas castanea (Chestnut Teal)*			
27.	24312	*Anas gracilis (Grey Teal)*			
28.	24313	*Anas platyrhynchos (Mallard)*			
29.	24315	*Anas rhynchotis (Australasian Shoveler)*			
30.	24316	*Anas superciliosa (Pacific Black Duck)*			
31.	47414	*Anhinga novaehollandiae (Australasian Darter)*			
32.		*Anser anser*			
33.	24561	*Anthochaera carunculata (Red Wattlebird)*			
34.	24562	*Anthochaera lunulata (Western Little Wattlebird)*			
35.	25554	*Apus pacificus (Fork-tailed Swift, Pacific Swift)*		IA	
36.	24285	*Aquila audax (Wedge-tailed Eagle)*			
37.	24337	*Ardea garzetta subsp. nigripes (Little Egret)*			
38.	25558	*Ardea ibis (Cattle Egret)*		IA	
39.	41324	*Ardea modesta (great egret, white egret)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
				IA	
40.	24340	*Ardea novaehollandiae (White-faced Heron)*			
41.	24341	*Ardea pacifica (White-necked Heron)*			
42.	25736	*Arenaria interpres (Ruddy Turnstone)*		IA	
43.	25566	*Artamus cinereus (Black-faced Woodswallow)*			
44.	24352	*Artamus cinereus subsp. melanops (Black-faced Woodswallow)*			
45.	24353	*Artamus cyanopterus (Dusky Woodswallow)*			
46.		*Artamus sordidus*			
47.	24318	*Aythya australis (Hardhead)*			
48.		*Barnardius zonarius*			
49.	24319	*Biziura lobata (Musk Duck)*			
50.	24345	*Botaurus poiciloptilus (Australasian Bittern)*		T	
51.	24359	*Burhinus grallarius (Bush Stone-curlew)*			
52.	25713	*Cacatua galerita (Sulphur-crested Cockatoo)*			
53.	25714	*Cacatua pastinator (Western Long-billed Corella)*			
54.	25715	*Cacatua roseicapilla (Galah)*			
55.	25716	*Cacatua sanguinea (Little Corella)*			
56.	24729	*Cacatua tenuirostris (Eastern Long-billed Corella)*	Y		
57.	25598	*Cacomantis flabelliformis (Fan-tailed Cuckoo)*			
58.	24427	*Cacomantis flabelliformis subsp. flabelliformis (Fan-tailed Cuckoo)*			
59.	42307	*Cacomantis pallidus (Pallid Cuckoo)*			
60.	24779	*Calidris acuminata (Sharp-tailed Sandpiper)*		IA	
61.	24784	*Calidris ferruginea (Curlew Sandpiper)*		T	
62.	24786	*Calidris melanotos (Pectoral Sandpiper)*		IA	
63.	24788	*Calidris ruficollis (Red-necked Stint)*		IA	
64.	24789	*Calidris subminuta (Long-toed Stint)*		IA	
65.	25717	*Calyptorhynchus banksii (Red-tailed Black-Cockatoo)*			
66.	24731	*Calyptorhynchus banksii subsp. naso (Forest Red-tailed Black-Cockatoo)*		T	
67.	24734	*Calyptorhynchus latirostris (Carnaby's Cockatoo (short-billed black-cockatoo), Carnaby's Cockatoo)*		T	
68.	48400	*Calyptorhynchus sp. (white-tailed black cockatoo)*		T	
69.	25574	*Charadrius dubius (Little Ringed Plover)*		IA	
70.	25575	*Charadrius leschenaultii (Greater Sand Plover)*		IA	
71.	24377	*Charadrius ruficapillus (Red-capped Plover)*			
72.	24321	*Chenonetta jubata (Australian Wood Duck, Wood Duck)*			
73.	47909	*Cheramoeca leucosterna (White-backed Swallow)*			
74.	41332	*Chlidonias leucopterus (White-winged Black Tern)*		IA	
75.		*Chroicocephalus novaehollandiae*			
76.	25601	*Chrysococcyx lucidus (Shining Bronze Cuckoo)*			
77.	24432	*Chrysococcyx lucidus subsp. plagosus (Shining Bronze Cuckoo)*			
78.	24288	*Circus approximans (Swamp Harrier)*			
79.	24289	*Circus assimilis (Spotted Harrier)*			
80.	24774	*Cladorhynchus leucocephalus (Banded Stilt)*			
81.	25675	*Colluricincla harmonica (Grey Shrike-thrush)*			
82.	24399	*Columba livia (Domestic Pigeon)*	Y		
83.	25568	*Coracina novaehollandiae (Black-faced Cuckoo-shrike)*			
84.	24362	*Coracina novaehollandiae subsp. novaehollandiae (Black-faced Cuckoo-shrike)*			
85.	24363	*Coracina novaehollandiae subsp. subpallida (Black-faced Cuckoo-shrike)*			
86.	24416	*Corvus bennetti (Little Crow)*			
87.	25592	*Corvus coronoides (Australian Raven)*			
88.	24417	*Corvus coronoides subsp. perplexus (Australian Raven)*			
89.	24671	*Coturnix pectoralis (Stubble Quail)*			
90.	25701	*Coturnix ypsilophora (Brown Quail)*			
91.	24673	*Coturnix ypsilophora subsp. australis (Brown Quail)*			
92.	24420	*Cracticus nigrogularis (Pied Butcherbird)*			
93.	25595	*Cracticus tibicen (Australian Magpie)*			
94.	24422	*Cracticus tibicen subsp. dorsalis (White-backed Magpie)*			
95.	24423	*Cracticus tibicen subsp. tibicen (Black-backed Magpie)*			
96.	25596	*Cracticus torquatus (Grey Butcherbird)*			
97.	24424	*Cracticus torquatus subsp. torquatus (Grey Butcherbird)*			
98.	24322	*Cygnus atratus (Black Swan)*			
99.	30901	*Dacelo novaeguineae (Laughing Kookaburra)*	Y		
100.	25673	*Daphoenositta chrysoptera (Varied Sittella)*			
101.	25607	*Dicaeum hirundinaceum (Mistletoebird)*			
102.		*Egretta garzetta*			
103.		*Egretta novaehollandiae*			
104.		*Elanus axillaris*			
105.	25540	*Elanus caeruleus (Black-shouldered Kite)*			
106.	24290	*Elanus caeruleus subsp. axillaris (Australian Black-shouldered Kite)*			
107.	47937	*Elseyornis melanops (Black-fronted Dotterel)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
108.		*Eolophus roseicapillus*			
109.	24652	*Eopsaltria georgiana (White-breasted Robin)*			
110.	24567	*Epthianura albifrons (White-fronted Chat)*			
111.	24379	*Erythrogonys cinctus (Red-kneed Dotterel)*			
112.	24368	*Eurostopodus argus (Spotted Nightjar)*			
113.	25621	*Falco berigora (Brown Falcon)*			
114.	25622	*Falco cenchroides (Australian Kestrel, Nankeen Kestrel)*			
115.	24472	*Falco cenchroides subsp. cenchroides (Australian Kestrel, Nankeen Kestrel)*			
116.	25623	*Falco longipennis (Australian Hobby)*			
117.	24474	*Falco longipennis subsp. longipennis (Australian Hobby)*			
118.	25624	*Falco peregrinus (Peregrine Falcon)*		S	
119.	24475	*Falco peregrinus subsp. macropus (Australian Peregrine Falcon)*		S	
120.	25727	*Fulica atra (Eurasian Coot)*			
121.	24761	*Fulica atra subsp. australis (Eurasian Coot)*			
122.	25729	*Gallinula tenebrosa (Dusky Moorhen)*			
123.	24763	*Gallinula tenebrosa subsp. tenebrosa (Dusky Moorhen)*			
124.	25730	*Gallirallus philippensis (Buff-banded Rail)*			
125.		*Gallus gallus*			
126.	47954	*Gelochelidon nilotica (Gull-billed Tern)*		IA	
127.	25530	*Gerygone fusca (Western Gerygone)*			
128.	24271	*Gerygone fusca subsp. fusca (Western Gerygone)*			
129.	47962	*Glyciphila melanops (Tawny-crowned Honeyeater)*			
130.	24443	*Grallina cyanoleuca (Magpie-lark)*			
131.	24293	*Haliaeetus leucogaster (White-bellied Sea-Eagle)*			
132.	24295	*Haliastur sphenurus (Whistling Kite)*			
133.	47965	*Hieraaetus morphnoides (Little Eagle)*			
134.	25734	*Himantopus himantopus (Black-winged Stilt)*			
135.	24775	*Himantopus himantopus subsp. leucocephalus (Black-winged Stilt)*			
136.	24491	*Hirundo neoxena (Welcome Swallow)*			
137.		*Hydroprogne caspia*			
138.	47975	*Ixobrychus dubius (Australian Little Bittern)*		P4	
139.	25637	*Larus novaehollandiae (Silver Gull)*			
140.	24511	*Larus novaehollandiae subsp. novaehollandiae (Silver Gull)*			
141.	25661	*Lichmera indistincta (Brown Honeyeater)*			
142.	24582	*Lichmera indistincta subsp. indistincta (Brown Honeyeater)*			
143.	25741	*Limosa limosa (Black-tailed Godwit)*		IA	
144.	25683	*Lonchura castaneothorax (Chestnut-breasted Mannikin)*			
145.		*Lophoictinia isura*			
146.	24326	*Malacorhynchus membranaceus (Pink-eared Duck)*			
147.	25650	*Malurus elegans (Red-winged Fairy-wren)*			
148.	25651	*Malurus lamberti (Variegated Fairy-wren)*			
149.	25652	*Malurus leucopterus (White-winged Fairy-wren)*			
150.	25654	*Malurus splendens (Splendid Fairy-wren)*			
151.	24583	*Manorina flavigula (Yellow-throated Miner)*			
152.	25758	*Megalurus gramineus (Little Grassbird)*			
153.	47997	*Melanodryas cucullata (Hooded Robin)*			
154.	25663	*Melithreptus brevirostris (Brown-headed Honeyeater)*			
155.	24587	*Melithreptus chloropsis (Western White-naped Honeyeater)*			
156.	24736	*Melopsittacus undulatus (Budgerigar)*			
157.	24598	*Merops ornatus (Rainbow Bee-eater)*		IA	
158.		*Microcarbo melanoleucos*			
159.	25693	*Microeca fascinans (Jacky Winter)*			
160.	25542	*Milvus migrans (Black Kite)*			
161.	25610	*Myiagra inquieta (Restless Flycatcher)*			
162.	24738	*Neophema elegans (Elegant Parrot)*			
163.	25747	*Ninox connivens (Barking Owl)*			
164.	25564	*Nycticorax caledonicus (Rufous Night Heron)*			
165.	24742	*Nymphicus hollandicus (Cockatiel)*			
166.	24407	*Ocyphaps lophotes (Crested Pigeon)*			
167.	24328	*Oxyura australis (Blue-billed Duck)*		P4	
168.	25680	*Pachycephala rufiventris (Rufous Whistler)*			
169.	24624	*Pachycephala rufiventris subsp. rufiventris (Rufous Whistler)*			
170.		*Pandion cristatus*			
171.	25543	*Pandion haliaetus (Osprey)*		IA	
172.	24299	*Pandion haliaetus subsp. cristatus (Osprey)*		IA	
173.	25681	*Pardalotus punctatus (Spotted Pardalote)*			
174.	24625	*Pardalotus punctatus subsp. punctatus (Spotted Pardalote)*			
175.	25682	*Pardalotus striatus (Striated Pardalote)*			
176.	24628	*Pardalotus striatus subsp. murchisoni (Striated Pardalote)*			
177.	24630	*Pardalotus striatus subsp. westraliensis (Striated Pardalote)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
178.	24648	*Pelecanus conspicillatus (Australian Pelican)*			
179.	48060	*Petrochelidon ariel (Fairy Martin)*			
180.	48061	*Petrochelidon nigricans (Tree Martin)*			
181.	48066	*Petroica boodang (Scarlet Robin)*			
182.	24659	*Petroica goodenovii (Red-capped Robin)*			
183.	24663	*Phaethon rubricauda (Red-tailed Tropicbird)*		P4	
184.	25697	*Phalacrocorax carbo (Great Cormorant)*			
185.	24665	*Phalacrocorax fuscescens (Black-faced Cormorant)*			
186.	25698	*Phalacrocorax melanoleucos (Little Pied Cormorant)*			
187.	24667	*Phalacrocorax sulcirostris (Little Black Cormorant)*			
188.	25699	*Phalacrocorax varius (Pied Cormorant)*			
189.	24409	*Phaps chalcoptera (Common Bronzewing)*			
190.	25587	*Phaps elegans (Brush Bronzewing)*			
191.	48071	*Phylidonyris niger (White-cheeked Honeyeater)*			
192.	24596	*Phylidonyris novaehollandiae (New Holland Honeyeater)*			
193.	24841	*Platalea flavipes (Yellow-billed Spoonbill)*			
194.	24842	*Platalea regia (Royal Spoonbill)*			
195.	25720	*Platycercus icterotis (Western Rosella)*			
196.	24747	*Platycercus spurius (Red-capped Parrot)*			
197.	25721	*Platycercus zonarius (Australian Ringneck, Ring-necked Parrot)*			
198.	24750	*Platycercus zonarius subsp. semitorquatus (Twenty-eight Parrot)*			
199.	24843	*Plegadis falcinellus (Glossy Ibis)*		IA	
200.	24382	*Pluvialis fulva (Pacific Golden Plover)*		IA	
201.	24383	*Pluvialis squatarola (Grey Plover)*		IA	
202.	25703	*Podargus strigoides (Tawny Frogmouth)*			
203.	24679	*Podargus strigoides subsp. brachypterus (Tawny Frogmouth)*			
204.	25704	*Podiceps cristatus (Great Crested Grebe)*			
205.	24681	*Poliocephalus poliocephalus (Hoary-headed Grebe)*			
206.	25722	*Polytelis anthopeplus (Regent Parrot)*			
207.	25731	*Porphyrio porphyrio (Purple Swamphen)*			
208.	24767	*Porphyrio porphyrio subsp. bellus (Purple Swamphen)*			
209.	24769	*Porzana fluminea (Australian Spotted Crake)*			
210.	25732	*Porzana pusilla (Baillon's Crake)*			
211.	24770	*Porzana pusilla subsp. palustris (Baillon's Crake)*			
212.	24771	*Porzana tabuensis (Spotless Crake)*			
213.	48085	*Psittacula krameri (Indian Ringnecked Parrot, Rose-ringed Parakeet)*	Y		
214.	24702	*Pterodroma brevirostris (Kerguelen Petrel)*			
215.	24711	*Puffinus assimilis subsp. assimilis (Little Shearwater)*			
216.		*Purpureicephalus spurius*			
217.	24776	*Recurvirostra novaehollandiae (Red-necked Avocet)*			
218.	48096	*Rhipidura albiscapa (Grey Fantail)*			
219.	25614	*Rhipidura leucophrys (Willie Wagtail)*			
220.	24454	*Rhipidura leucophrys subsp. leucophrys (Willie Wagtail)*			
221.	48237	*Rostratula australis (Australian Painted Snipe)*		T	
222.	25534	*Sericornis frontalis (White-browed Scrubwren)*			
223.	24279	*Sericornis frontalis subsp. maculatus (White-browed Scrubwren)*			
224.	30948	*Smicrornis brevirostris (Weebill)*			
225.	24645	*Stagonopleura oculata (Red-eared Firetail)*			
226.	24516	*Stercorarius longicaudus (long-tailed jaeger, long-tailed skua)*		IA	
227.	24528	*Sterna hybrida subsp. javanica (Whiskered Tern)*			
228.	24329	*Stictonetta naevosa (Freckled Duck)*			
229.	25597	*Strepera versicolor (Grey Currawong)*			
230.	24426	*Strepera versicolor subsp. plumbea (Grey Currawong)*			
231.	25589	*Streptopelia chinensis (Spotted Turtle-Dove)*	Y		
232.	30951	*Streptopelia chinensis subsp. tigrina (Spotted Turtle-Dove)*	Y		
233.	25590	*Streptopelia senegalensis (Laughing Turtle-Dove)*	Y		
234.	30950	*Streptopelia senegalensis subsp. senegalensis (Laughing Turtle-Dove)*	Y		
235.	25705	*Tachybaptus novaehollandiae (Australasian Grebe, Black-throated Grebe)*			
236.	24682	*Tachybaptus novaehollandiae subsp. novaehollandiae (Australasian Grebe, Black-throated Grebe)*			
237.	25552	*Tadorna radjah (Radjah Shelduck)*			
238.	24331	*Tadorna tadornoides (Australian Shelduck, Mountain Duck)*			
239.	48135	*Thinornis rubricollis (Hooded Plover, Hooded Dotterel)*		P4	
240.	24845	*Threskiornis spinicollis (Straw-necked Ibis)*			
241.	25549	*Todiramphus sanctus (Sacred Kingfisher)*			
242.	24309	*Todiramphus sanctus subsp. sanctus (Sacred Kingfisher)*			
243.	48141	*Tribonyx ventralis (Black-tailed Native-hen)*			
244.	25723	*Trichoglossus haematodus (Rainbow Lorikeet)*			
245.	24755	*Trichoglossus haematodus subsp. moluccanus (Rainbow Lorikeet)*	Y		
246.	24806	*Tringa glareola (Wood Sandpiper)*		IA	

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
247.	24808	*Tringa nebularia (Common Greenshank, greenshank)*		IA	
248.	24809	*Tringa stagnatilis (Marsh Sandpiper, little greenshank)*		IA	
249.	48147	*Turnix varius (Painted Button-quail)*			
250.	24852	*Tyto alba subsp. delicatula (Barn Owl)*			
251.	24855	*Tyto novaehollandiae subsp. novaehollandiae (Masked Owl (southwest))*		P3	
252.	25577	*Vanellus miles (Masked Lapwing)*			
253.	24386	*Vanellus tricolor (Banded Lapwing)*			
254.	25765	*Zosterops lateralis (Grey-breasted White-eye, Silvereye)*			
Fish					
255.		*Acentrogobius bifrenatus*			
256.		*Apogon rueppellii*			
257.		*Atherinomorus vaigiensis*			
258.		*Atherinosoma wallacei*			
259.		*Carassius auratus*			
260.		*Cnidoglanis macrocephalus*			
261.		*Craterocephalus mugiloides*			
262.	34028	*Galaxias occidentalis (Western Minnow)*			
263.		*Pelates sexlineatus*			
264.		*Sillago burrus*			
265.		*Tandanus bostocki*			
266.		*Torquigener pleurogramma*			
267.		*Urocampus carinirostris*			
Invertebrate					
268.		*Acercella falcipes*			
269.		*Aganippe rhaphiduca*			
270.		*Akamptogonus novarae*			
271.		*Allothereua maculata*			
272.		*Aname mainae*			
273.		*Aname tepperi*			
274.		*Ancylidae sp.*			
275.		*Arachnura higginsi*			
276.		*Araneus cyphoxis*			
277.		*Araneus eburneiventris*			
278.		*Araneus senicaudatus*			
279.		*Arkys walckenaeri*			
280.		*Artoria flavimana*			
281.		*Artoria linnaei*			
282.		*Artoria taeniifera*			
283.		*Asadipus kunderang*			
284.		*Austracantha minax*			
285.		*Backobourkia heroine*			
286.		*Ballarra longipalpus*			
287.		*Caenidae sp.*			
288.		*Ceratopogonidae sp.*			
289.		*Cercophonius sulcatus*			
290.		*Ceryerda cursitans*			
291.	33939	*Cherax cainii (Marron)*			
292.		*Cherax destructor*			
293.		*Cherax preissii*			
294.		*Cherax quinquecarinatus*			
295.		*Cherax sp.*			
296.		*Chironominae sp.*			
297.		*Clynotis albobarbatus*			
298.		*Cormocephalus aurantiipes*			
299.		*Cormocephalus novaehollandiae*			
300.		*Cormocephalus rubriceps*			
301.		*Crustulina bicruciata*			
302.		*Cryptoerithus quobba*			
303.		*Cyrtophora parnasia*			
304.		*Dingosa serrata*			
305.		*Eodelena convexa*			
306.		*Eodelena lapidicola*			
307.		*Eriophora biapicata*			
308.		*Erythracarus decoris*			
309.		*Gea theridioides*			
310.		*Gyrinidae sp.*			
311.		*Henicops dentatus*			
312.		*Heurodes turritus*			
313.		*Hogna crispipes*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
314.		*Hydrophilidae sp.*			
315.		*Hydropsychidae sp.*			
316.		*Hydroptilidae sp.*			
317.		*Idiommata blackwalli*			
318.		*Isometroides vescus*			
319.		*Isopeda leishmanni*			
320.		*Ixodes australiensis*			
321.		*Kangarosa properipes*			
322.		*Lampona cylindrata*			
323.		*Latrodectus hasseltii*			
324.	33982	*Leioproctus contrarius (short-tongued bee)*		P3	
325.	33983	*Leioproctus douglasiellus (short-tongued bee)*		T	
326.		*Leptoceridae sp.*			
327.		*Longepi woodman*			
328.		*Lycosa ariadnae*			
329.		*Lycosa gilberta*			
330.		*Maratus pavonis*			
331.		*Marsupiopus antechinus*			
332.		*Missulena granulosa*			
333.		*Missulena occatoria*			
334.		*Mituliodon tarantulinus*			
335.		*Mitzoruga insularis*			
336.		*Nanometa gentilis*			
337.	33984	*Neopasiphae simplicior (short-tongued bee)*		T	
338.		*Nephila edulis*			
339.		*Nicodamus mainae*			
340.		*Notiasemus glauerti*			
341.		*Oligochaeta sp.*			
342.		*Ommatoiulus moreleti*			
343.		*Ommatoiulus moreletii*			
344.		*Orthocladiinae sp.*			
345.		*Oxidus gracilis*			
346.		*Palaemonidae sp.*			
347.		*Paralamyctes cammooensis*			Y
348.		*Parastacidae sp.*			
349.		*Phenasteron longiconductor*			
350.		*Pinkfloydia harveii*			
351.		*Piona cumberlandensis*			
352.		*Podykipus collinus*			
353.		*Poltys laciniosus*			
354.		*Prionosternum scutatum*			
355.		*Raveniella cirrata*			
356.		*Raveniella peckorum*			
357.		*Scolopendra laeta*			
358.		*Servaea melaina*			
359.		*Simaetha tenuior*			
360.		*Simuliidae sp.*			
361.		*Smeringopus natalensis*			
362.		*Solaenodolichopus pruvoti*			
363.		*Steatoda capensis*			
364.		*Steatoda grossa*			
365.		*Supunna funerea*			
366.		*Supunna picta*			
367.	33992	*Synemon gratiosa (Graceful Sunmoth)*		P4	
368.		*Synothele michaelseni*			
369.		*Synothele rastelloides*			
370.		*Tamopsis darlingtoniana*			
371.		*Tasmanicosa leuckartii*			
372.		*Tetragnatha demissa*			
373.		*Tetragnatha nitens*			
374.	33994	*Throscodectes xiphos (cricket)*		P1	Y
375.		*Tinytrema yarra*			
376.		*Urodacus novaehollandiae*			
377.		*Urodacus planimanus*			
378.		*Venator immansueta*			
379.		*Venatrix pullastra*			
380.	34113	*Westralunio carteri (Carter's Freshwater Mussel)*		T	
381.		*Withius piger*			
382.		*Zachria flavicoma*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
Mammal					
383.	30883	*Canis lupus subsp. familiaris (Dog)*	Y		
384.	24086	*Cercartetus concinnus (Western Pygmy-possum, Mundarda)*			
385.	24186	*Chalinolobus gouldii (Gould's Wattled Bat)*			
386.	24092	*Dasyurus geoffroii (Chuditch, Western Quoll)*		T	
387.	24189	*Falsistrellus mackenziei (Western False Pipistrelle, Western Falsistrelle)*		P4	
388.	24041	*Felis catus (Cat)*	Y		
389.	30916	*Funambulus pennanti (Indian Palm Squirrel)*	Y		
390.	24215	*Hydromys chrysogaster (Water-rat, Rakali)*		P4	
391.	25478	*Isoodon obesulus (Southern Brown Bandicoot)*		P4	
392.	24153	*Isoodon obesulus subsp. fusciventer (Quenda, Southern Brown Bandicoot)*		P4	
393.	24131	*Macropus eugenii subsp. derbianus (Tammar Wallaby (WA subsp))*		P4	
394.	24132	*Macropus fuliginosus (Western Grey Kangaroo)*			
395.	24133	*Macropus irma (Western Brush Wallaby)*		P4	
396.	24223	*Mus musculus (House Mouse)*	Y		
397.	24146	*Myrmecobius fasciatus (Numbat, Walpurti)*		T	
398.	24194	*Nyctophilus geoffroyi (Lesser Long-eared Bat)*			
399.	24085	*Oryctolagus cuniculus (Rabbit)*	Y		
400.	24243	*Rattus fuscipes (Western Bush Rat)*			
401.	24244	*Rattus norvegicus (Brown Rat)*	Y		
402.	24245	*Rattus rattus (Black Rat)*	Y		
403.	24145	*Setonix brachyurus (Quokka)*		T	
404.	24111	*Sminthopsis gilberti (Gilbert's Dunnart)*			
405.	24207	*Tachyglossus aculeatus (Short-beaked Echidna)*			
406.	24167	*Tarsipes rostratus (Honey Possum, Noolbenger)*			
407.	25521	*Trichosurus vulpecula (Common Brushtail Possum)*			
408.	24158	*Trichosurus vulpecula subsp. vulpecula (Common Brushtail Possum)*			
409.	24206	*Vespadelus regulus (Southern Forest Bat)*			
410.	24040	*Vulpes vulpes (Red Fox)*	Y		
Reptile					
411.	25242	*Acanthophis antarcticus (Southern Death Adder)*		P3	
412.	42368	*Acritoscincus trilineatus (Western Three-lined Skink)*			
413.	44629	*Anilios australis*			
414.	24990	*Aprasia pulchella (Granite Worm-lizard)*			
415.	24991	*Aprasia repens (Sand-plain Worm-lizard)*			
416.	42380	*Brachyurophis fasciolatus subsp. fasciolatus (Narrow-banded Shovel-nosed Snake)*			
417.	42381	*Brachyurophis semifasciatus (Southern Shovel-nosed Snake)*			
418.	43380	*Chelodina colliei (South-western Snake-necked Turtle)*			
419.	24980	*Christinus marmoratus (Marbled Gecko)*			
420.	30893	*Cryptoblepharus buchananii*			
421.	25020	*Cryptoblepharus plagiocephalus*			
422.	30899	*Ctenophorus adelaidensis (Southern Heath Dragon, Western Heath Dragon)*			
423.	25027	*Ctenotus australis*			
424.	25035	*Ctenotus delli (Dell's skink, Dell's Ctenotus)*		P4	
425.	25039	*Ctenotus fallens*			
426.	25040	*Ctenotus gemmula (Jewelled South-west Ctenotus (Swan Coastal Plain pop P3), skink)*			
427.	25047	*Ctenotus impar*			
428.	25049	*Ctenotus labillardieri*			
429.	41641	*Ctenotus ora (Coastal Plains Skink)*		P3	
430.	25766	*Delma fraseri (Fraser's Legless Lizard)*			
431.	24999	*Delma grayii*			
432.	25468	*Demansia psammophis (Yellow-faced Whipsnake)*			
433.	25296	*Demansia psammophis subsp. reticulata (Yellow-faced Whipsnake)*			
434.	24939	*Diplodactylus polyophthalmus*			
435.	25251	*Echiopsis curta (Bardick)*			
436.	25096	*Egernia kingii (King's Skink)*			
437.	25100	*Egernia napoleonis*			
438.	25250	*Elapognathus coronatus (Crowned Snake)*			
439.	24959	*Gehyra variegata*			
440.	25115	*Hemiergis initialis subsp. initialis*			
441.	25119	*Hemiergis quadrilineata*			
442.	25131	*Lerista distinguenda*			
443.	25133	*Lerista elegans*			
444.	25147	*Lerista lineata (Perth Slider, Lined Skink)*		P3	
445.	25005	*Lialis burtonis*			
446.	25184	*Menetia greyii*			
447.	25240	*Morelia spilota subsp. imbricata (Carpet Python)*			
448.	25191	*Morethia lineoocellata*			
449.	25192	*Morethia obscura*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
450.	25248	*Neelaps bimaculatus (Black-naped Snake)*			
451.	25249	*Neelaps calonotos (Black-striped Snake, black-striped burrowing snake)*		P3	
452.	25252	*Notechis scutatus (Tiger Snake)*			
453.	25253	*Parasuta gouldii*			
454.	25255	*Parasuta nigriceps*			
455.	25509	*Pletholax gracilis (Keeled Legless Lizard)*			
456.	25007	*Pletholax gracilis subsp. gracilis (Keeled Legless Lizard)*			
457.	25510	*Pogona minor (Dwarf Bearded Dragon)*			
458.	24907	*Pogona minor subsp. minor (Dwarf Bearded Dragon)*			
459.	25261	*Pseudechis australis (Mulga Snake)*			
460.	25511	*Pseudonaja affinis (Dugite)*			
461.	25259	*Pseudonaja affinis subsp. affinis (Dugite)*			
462.	42416	*Pseudonaja mengdeni (Western Brown Snake)*			
463.	25008	*Pygopus lepidopodus (Common Scaly Foot)*			
464.	25266	*Simoselaps bertholdi (Jan's Banded Snake)*			
465.	25203	*Tiliqua occipitalis (Western Bluetongue)*			
466.	25519	*Tiliqua rugosa*			
467.	25204	*Tiliqua rugosa subsp. aspera*			
468.	25207	*Tiliqua rugosa subsp. rugosa*			
469.	24983	*Underwoodisaurus milii (Barking Gecko)*			
470.	25218	*Varanus gouldii (Bungarra or Sand Monitor)*			
471.	25225	*Varanus rosenbergi (Heath Monitor)*			

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

[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.

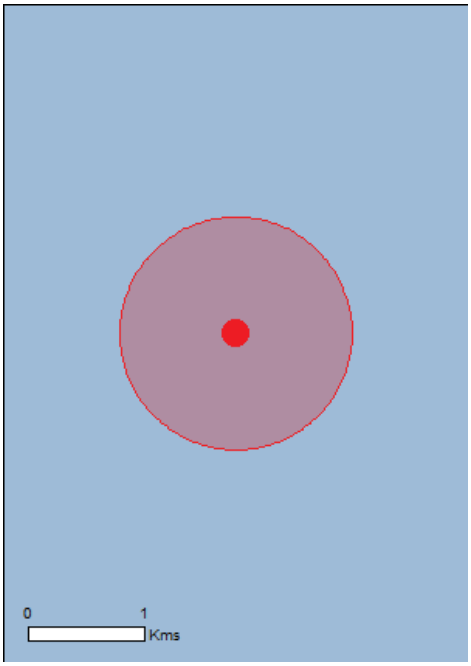
EPBC Act Protected Matters Report

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.

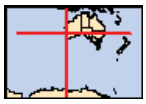
Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 26/05/18 15:09:05



Coordinates
Buffer: 1.0Km



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	1
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	1
Listed Threatened Species:	17
Listed Migratory Species:	9

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. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

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:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	15
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Commonwealth Reserves Marine:	None

Extra Information

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

State and Territory Reserves:	None
Regional Forest Agreements:	None
Invasive Species:	38
Nationally Important Wetlands:	1
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar) [Resource Information]

Name	Proximity
Forrestdale and thomsons lakes	Within 10km of Ramsar

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
Banksia Woodlands of the Swan Coastal Plain ecological community	Endangered	Community likely to occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calyptorhynchus banksii naso Forest Red-tailed Black-Cockatoo, Karrak [67034]	Vulnerable	Species or species habitat known to occur within area
Calyptorhynchus baudinii Baudin's Cockatoo, Long-billed Black-Cockatoo [769]	Endangered	Species or species habitat likely to occur within area
Calyptorhynchus latirostris Carnaby's Cockatoo, Short-billed Black-Cockatoo [59523]	Endangered	Species or species habitat known to occur within area
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
Mammals		
Dasyurus geoffroii Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat likely to occur within area
Pseudocheirus occidentalis Western Ringtail Possum, Ngwayir, Womp, Woder, Ngoor, Ngoolangit [25911]	Critically Endangered	Species or species habitat may occur within

Name	Status	Type of Presence
		area
Plants		
Andersonia gracilis Slender Andersonia [14470]	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 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 likely to occur within area
Drakaea elastica Glossy-leafed Hammer Orchid, Glossy-leaved Hammer Orchid, Warty Hammer Orchid [16753]	Endangered	Species or species habitat likely to occur within area
Drakaea micrantha Dwarf Hammer-orchid [56755]	Vulnerable	Species or species habitat likely to occur within area
Lepidosperma rostratum Beaked Lepidosperma [14152]	Endangered	Species or species habitat likely to 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
Migratory Terrestrial Species		
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur

Name	Threatened	Type of Presence within area

Other Matters Protected by the EPBC Act

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		
Actitis hypoleucos Common Sandpiper [59309]		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 may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species

Name	Threatened	Type of Presence
		habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat may occur within area
Thinornis rubricollis Hooded Plover [59510]		Species or species habitat may occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Extra Information

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		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		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

Name	Status	Type of Presence
		within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Turdus merula Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
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
Funambulus pennantii Northern Palm Squirrel, Five-striped Palm Squirrel [129]		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 norvegicus Brown Rat, Norway Rat [83]		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
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 aethiopicus Asparagus Fern, Ground Asparagus, Basket Fern, Sprengi's Fern, Bushy Asparagus, Emerald Asparagus [62425]		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 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

Name	Status	Type of Presence
		habitat may occur within area
Chrysanthemoides monilifera subsp. monilifera Boneseed [16905]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
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
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Sagittaria platyphylla Delta Arrowhead, Arrowhead, Slender Arrowhead [68483]		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
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Tamarix aphylla Athel Pine, Athel Tree, Tamarisk, Athel Tamarisk, Athel Tamarix, Desert Tamarisk, Flowering Cypress, Salt Cedar [16018]		Species or species habitat likely to occur within area
Reptiles		
Hemidactylus frenatus Asian House Gecko [1708]		Species or species habitat likely to occur within area

Nationally Important Wetlands [Resource Information]

Name	State
Gibbs Road Swamp System	WA

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 and National Heritage properties, Wetlands of International and National 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.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

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

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

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

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

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

Coordinates

-32.12921 115.90505

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:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian 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, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

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

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

Department of the Environment
GPO Box 787
Canberra ACT 2601 Australia
+61 2 6274 1111

APPENDIX D

HABITAT TREE DETAILS

Habitat Trees (DBH >50cm)
Datum = GDA94

Waypoint Number	Zone	mE	mN	Tree Species	Tree Height (m)	DBH (cm)	Number of Hollows
wpt001	50H	397230	6445663	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt002	50H	397243	6445675	Unknown Planted Non-endemic Eucalyptus	10-15	>50	0
wpt003	50H	397272	6445719	Jarrah	15-20	>50	0
wpt004	50H	397301	6445703	Unknown Planted Non-endemic Eucalyptus	20+	>50	0
wpt005	50H	397296	6445688	Unknown Planted Non-endemic Eucalyptus	20+	>50	0
wpt006	50H	397286	6445685	Unknown Planted Non-endemic Eucalyptus	20+	>50	0
wpt007	50H	397278	6445678	Unknown Planted Non-endemic Eucalyptus	20+	>50	0
wpt008	50H	397306	6445682	Unknown Planted Non-endemic Eucalyptus	20+	>50	0
wpt009	50H	397358	6445701	Flooded Gum	15-20	>50	0
wpt010	50H	397381	6445683	Flooded Gum	15-20	>50	0
wpt011	50H	397393	6445671	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt012	50H	397405	6445660	Unknown Planted Non-endemic Eucalyptus	20+	>50	0
wpt013	50H	397445	6445620	Unknown Planted Non-endemic Eucalyptus	20+	>50	0
wpt014	50H	397449	6445616	Flooded Gum	15-20	>50	0
wpt015	50H	397506	6445556	Flooded Gum	15-20	>50	0
wpt016	50H	397513	6445555	Unknown Planted Non-endemic Eucalyptus	20+	>50	0
wpt017	50H	397527	6445542	Flooded Gum	15-20	>50	0
wpt018	50H	397535	6445533	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt019	50H	397398	6445474	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt020	50H	397274	6445621	Tuart	20+	>50	0
wpt021	50H	396950	6445320	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt022	50H	396958	6445321	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt023	50H	396953	6445319	Unknown Planted Non-endemic Eucalyptus	20+	>50	0
wpt024	50H	396944	6445309	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt025	50H	396932	6445300	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt026	50H	396913	6445284	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt027	50H	397018	6445320	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt028	50H	397022	6445315	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt029	50H	397034	6445309	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt030	50H	397037	6445304	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt031	50H	397041	6445299	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt032	50H	397062	6445284	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt033	50H	397106	6445244	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt034	50H	397144	6445210	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt035	50H	397146	6445208	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt036	50H	397157	6445200	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt037	50H	397037	6444978	Unknown Planted Non-endemic Eucalyptus	20+	>50	0
wpt038	50H	396918	6445005	Coastal Blackbutt	10-15	>50	0
wpt039	50H	396932	6444964	Coastal Blackbutt	10-15	>50	0
wpt040	50H	396791	6445095	Dead Jarrah	15-20	>50	0
wpt041	50H	396752	6445099	Dead Jarrah	20+	>50	0
wpt042	50H	396784	6445172	Flooded Gum	15-20	>50	0
wpt043	50H	396817	6445161	Dead Jarrah	15-20	>50	0
wpt044	50H	396632	6444928	Unknown Planted Non-endemic Eucalyptus	20+	>50	0
wpt045	50H	396665	6444989	Tuart	20+	>50	0
wpt046	50H	396661	6444994	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt047	50H	396664	6445011	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0

Waypoint Number	Zone	mE	mN	Tree Species	Tree Height (m)	DBH (cm)	Number of Hollows
wpt048	50H	396796	6444967	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt049	50H	396847	6444868	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt050	50H	396837	6444830	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt051	50H	396767	6444835	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt052	50H	396775	6444822	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt053	50H	396927	6444871	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt054	50H	396880	6444760	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt055	50H	396846	6444723	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt056	50H	396783	6444758	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt057	50H	396766	6444685	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt058	50H	396766	6444682	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt059	50H	396748	6444700	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt060	50H	396742	6444692	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt061	50H	396700	6444731	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt062	50H	396743	6444753	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt063	50H	396717	6444806	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt064	50H	396795	6444584	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt065	50H	396846	6444567	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt066	50H	396920	6444695	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt067	50H	396967	6444761	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt068	50H	396931	6444809	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt069	50H	396957	6444661	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt070	50H	396959	6444634	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt071	50H	396982	6444632	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt072	50H	396861	6444532	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt073	50H	396854	6444498	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt074	50H	396829	6444532	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt075	50H	396809	6444531	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt076	50H	396792	6444525	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt077	50H	396786	6444539	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt078	50H	396753	6444542	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt079	50H	396645	6444497	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt080	50H	396725	6444418	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt081	50H	396742	6444459	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt082	50H	396754	6444488	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt083	50H	396775	6444463	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt084	50H	396553	6444576	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt085	50H	396608	6444850	Tuart	20+	>50	0
wpt086	50H	396737	6443695	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt087	50H	396716	6443713	Unknown Planted Non-endemic Eucalyptus	20+	>50	0
wpt088	50H	396702	6443758	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt089	50H	396701	6443763	Unknown Planted Non-endemic Eucalyptus	20+	>50	0
wpt090	50H	396692	6443775	Unknown Planted Non-endemic Eucalyptus	20+	>50	0
wpt091	50H	396710	6443778	Unknown Planted Non-endemic Eucalyptus	20+	>50	0
wpt092	50H	396730	6443789	Unknown Planted Non-endemic Eucalyptus	20+	>50	0
wpt093	50H	396750	6443792	Unknown Planted Non-endemic Eucalyptus	20+	>50	0
wpt094	50H	396816	6443894	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt095	50H	396822	6443918	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt096	50H	396785	6443917	Unknown Planted Non-endemic Eucalyptus	20+	>50	0

Waypoint Number	Zone	mE	mN	Tree Species	Tree Height (m)	DBH (cm)	Number of Hollows
wpt097	50H	396682	6443934	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt098	50H	396690	6443933	Unknown Planted Non-endemic Eucalyptus	20+	>50	0
wpt099	50H	396679	6443907	Unknown Planted Non-endemic Eucalyptus	20+	>50	0
wpt100	50H	396674	6443890	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt102	50H	396693	6443871	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt104	50H	396701	6443884	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt105	50H	396670	6443865	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt106	50H	396665	6443857	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt107	50H	396676	6443852	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt108	50H	396673	6443852	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt109	50H	396665	6443862	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt110	50H	396762	6443853	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt111	50H	396753	6444345	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt112	50H	396734	6444373	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt113	50H	396704	6444357	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt114	50H	396695	6444365	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt115	50H	396468	6444362	Dead Unknown	20+	>50	0
wpt116	50H	396413	6444438	Unknown Planted Non-endemic Eucalyptus	20+	>50	0
wpt117	50H	396598	6444295	Dead Unknown	20+	>50	0
wpt118	50H	396449	6443695	Unknown Planted Non-endemic Eucalyptus	20+	>50	0
wpt119	50H	396453	6443695	Unknown Planted Non-endemic Eucalyptus	20+	>50	0
wpt120	50H	396463	6443710	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt121	50H	396481	6443726	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt122	50H	396467	6443721	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt123	50H	396465	6443716	Unknown Planted Non-endemic Eucalyptus	20+	>50	0
wpt124	50H	396470	6443738	Unknown Planted Non-endemic Eucalyptus	20+	>50	0
wpt125	50H	396480	6443758	Unknown Planted Non-endemic Eucalyptus	20+	>50	0
wpt126	50H	396490	6443780	Unknown Planted Non-endemic Eucalyptus	20+	>50	0
wpt127	50H	396492	6443783	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt128	50H	396494	6443785	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt129	50H	396495	6443790	Unknown Planted Non-endemic Eucalyptus	20+	>50	0
wpt130	50H	396497	6443792	Unknown Planted Non-endemic Eucalyptus	20+	>50	0
wpt131	50H	396468	6443806	Unknown Planted Non-endemic Eucalyptus	20+	>50	0
wpt132	50H	396519	6443773	Unknown Planted Non-endemic Eucalyptus	20+	>50	0
wpt133	50H	396517	6443764	Unknown Planted Non-endemic Eucalyptus	20+	>50	0
wpt134	50H	396518	6443754	Unknown Planted Non-endemic Eucalyptus	20+	>50	0
wpt135	50H	396514	6443745	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt136	50H	396512	6443735	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt137	50H	396510	6443731	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt138	50H	396508	6443742	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt139	50H	396507	6443742	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt140	50H	396505	6443740	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt141	50H	396536	6443718	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt142	50H	396538	6443696	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt143	50H	396548	6443689	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt144	50H	396569	6443679	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt145	50H	396580	6443673	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt146	50H	396519	6443662	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt147	50H	396519	6443684	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0

Waypoint Number	Zone	mE	mN	Tree Species	Tree Height (m)	DBH (cm)	Number of Hollows
wpt148	50H	396489	6443695	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt149	50H	396478	6443689	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt150	50H	396239	6443816	Unknown Planted Non-endemic Eucalyptus	20+	>50	0
wpt151	50H	396236	6443809	Unknown Planted Non-endemic Eucalyptus	20+	>50	0
wpt152	50H	396226	6443818	Unknown Planted Non-endemic Eucalyptus	20+	>50	0
wpt153	50H	396205	6443831	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt154	50H	396366	6444132	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt155	50H	396354	6444097	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt156	50H	396312	6444071	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt157	50H	396298	6444044	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt158	50H	396273	6443994	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt159	50H	396246	6443863	Unknown Planted Non-endemic Eucalyptus	20+	>50	0
wpt160	50H	396240	6443836	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt161	50H	396287	6443813	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt162	50H	396301	6443832	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt163	50H	396325	6443883	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt164	50H	396344	6443920	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt165	50H	396273	6443854	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt166	50H	396292	6443862	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt167	50H	396297	6443895	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt168	50H	396300	6443912	Unknown Planted Non-endemic Eucalyptus	20+	>50	0
wpt169	50H	396249	6443957	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt170	50H	396240	6443927	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt171	50H	396041	6443936	Unknown Planted Non-endemic Eucalyptus	20+	>50	0
wpt172	50H	396049	6443949	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt173	50H	396056	6443961	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt174	50H	396008	6443954	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt175	50H	396021	6443947	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt176	50H	396022	6443963	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt177	50H	396055	6444047	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt178	50H	396083	6444022	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt179	50H	396117	6443952	Unknown Planted Non-endemic Eucalyptus	20+	>50	0
wpt180	50H	396147	6444006	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt181	50H	396192	6443985	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt182	50H	396083	6443948	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0
wpt183	50H	396101	6444046	Unknown Planted Non-endemic Eucalyptus	15-20	>50	0

DISCLAIMER

This fauna assessment report ("the report") has been prepared in accordance with the scope of services set out in the contract, or as otherwise agreed, between the Client and Greg Harewood ("the Author"). In some circumstances the scope of services may have been limited by a range of factors such as time, budget, access and/or site disturbance constraints. In accordance with the scope of services, the Author has relied upon the data and has conducted environmental field monitoring and/or testing in the preparation of the report. The nature and extent of monitoring and/or testing conducted is described in the report.

The conclusions are based upon field data and the environmental monitoring and/or testing carried out over a limited period of time and are therefore merely indicative of the environmental condition of the site at the time of preparing the report. Also it should be recognised that site conditions, can change with time.

Within the limitations imposed by the scope of services, the field assessment and preparation of this report have been undertaken and performed in a professional manner, in accordance with generally accepted practices and using a degree of skill and care ordinarily exercised by reputable environmental consultants under similar circumstances. No other warranty, expressed or implied, is made.

In preparing the report, the Author has relied upon data, surveys, analyses, designs, plans and other information provided by the Client and other individuals and organisations, most of which are referred to in the report ("the data"). Except as otherwise stated in the report, the Author has not verified the accuracy of completeness of the data. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations in the report ("conclusions") are based in whole or part on the data, those conclusions are contingent upon the accuracy and completeness of the data. The Author will not be liable in relation to incorrect conclusions should any data, information or condition be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed to the Author.

The report has been prepared for the benefit of the Client and no other party. The Author assumes no responsibility and will not be liable to any other person or organisation for or in relation to any matter dealt with or conclusions expressed in the report, or for any loss or damage suffered by any other person or organisation arising from matters dealt with or conclusions expressed in the report (including without limitation matters arising from any negligent act or omission of the Author or for any loss or damage suffered by any other party relying upon the matters dealt with or conclusions expressed in the report). Other parties should not rely upon the report or the accuracy or completeness of any conclusions and should make their own enquiries and obtain independent advice in relation to such matters.

The Author will not be liable to update or revise the report to take into account any events or emergent circumstances or facts occurring or becoming apparent after the date of the report.

COTERRA
ENVIRONMENT

Level 3, 25 Prowse Street
West Perth WA 6005

T (08) 9381 5513

www.coterra.com.au
info@coterra.com.au