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Gascoyne Food Bowl Initiative

Level 2 Flora and Vegetation Survey

Prepared for
Shire of Carnarvon and Department of Agriculture and Food
by Strategen

March 2017

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Gascoyne Food Bowl Initiative

Level 2 Flora and Vegetation Survey

Strategen is a trading name of
Strategen Environmental Consultants Pty Ltd
Level 1, 50 Subiaco Square Road Subiaco WA 6008
ACN: 056 190 419

March 2017

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Client: Shire of Carnarvon and Department of Agriculture and Food

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1. Introduction

This report presents the findings of a Level 2 flora and vegetation survey undertaken for the Gascoyne Food Bowl Initiative.

1.1 Background

The Department of Agriculture and Food, Western Australia (DAFWA) and the Shire of Carnarvon (the Shire) have secured funding from the Western Australian State Government's *Royalties for Regions* to implement the Gascoyne Food Bowl Initiative which will increase horticultural production in the area by an additional 400 hectares, matched with borefield development.

Part of the initiative involves the introduction of a Special Control Area (SCA) to the Shire of Carnarvon District Zoning Scheme 11 to provide for subdivision and development control within the SCA boundary. The proposed SCA will involve the rezoning of approximately 594.8 ha of land from 'Rural' to 'Intensive Horticulture' (LPS10 and LPS11 project areas, the 'project area') within the survey area (Figure 1).

The scheme amendment proposal included a Level 1 flora and vegetation survey undertaken by Western Botanical in 2013 and was submitted to the Western Australian Environmental Protection Authority (EPA) for assessment under Part IV Division 3 of the *Environmental Protection Act 1986* (EP Act). The EPA provided formal correspondence to the Shire on 4 April 2016, stating that the environmental impacts of the proposed scheme amendment are not so significant to warrant formal assessment under Part IV of the EP Act, providing the advice provided by the EPA is implemented. Part of the advice provided included a recommendation that a Level 2 flora and vegetation survey is undertaken within the survey area to inform the provisions of the SCA.

Strategen was subsequently commissioned to undertake the flora and vegetation survey.

1.2 Scope

The scope of this flora and vegetation survey was to undertake a desktop assessment and field assessment within the survey area (Figure 1).

The objectives were to:

- conduct a desktop survey for Threatened and Priority flora which have been identified as being present in or around the survey area
- collect and identify the vascular plant species present within the survey area
- search areas of suitable habitat for Threatened and/or Priority flora
- define and map the native vegetation communities present within the survey area
- map vegetation condition within the survey area
- provide recommendations on the local and regional significance of the vegetation communities
- prepare a report summarising the findings.

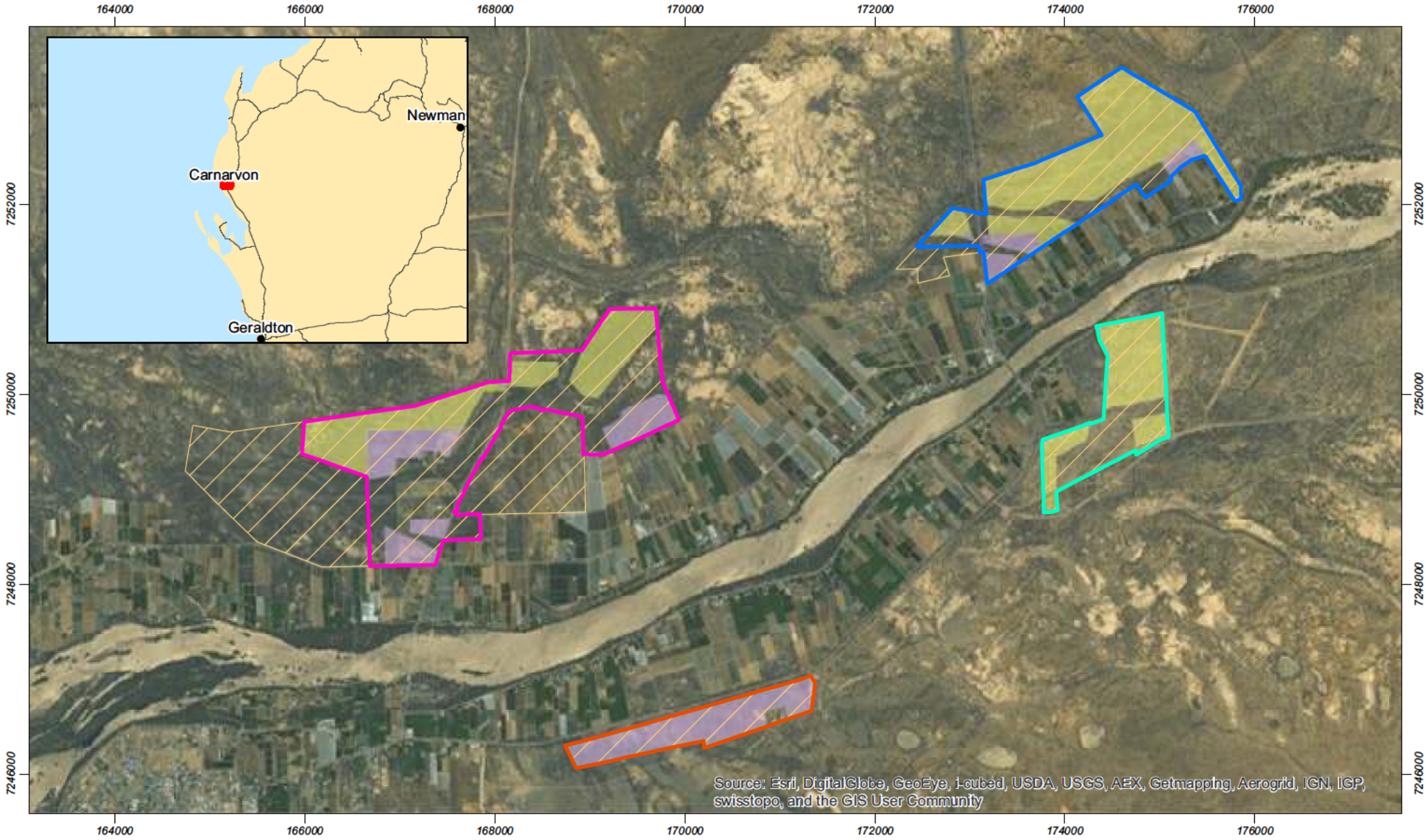

Figure 1: Survey area

Scale 1:55,643 at A4

0 300 600 900 1,200 1,500 m

Coordinate System: GDA 1994 MGA Zone 50
Note that positional errors may occur in some areas
Date: 20/02/2017
Author: JCrute
Source: Aerial image: ESRI, approx. 2012.

N

Legend

Survey area
Area B
Area C
Area D
Area E
Special Control Area
LPS10 project area
LPS11 project area

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info@strategen.com.au
www.strategen.com.au

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2. Context

2.1 Legislative context

This biological survey has been conducted with reference to the following Australian and Western Australian legislation:

- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) – Australian Government
- *Wildlife Conservation Act 1950* (WC Act) – State
- *Environmental Protection Act 1986* (EP Act) – State
- *Biosecurity and Agriculture Management Act 2007* (BAM Act) – State.

2.1.1 Conservation significant flora and ecological communities

Conservation significant flora and ecological communities are determined at a state and federal legislative level. Threatened species are listed under the EPBC Act at the Australian Government level and under the WC Act at the State level (Appendix 1). Priority species are listed by the Department of Parks and Wildlife (Parks and Wildlife) and include species of 'significant conservation value' (Appendix 1).

Threatened Ecological Communities (TECs) are listed under both the EPBC Act and EP Act (Appendix 1Priority Ecological Communities (PECs) are listed by Parks and Wildlife and include species of significant conservation value (Appendix 1).

2.1.2 Environmentally Sensitive Areas

Environmentally Sensitive Areas (ESAs) are protected under the EP Act, and include the following:

- World Heritage areas
- areas included on the National Estate Register
- defined wetlands and associated buffers
- vegetation within 50 m of a listed Threatened species
- TECs.

2.1.3 Protection of native vegetation

Native vegetation is defined under the EP Act as "indigenous aquatic or terrestrial vegetation, and includes dead vegetation unless that dead vegetation is of a class declared by regulation to be excluded from this definition but does not include vegetation in a plantation".

This definition of native vegetation does not include vegetation that was intentionally sown, planted or propagated unless either of the following applies:

(a) the vegetation was sown, planted or propagated as required under the EP Act or another written law

(b) the vegetation is declared to be native under Regulation 4 of the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*.

Regulation 4 prescribes the kinds of intentionally planted indigenous vegetation that are "native vegetation" and which therefore require a clearing permit or exemption to clear and includes:

(a) planting that was funded (fully or partly)
    i. by a person who was not the owner of the land
    ii. for the purpose of biodiversity conservation or land conservation

(b) intentionally planted vegetation that has one of the following:
    i. a conservation covenant or agreement to reserve under section 30B of the *Soil and Land Conservation Act 1945*
    ii. a covenant to conserve under section 21A of the *National Trust of Australia (WA) Act 1964*
    iii. restrictive covenant to conserve under section 129B of the *Transfer of Land Act 1983*
    iv. some other form of binding or undertaking to establish and maintain, or maintain, the vegetation.

Native vegetation can only be cleared with a clearing permit, unless for some circumstances where exemptions apply pursuant to the EP Act and the Environmental Protection (Clearing of Native Vegetation) Regulations 2004 (the Regulations). Clearing permits issued pursuant to the Regulations may be issued as area permits or purpose permits. Exemptions for clearing under Regulation 5 of the Regulations do not apply within ESAs.

2.1.4 Introduced species

The BAM Act provides for management and control of listed organisms, including introduced flora species (weeds). Species listed as declared pests under the BAM Act are classified under three categories:

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

Under the BAM Act, land managers are required to manage populations of declared pests as outlined under the relevant category.

2.2 Environmental setting

2.2.1 Soils and topography

The survey area is located within Carnarvon region of the *Interim Biogeographic Region of Australia* (IBRA). At a finer scale, the survey area is located within the Carnarvon 2 (CAR 2 – Wooramel subregion) bioregion which is described by Desmond & Chant (2002) as encompassing the southern and central parts of the Carnarvon Basin. This bioregion contains alluvial plains associated with downstream sections and deltas of the Gascoyne, Minilya and Wooramel Rivers as well as Lake MacLeod and the Kennedy Range. Tree to shrub steppe over hummock grasslands on and between aeolian red sand dunefields are extensive in the north and east of the bioregion as well as on top of Kennedy Range, while Permian sediments are common in northern parts. Southern areas comprise limestone plateaux overlain by red sand plains.

2.2.2 Climate

The Carnarvon locality experiences a seasonally arid climate, tending towards bimodal rainfall (Desmond & Chant 2002). The nearest Bureau of Meteorology (BoM) weather station at Carnarvon Airport (Station No. 6011) provides average monthly climate statistics for the Carnarvon locality (Figure 2). Average annual rainfall recorded at Carnarvon since 1945 is 224.6 mm (BoM 2017). Rainfall may occur at any time of year; however, most occurs in winter. Highest temperatures occur between December and April, with average monthly maximums ranging from 29.1°C in April to 32.6°C in February (BoM 2016). Lowest temperatures occur between June and August, with average monthly minimums ranging from 10.9°C in July to 12.3°C in June (BoM 2017).

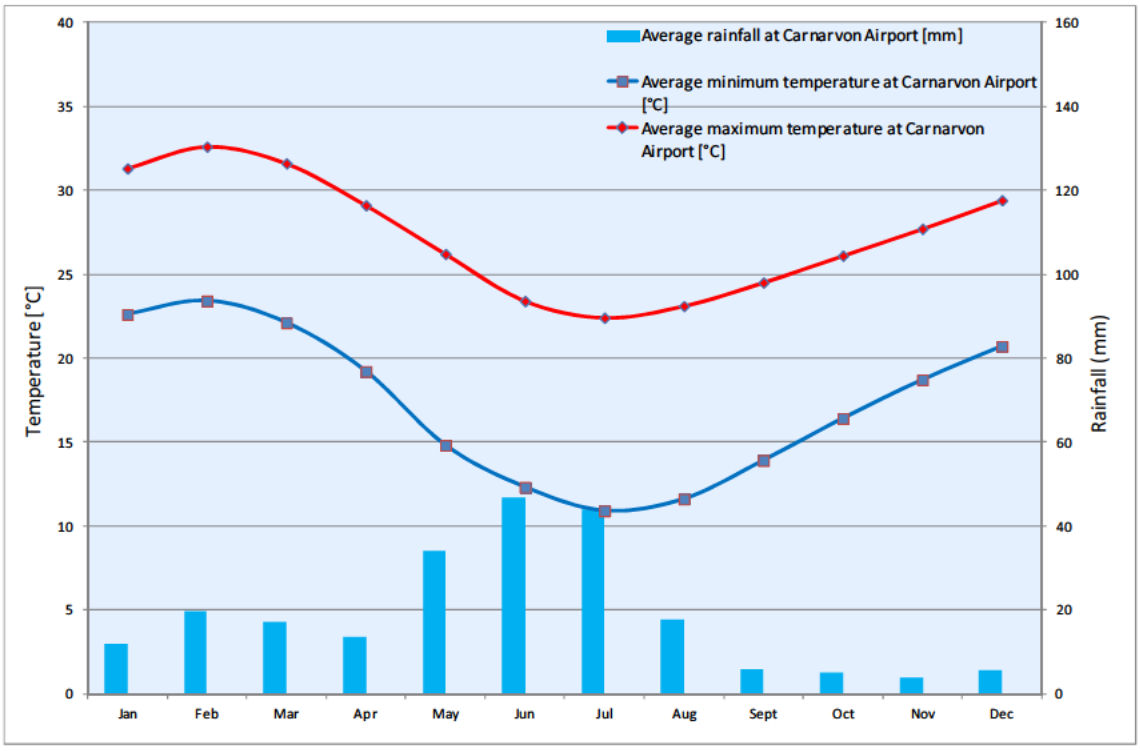

Figure 2: Mean monthly climatic data (temperature and rainfall) for Carnarvon Airport

2.2.3 Regional vegetation

Vegetation occurring within the region was initially mapped at a broad scale (1:1 000 000) by Beard during the 1970s. This dataset has formed the basis of several regional mapping systems, including physiographic regions defined by Beard (1976) which led to the delineation of botanical districts as described in Beard (1990) and the biogeographical region dataset (i.e. IBRA) for Western Australia (DEE 2016a).

Beard (1990) Botanical Subdistrict

The survey area occurs within the Carnarvon Botanical District which is characterised by Acacia scrub and low woodlands becoming tree and shrub steppe in the north, and with halophytes along the lower river courses (Beard 1990).

IBRA subregion

IBRA describes a system of 85 'biogeographic regions' (bioregions) and 403 subregions covering the entirety of the Australian continent (Thackway & Cresswell 1995). Bioregions are defined on the basis of climate, geology, landforms, vegetation and fauna.

The survey area occurs within the Carnarvon 2 (CAR 2 – Wooramel subregion) region which is typically comprised of Acacia shrublands (e.g. Mulga, Bowgada and *A. coriacea*) over bunch grasses on red sandy ridges and plains. Mangroves occur within the bioregion; however are confined to small areas around Lake MacLeod and near Carnarvon. Saline alluvial plains with samphire and saltbush low shrublands also occur in near-coastal areas (Desmond & Chant 2002).

Vegetation system association mapping

The survey area falls within the Gascoyne Marshes vegetation system association as defined in Government of Western Australia (2015):

- Gascoyne Marshes 129: Bare areas; dune sand
- Gascoyne Marshes 308: Mosaic: Shrublands; Acacia sclerosperma sparse scrub / Succulent steppe; saltbush and bluebush
- Gascoyne Marshes 1271: Bare areas; claypans.

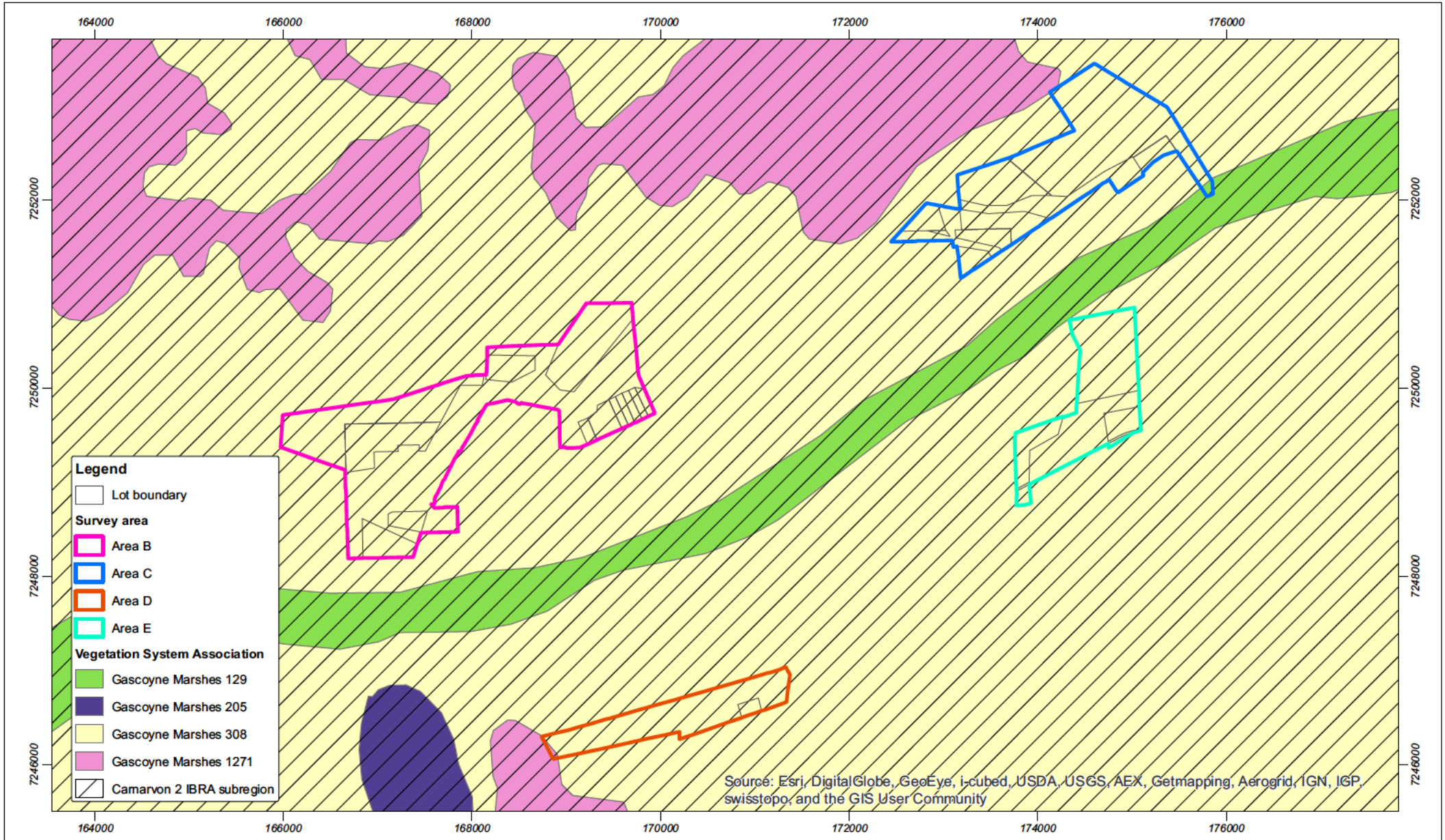

Figure 3: Regional vegetation mapping

Scale 1:55,000 at A4

0 300 600 900 1,200 1,500 m

N

Coordinate System: GDA 1994 MGA Zone 50
Note that positional errors may occur in some areas
Date: 20/02/2017
Author: J Crute
Source: Aerial image: ESRI, approx. 2012.

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3. Methods

3.1 Desktop assessment

A desktop assessment was conducted using Florabase, Parks and Wildlife, and Department of Environment and Energy (DEE) databases to identify the possible occurrence of TECs, PECs and Threatened and Priority flora potentially occurring within the survey area (Appendix 2). The Level 1 flora and vegetation report prepared by Western Botanical (Western Botanical 2013) was also reviewed prior to the field assessment.

3.2 Field assessment

The field survey was conducted according to standards set out in Guidance Statement 51 (EPA 2004). The assessment of flora and vegetation within the survey area was undertaken by four ecologists between 17-20 October 2016. Table 1 identifies staff involved in the field surveys, their role and qualifications. The survey area was traversed on foot to record changes in vegetation structure and type and 35 vegetation quadrats, encompassing 30 m x 30 m were surveyed to identify vegetation types (Appendix 3; Appendix 4).

Table 1: Personnel

Name	Role
[redacted] Strategen (Lead Ecologist)	Planning, fieldwork, data interpretation and report preparation
[redacted] Strategen (Ecologist)	Planning, fieldwork, data interpretation and report preparation
[redacted] Maia Environmental Consultancy (Director / Botanist)	Planning, fieldwork, data interpretation and report preparation
[redacted] Maia Environmental Consultancy (Botanist)	Planning, fieldwork, data interpretation and report preparation

Site selection for vegetation mapping was based on differences in structure and species composition of the communities present within the survey area. Vegetation mapping sites were determined from aerial photographs. The survey area was traversed on foot, allowing for opportunistic sites to be placed where a change in vegetation structure or composition was observed.

Flora and vegetation was described and sampled systematically at each quadrat and additional opportunistic collecting was undertaken wherever previously unrecorded plants were observed. At each site the following floristic and environmental parameters were noted:

- GPS location
- topography
- soil type and colour
- outcropping rocks and their type
- percentage cover and average height of each vegetation stratum.

For each vascular plant species, the average height, number of plants and percent cover were recorded.

All plant specimens collected during the field surveys were identified using appropriate reference material or through comparisons with pressed specimens housed at the Western Australian Herbarium where necessary. Nomenclature of the species recorded is in accordance with Western Australian Herbarium (1998-).

3.3 Data analysis and vegetation mapping

Pattern analysis

A number of different pattern analyses were carried out on the data collected from quadrats in the survey area. Prior to carrying out the analyses, annual, weed and singleton species were removed from the data. Version 3.12 of the multivariate statistical analysis package PATN (Belbin, 1989; Belbin, 2004) was used to analyse the data. The statistical analyses included using only species presence and absence data and then presence and absence and cover data. Two different association measures, Bray-Curtis and Kulczynski, were used in each analysis for each of the species data types and four separate analyses were carried out to define the floristic communities of the survey area.

Indicator Species Analysis

After carrying out the pattern analyses and defining the floristic communities an indicator species analysis was run on the quadrat data. PC-Ord (McCune & Mefford, 2010) was used selecting the Dufrene and Legendre (1997) analysis option to determine indicator species for each community. Indicator species are considered to be those species with a high observed indicator value (Dai, Page & Duffy, 2006).

Indicator values are obtained by combining the relative abundances and relative frequencies of the species occurring in each community/association. A Monte Carlo Permutation Test was used to determine the significance of the observed indicator value (maximum) for each species, based on 1,000 randomisations.

Species with a 100% observed indicator value and a p value of ≤ 0.05 are considered to be perfect indicator species. Species with an observed indicator value of 80% - 99% and a p value of ≤ 0.05 are considered to be high indicator species. Species with an observed indicator value of 50% to 79% and a p value ≤ 0.05 are considered to be moderate indicator species. Species with an observed indicator value of > 30% to 49% and p value of ≤ 0.05 are considered to be low indicator species. Species with an observed indicator value of ≤ 30% and a p value of ≤ 0.05 are considered to be poor indicator species. Those species with a p value ≥ 0.05 are not considered to be indicator species.

Species Accumulation Curve

A Species Accumulation Curve was generated for the data collected from quadrats using the software package EstimateS and the methodology outlined in Colwell (2006). The results of the species accumulation analysis are used to estimate the percentage of the flora of the area that was sampled. This estimate is calculated using the last Sobs (Mao Tau) result divided by the last Chao2 Mean listed in the results table (where: Sobs is the total number of species observed in a sample or set of samples; Sobs (Mao Tau) is the number of samples expected in the pooled quadrat samples given the empirical data; and, the Chao2 Mean is the Chao2 richness estimator (mean among runs) (Colwell, 2006)). By dividing the species richness observed (Sobs [Mao Tau]) by the species richness predicted (Chao2 Mean) the sampling effort can be estimated.

Vegetation mapping

The results of the pattern analysis carried out on quadrat data were used to define floristic communities while the growth form, height classes and cover characteristics of dominant species were used to describe the vegetation types of the survey area. Vegetation types are described using the current National Vegetation Information System (NVIS) methodology at the association level (Level 5). At this level up to three strata and a maximum of three taxa per stratum are used to describe the vegetation type (ESCAVI, 2003). The NVIS structural formation terminology is outlined in Appendix 4; it utilises growth forms, height classes and foliage cover characteristics.

Vegetation descriptions included in the site sheets (Appendix 3) use the sub-association level (Level 6), where up to eight sub-strata and a maximum of five taxa per stratum are used to describe the subassociation (ESCAVI, 2003).

Bing aerial photography mosaic (Microsoft Corporation, 2016) captured between December 2009 and July 2014 was used to map the vegetation in ArcGIS 10.2.2. A standard scale was not used while mapping the vegetation and the finest scale used was approximately 1:500 for small discreet areas and 1:5,000 at the broadest scale for larger and more widespread areas.

Vegetation condition was mapped using data collected from quadrats, notes recorded while walking traverses and from Bing aerial photography. Field assessments of vegetation condition were updated as necessary once the plant identifications had been confirmed and the number, ecological impact and invasiveness ratings of any weed species located had been determined (Parks and Wildlife 2016b). The vegetation condition scale used is that for the Eremaean and Northern Botanical Provinces indicated in EPA and Parks and Wildlife (2015) and shown in Table 2.

Table 2: Vegetation condition scale (EPA and DPaW, 2015)

Vegetation Condition	Eremaean and Northern Botanical Provinces
1	
2	Pristine or nearly so, no obvious signs of damage caused by human activities since European settlement.
3	Some relatively slight signs of damage caused by human activities since European settlement. For example some signs of damage to tree trunks caused by repeated fire, the presence of some relatively non-aggressive weeds or occasional vehicle tracks.
4	More obvious signs of damage caused by human activity since European settlement, including some obvious impact on the vegetation structure such as that caused by low levels of grazing or slightly aggressive weeds.
5	Still retains basic vegetation structure or ability to regenerate it after very obvious impacts of human activities since European settlement, such as grazing, partial clearing, frequent fires or aggressive weeds.
6	Severely impacted by grazing, very frequent fires, clearing or a combination of these activities. Scope for some regeneration but not to a state approaching good condition without intensive management. Usually with a number of weed species present including very aggressive species.
7	Areas that are completely or almost completely without native species in the structure of their vegetation; i.e. areas that are cleared or 'parkland cleared' with their flora comprising weed or crop species with isolated native trees or shrubs.

Significance ratings

The following attributes were considered in the assessment of local conservation significance of the vegetation types (VTs)mapped: the cover of each VT mapped, the percentage of the VT surveyed, the number of CSF species located in the VT, the number of weed species recorded in the VT, the dominant condition of the vegetation of the VT, whether the VT occurs outside the survey area, and any other attributes that could increase the significance of the VT (e.g. whether the VT could be a GDE, dependent on surface flow or runoff or is described as an Environmentally Sensitive Area [ESA]). The attributes and scoring system used to assess the local significance of the VTs mapped in the survey area are listed in Appendix 5.

3.4 Survey limitations and constraints

Table 3 displays the evaluation of the flora and vegetation assessment against a range of potential limitations that may have an effect on that assessment. Based on this evaluation, the assessment has not been subject to constraints that would affect the thoroughness of the assessment and the conclusions reached.

Table 3: Flora and vegetation survey potential limitations and constraints

Potential limitation	Impact on assessment	Comment
Sources of information and availability of contextual information (i.e. pre-existing background versus new material).	**Not a constraint.**	The survey has been undertaken in the Carnarvon region which has been well studied and documented with ample literature available (Beard 1990). Additionally, the survey area was subject to a Level 1 flora and vegetation survey in 2013 which contains site specific information pertaining to flora and vegetation (Western Botanical 2013).
Scope (i.e. what life forms, etc., were sampled).	**Not a constraint.**	Due to the degraded nature and uniform distribution of vegetation within the survey area and timing of the survey (i.e. spring); most life forms are likely to have been sampled adequately during the time of the survey.
Proportion of flora/fauna collected and identified (based on sampling, timing and intensity).	**Not a constraint.**	The proportion of flora surveyed was adequate. The entire survey area was traversed and flora species were recorded systematically.
Completeness and further work which might be needed (i.e. was the relevant survey area fully surveyed).	**Not a constraint**	The information collected during the survey was sufficient to assess the vegetation that was present during the time of the survey.
Mapping reliability.	**Not a constraint.**	Aerial photography of a suitable scale was used to map the survey area and identify potential fauna habitat. Sites were chosen from these aerials to reflect changes in community structure. Opportunistic sites were also used if differences were observed during on ground reconnaissance. Vegetation types were assigned to each site based on topography, soil type and presence/absence and percent foliage cover of vegetation.
Timing, weather, season, cycle.	**Not a constraint.**	Flora and vegetation surveys are normally conducted 6-8 weeks post west season in the Eremaean Province (i.e. surveys should be undertaken in August-September). The field assessment was conducted in October (i.e. spring) in fine weather conditions. While the survey was conducted slightly later than recommended, annual species were still present and able to be identified in most cases, therefore this factor is not considered to be a constraint.
Disturbances (fire flood, accidental human intervention, etc.).	**Not a constraint.**	The survey area and regional surrounds have been subject to disturbance over a significant period of time. Given the wide range of this disturbance, this is not considered to be a limitation within the survey area.
Intensity (in retrospect, was the intensity adequate).	**Not a constraint.**	The survey area was traversed on foot and all differences in vegetation structure were recorded appropriately.
Resources (i.e. were there adequate resources to complete the survey to the required standard).	**Not a constraint.**	The available resources were adequate to complete the survey.
Access problems (i.e. ability to access survey area).	**Not a constraint.**	Existing tracks enabled adequate access to survey the vegetation and fauna within the survey area. Where access was not available by car, the area was easily traversed by foot.
Experience levels (e.g. degree of expertise in species identification to taxon level).	**Not a constraint.**	All survey personnel have the appropriate training in sampling and identifying the flora of the region.

4. Results

4.1 Desktop assessment results

A total of 386 native vascular plant taxa from 63 plant families have the potential to occur within the survey area (Parks and Wildlife 2007-; DEE 2016c). The majority of taxa were from within the Fabaceae (56 taxa), Chenopodiaceae (48 taxa) and Asteraceae (48 taxa) families (Appendix 2).

4.1.1 Threatened and Priority flora

A desktop survey for Threatened and Priority flora that may potentially occur within the survey area was undertaken using NatureMap (Parks and Wildlife 2007-), the Western Australian Herbarium (Western Australian Herbarium 1998-), and the DEE Protected Matters Search Tool (DEE 2016c).

Flora within Western Australia that is considered to be under threat may be classed as either Threatened flora or Priority flora. Where flora has been gazetted as Threatened flora under the WC Act, the taking of such flora without the written consent of the Minister is an offence. The WC Act defines "to take" flora as to gather, pluck, cut, pull up, destroy, dig up, remove or injure the flora or to cause or permit the same to be done by any means. Parks and Wildlife (2015) contains the current list of Threatened flora in Western Australia.

Priority flora are considered to be species which are potentially under threat, but for which there is insufficient information available concerning their distribution and/or populations to make a proper evaluation of their conservation status. Parks and Wildlife categorises Priority flora according to their conservation priority using five categories, P1 (highest conservation significance) to P5 (lowest conservation significance), to denote the conservation priority status of such species. Priority flora species are regularly reviewed and may have their priority status changed when more information on the species becomes available. Appendix 1 defines levels of Threatened and Priority flora (Western Australian Herbarium 1998-).

At the national level, the EPBC Act lists Threatened species as extinct, extinct in the wild, critically endangered, endangered, vulnerable, or conservation dependent. Appendix 1 defines each of these categories of Threatened species. The EPBC Act prohibits an action that has or will have a significant impact on a listed Threatened species without approval from the Australian Government Minister for the Environment. The current EPBC Act list of Threatened flora may be found on the DEE (2016d) website.

Table 4 shows the Threatened and Priority flora potentially occurring within the survey area. The desktop assessment identified one Threatened flora and eight Priority flora species that have been recorded in the regional area. Of these, based on specific habitat requirements, one Threatened flora species and eight Priority flora species were considered to have the potential to occur within the survey area.

Western Botanical (2013) identified *Gnephosis* sp. Billabong (P 1) as highly likely to occur within the survey area. This species has since been renamed to *Gnephosis gynotricha* and removed from the Priority species list, and is no longer considered to be of conservation significance.

Table 4: Threatened and Priority flora potentially occurring within the survey area

Species	Conservation status		Description	Potential to occur
	EPBC Act	WC Act		
Tecticornia bulbosa	**Threatened** - Vulnerable	Threatened	A low sprawling shrub growing to 1 m high by 1-3 m in diameter. The spreading branches consist of barrel-shaped segments (known as 'articles') about 15 mm long and 12 mm wide, which are coated with a thick waxy powder. The articles are hairless and pale blue or pink. The lateral flowering spikes, which are up to 20 mm long, are stalkless with opposite bracts that are united and have wavy edges. The hermaphroditic flowers are arranged in groups of three. Flowering occurs in June. The outer floral whorl is united and has succulent side walls, but is otherwise thin, hard and brittle. The tip is flattened and divided into two lateral lobes. The fruiting spike is dark brown and persistent. Enclosing the fruitlets are cup-shaped leathery bracts. The fruitlets are partially spiny and eventually become free from one another and from the bracts. The seeds produced by this shrub are smooth and pale brown. Habitat for this species includes saline sandy clay or red/brown loam (Western Australian Herbarium 1998-, DotE 2015d).	**Possible** – Preferred soil type/habitat occurs within the survey area
Abutilon sp. Pritzelianum (S. van Leeuwen 5095)	Not listed	Priority 1	No information is available on this species.	**Undeterminable** – Limited information is available on this species – may occur
Myriocephalus nudus	Not listed	Priority 1	An annual, herb, growing to 0.2 m tall. Flowers are yellow, occurring in January or April to November. Habitat for this species includes moist areas, along rivers and creeks and granite outcrops (Western Australian Herbarium 1998-).	**Possible** – Preferred soil type/habitat occurs within the survey area
Schoenia filifolia subsp. *arenicola*	Not listed	Priority 1	An erect, single-stemmed annual, herb growing to 0.5 m tall. Flowers are yellow, occurring from August to September. Habitat for this species includes sand and red clay on sub-coastal sand ridges (Western Australian Herbarium 1998).	**Possible** – Preferred soil type/habitat occurs within the survey area
Atriplex spinulosa	Not listed	Priority 1	A monoecious, erect, rounded annual herb, growing up to 0.2 m tall.	**Undeterminable** – Limited information is available on this species – may occur
Acacia ryaniana	Not listed	Priority 2	A prostrate, straggly or domed, spinescent shrub, 0.1-0.4 m tall. Flowers are yellow, occurring from June to November. Habitat for this species includes white or red sand on coastal sand dunes (Western Australian Herbarium 1998).	**Unlikely** – Preferred soil type/habitat does not occur within the survey area
Chthonocephalus tomentellus	Not listed	Priority 2	A prostrate to ascending annual herb. Flowers are yellow, occurring from August to November. Habitat for this species includes red sand on undulating plains, sand dunes, and near saline depressions (Western Australian Herbarium 1998).	**Possible** – Preferred soil type/habitat occurs within the survey area
Rumex crystallinus	Not listed	Priority 2	An annual herb, 0.06-0.4 m tall. Flowering occurs in August and November. Habitat for this species includes arid and semi-arid areas (Western Australian Herbarium 1998).	**Possible** – Preferred soil type/habitat occurs within the survey area
Sporobolus blakei	Not listed	Priority 3	A tufted perennial, grass-like or herb, 0.45-0.6 m tall. Flowers are green-purple, occurring in March or June to July. Habitat for this species includes red sandy clay and loam and creeks (Western Australian Herbarium 1998).	**Possible** – Preferred soil type/habitat occurs within the survey area

4.1.2 Threatened and Priority Ecological Communities

A TEC is defined under the EP Act as an ecological community listed, designated or declared under a written law or a law of the Australian Government as Threatened, Endangered or Vulnerable. There are four State categories of TECs (DEC 2010)[1]:

- presumed totally destroyed (PD)
- critically endangered (CR)
- endangered (EN)
- vulnerable (VU).

A description of each of these TEC categories is presented in Appendix 1. TECs are gazetted as such (Parks and Wildlife 2015a) and some Western Australian TECs listed by Parks and Wildlife (2015c) are also listed as Threatened under the EPBC Act.

Under the EPBC Act, a person must not undertake an action that has or will have a significant impact on a listed TEC without approval from the Australian Government Minister for the Environment, unless those actions are not prohibited under the EPBC Act. A description of each of these categories of TECs is presented in Appendix 1. The current EPBC Act list of TECs can be located on the DEE (2016e) website.

Ecological communities identified as Threatened, but not listed as TECs, are classified as Priority Ecological Communities (PECs). These communities are under threat, but there is insufficient information available concerning their distribution to make a proper evaluation of their conservation status. Parks and Wildlife categorises PECs according to their conservation priority, using five categories, P1 (highest conservation significance) to P5 (lowest conservation significance), to denote the conservation priority status of such ecological communities. Appendix 1 defines PECs (DEC 2010). Parks and Wildlife (2016) contains a list of current PECs.

One TEC (*Subtropical and Temperate Coastal Saltmarsh* – Vulnerable [EPBC Act]) and no PECs were identified as having the potential to occur within 5 km of the survey area by the desktop survey. This TEC is located approximately 4 km to the west of Area B.

[1] The Department of Environment and Conservation is still listed as the author of all TEC and PEC databases and have been referred to as such in this document instead of the Department of Parks and Wildlife (Parks and Wildlife).

4.2 Field survey results

4.2.1 Native flora

A total of 103 native vascular plant taxa from 68 plant genera and 29 plant families were recorded from quadrats within the survey area. The majority of taxa were recorded within the Chenopodiaceae (21 taxa) and Asteraceae (20 taxa) families (Appendix 3; Appendix 4). The relatively low number of plant genera recorded reflects the disturbed nature of the survey area.

4.2.2 Threatened and Priority flora

No Threatened flora species as listed under section 178 of the EPBC Act or pursuant to Schedule 1 of the WC Act and as listed by Parks and Wildlife (2015) were recorded within the survey area. One Priority flora species as listed by Western Australian Herbarium (1998-) was potentially recorded within the survey area. The species identification for *Corchorus congener* was unable to be confirmed due to lack of suitable flowering/fruiting material, however it is highly likely that this is the species recorded within the survey area. Table 5 and Figure 4 display the species recorded and their locations within the survey area.

Western Botanical (2013) identified *Gnephosis* sp. Billabong (P 1) as highly likely to occur within the survey area. This species was recorded within the survey area, however has since been renamed to *Gnephosis gynotricha* and removed from the Priority species list, and is no longer considered to be of conservation significance.

Table 5: Locations of Threatened and Priority flora species recorded within the survey area

Species	Conservation status		GPS location (GDA 94)	
	EPBC Act	WC Act	Easting	Northing
Corchorus ?congener	Not listed	Priority 3	[redacted]	[redacted]

4.2.3 Introduced (exotic) taxa

A total of 14 introduced (exotic) taxa were recorded within the survey area (Appendix 3; Appendix 4):

- **Asphodelus fistulosus*
- **Brassica rapa*
- **Cenchrus ciliaris*
- **Cenchrus setiger*
- **Chenopodium murale*
- **Chloris virgata*
- **Malvastrum americanum*
- **Medicago polymorpha*
- **Mesembryanthemum crystallinum*
- **Prosopis pallida*
- **Rumex vesicarius*
- **Sisymbrium erysimoides*
- **Sonchus oleraceus*
- **Vachellia farnesiana.*

None of these species is a Declared Plant species in Western Australia pursuant to section 22 of the *Biosecurity and Agriculture Management Act 2007* (BAM Act) according to the Western Australian Department of Agriculture and Food (DAFWA 2016).

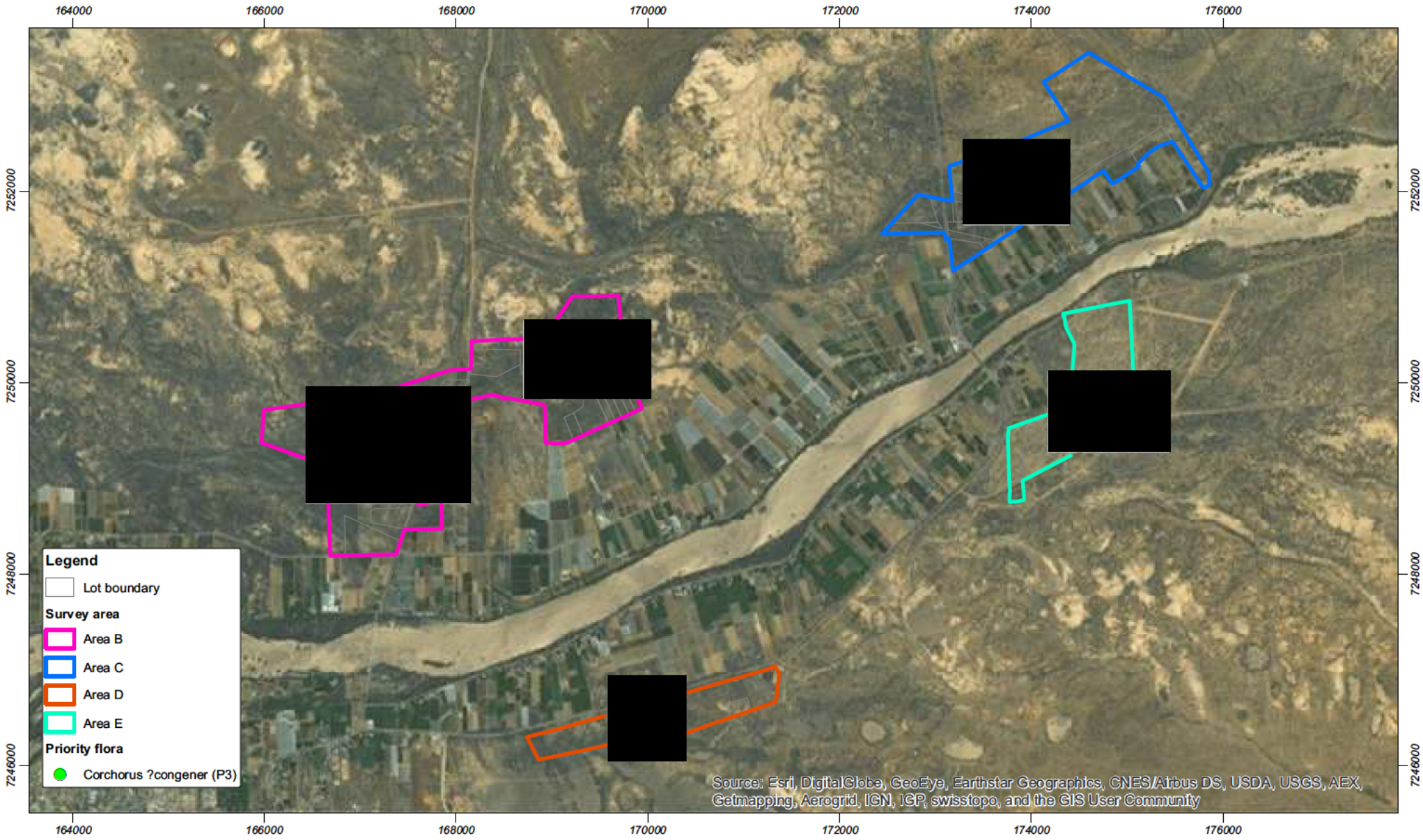

Figure 4: Location of Priority Flora located within the survey area

Scale 1:55,000 at A4

0 300 600 900 1,200 1,500 m

N

Coordinate System: GDA 1994 MGA Zone 50
Note that positional errors may occur in some areas
Date: 21/02/2017
Author: [redacted]
Source: Aerial image: ESRI, approx. 2012.

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4.2.4 Accumulated species – sites surveyed (species-area curve)

The species-area curve (Figure 5), based on a species accumulation analysis of the 35 quadrats was used to evaluate the adequacy of sampling (Colwell 2013). The results of the analysis are presented in Appendix 4. The species accumulation analysis indicate that 71% of the flora estimated to be in the survey area were recorded when the 105 confirmed taxa recorded in the 35 quadrats assessed in the survey area were included in the analysis. However, this estimate does not include the 12 additional taxa recorded opportunistically and in the one relevé assessed.

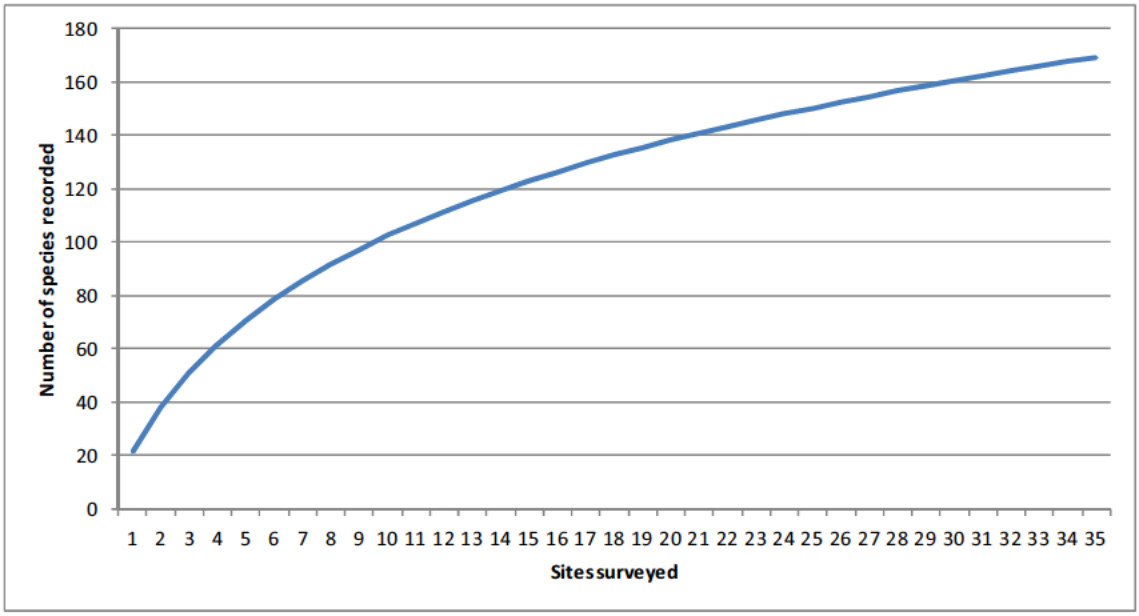

Figure 5: Averaged randomised Species Accumulation Curve

4.2.5 Vegetation types

Six native vegetation types (VTs) were defined and mapped within the survey area (Appendix 3; Figure 6) and are summarised in Table 6. Areas containing vegetation in parkland cleared or highly degraded state have not been counted as unique native VTs but have been included in Table 6 for area calculation purposes. Total areas occupied within the survey area by each of the identified VTs are set out in Table 7.

Table 6: Vegetation Types

Vegetation Type	Description
ASL (1): *Acacia* Shrubland	Tall Sparse to Open Shrubland of *Acacia sclerosperma* subsp. *sclerosperma* and / or *A. synchronicia* with a Sparse to Open Shrubland of *Rhagodia eremaea* and *Alectryon oleifolius* subsp. *oleifolius* and an Open Tussock Grassland of **Cenchrus ciliaris* and / or *Chloris pumilio*.
ASL (2): *Acacia* Shrubland	Tall Sparse Shrubland of *Acacia sclerosperma* subsp. *sclerosperma* and / or *A. synchronicia* with a Sparse Chenopod Shrubland of *Atriplex amnicola* and *A. semilunaris* and Sparse Tussock Grassland of **Cenchrus ciliaris*.
EWL (3): *Eucalyptus* woodland	Low Woodland of *Eucalyptus victrix* with a Sparse Tall Shrubland of *Acacia sclerosperma* subsp. *sclerosperma* and *Rhagodia eremaea* and an Open Tussock grassland of **Cenchrus ciliaris*.
CSL (4): Chenopod shrubland	Low Open mixed Chenopod Shrubland (*Atriplex holocarpa*, *A. amnicola*, *Threlkeldia diffusa*).
CSL (5): Chenopod shrubland	Open Chenopod Shrubland of *Maireana polypterygia* with a mixed Low Sparse Chenopod Shrubland (*Sclerolaena eurotioides*, *Atriplex codonocarpa*, *A. semilunaris*) with a Low Open Forbland of *Tetragonia diptera*.
CDSL (6): *Chenopodium* and *Duma* shrubland	*Chenopodium* and *Duma* Shrubland Open Shrubland of *Chenopodium auricomum* and *Duma florulenta* with a Low Sparse mixed Tussock grassland (*Eulalia aurea*, *Panicum decompositum*, *Sporobolus mitchellii*) and +/- Isolated Low Trees of *Eucalyptus victrix*.
Cleared	Cleared areas.

Vegetation type coverage

The total area mapped within the survey area and project area was 878.49 ha and 594.76 ha, respectively, and which includes fully cleared areas (Table 7). The dominant native VT within the survey area was ASL (1) which can be broadly described as a 'Tall Sparse to Open Shrubland of *Acacia sclerosperma* subsp. *sclerosperma* and / or *A. synchronicia* with a Sparse to Open Shrubland of *Rhagodia eremaea* and *Alectryon oleifolius* subsp. *oleifolius* and an Open Tussock Grassland of **Cenchrus ciliaris* and / or *Chloris pumilio*'.

Table 7: Area (ha) and percentage covered by each VT mapped within the survey area and project area

VT	Survey area		Project area			
	B, C, D and E		LPS10		LPS11	
	Area (ha)	% of the Survey area	Area (ha)	% of the project area	Area (ha)	% of the project area
ASL (1)	486.06	55.33	98.42	51.92	267.79	66.09
ASL (2)	78.35	8.92	49.51	26.12	10.33	2.55
EWL (3)	188.25	21.43	0.15	0.08	84.15	20.77
CSL (4)	35.92	4.09	14.02	7.40	14.03	3.46
CSL (5)	25.30	2.88	0.00	0.00	24.87	6.14
CDSL (6)	19.20	2.19	19.20	10.13	0.00	0.00
Cleared	45.41	5.16	8.27	4.35	4.02	0.99
TOTAL	**878.49**	**100.00**	**189.57**	**100.00**	**405.19**	**100.00**

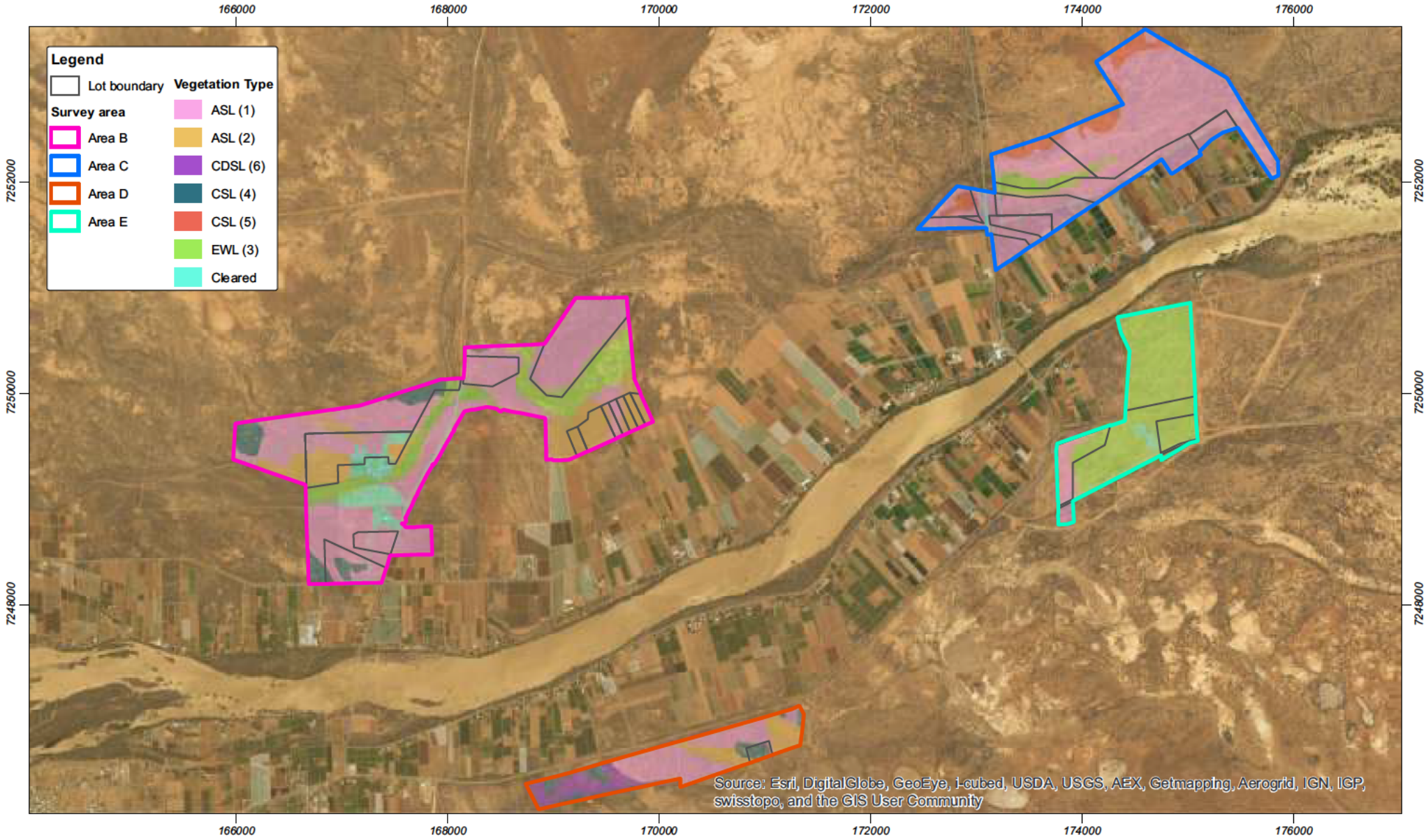

Figure 6: Vegetation Types (VTs) mapped within the survey area

Scale 1:50,000 at A4

0 300 600 900 1,200 1,500 m

N

Coordinate System: GDA 1994 MGA Zone 50
Note that positional errors may occur in some areas
Date: 20/02/2017
Author: JCrute
Source: Aerial image: ESRI, approx. 2012.

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4.2.6 Vegetation condition

The survey area and project area show signs of having been degraded for a long period of time through historical clearing and grazing by livestock. As such, majority of the vegetation condition within the survey area is rated as 3 (vegetation structure altered) and the remainder (i.e. areas excluded or isolated from grazing) as 2 (pristine or nearly so); Figure 7; Figure 7).

Parks and Wildlife ranking of the weed species located in the quadrats were considered while assessing vegetation condition. Many of the weed species were widely distributed and dominant in some areas (e.g. **Cenchrus ciliaris*) and most weed species were considered to have moderate to high ecological impact and rapid invasiveness according to the Parks and Wildlife Midwest assessment spreadsheet (Parks and Wildlife 2013).

Table 8 gives a numerical breakdown of the area occupied by each vegetation condition rating within the survey area and project area.

Table 8: Area (ha) and percentage covered by each vegetation condition category mapped within the survey area and project area

Vegetation Condition	Comment	Survey area		Project area			
		Area (ha)	% of the survey area	Area (ha) LPS 10	% of the project area LPS 10	Area (ha) LPS 11	% of the project area LPS 11
2 (pristine or nearly so)	Areas where there was little evidence of disturbance by feral animals or human activities were mapped as 2. The diversity and cover of weed species was lower than areas mapped as 3. This rating was consistent at quadrats on clay pans and loamy plains (chenopod shrublands) with less palatable plant species for feral animals to graze on and areas away from existing plantations and homesteads.	44.50	5.07	19.20	10.13	24.87	6.14
3 (vegetation structure altered)	The structure of vegetation in these areas was obviously altered from ongoing disturbance from feral animals or human activities. This was particularly evident in Area E where vegetation cover was visibly denser outside of the fenced lot boundaries. This is quite obvious when looking at aerial photographs. The cover and diversity of weed species in the areas mapped as 3 was higher than in those mapped as 2. There was often damage to individual taller shrubs from horses and other feral animals. Fenced cattle / horse yards along with old abandoned vehicles and general household rubbish were also recorded in these areas.	788.57	89.76	162.10	85.51	376.30	92.87
Cleared		45.42	5.17	8.27	4.36	4.02	0.99
Total		**878.49**	**100**	**189.57**	**100**	**405.19**	**100**

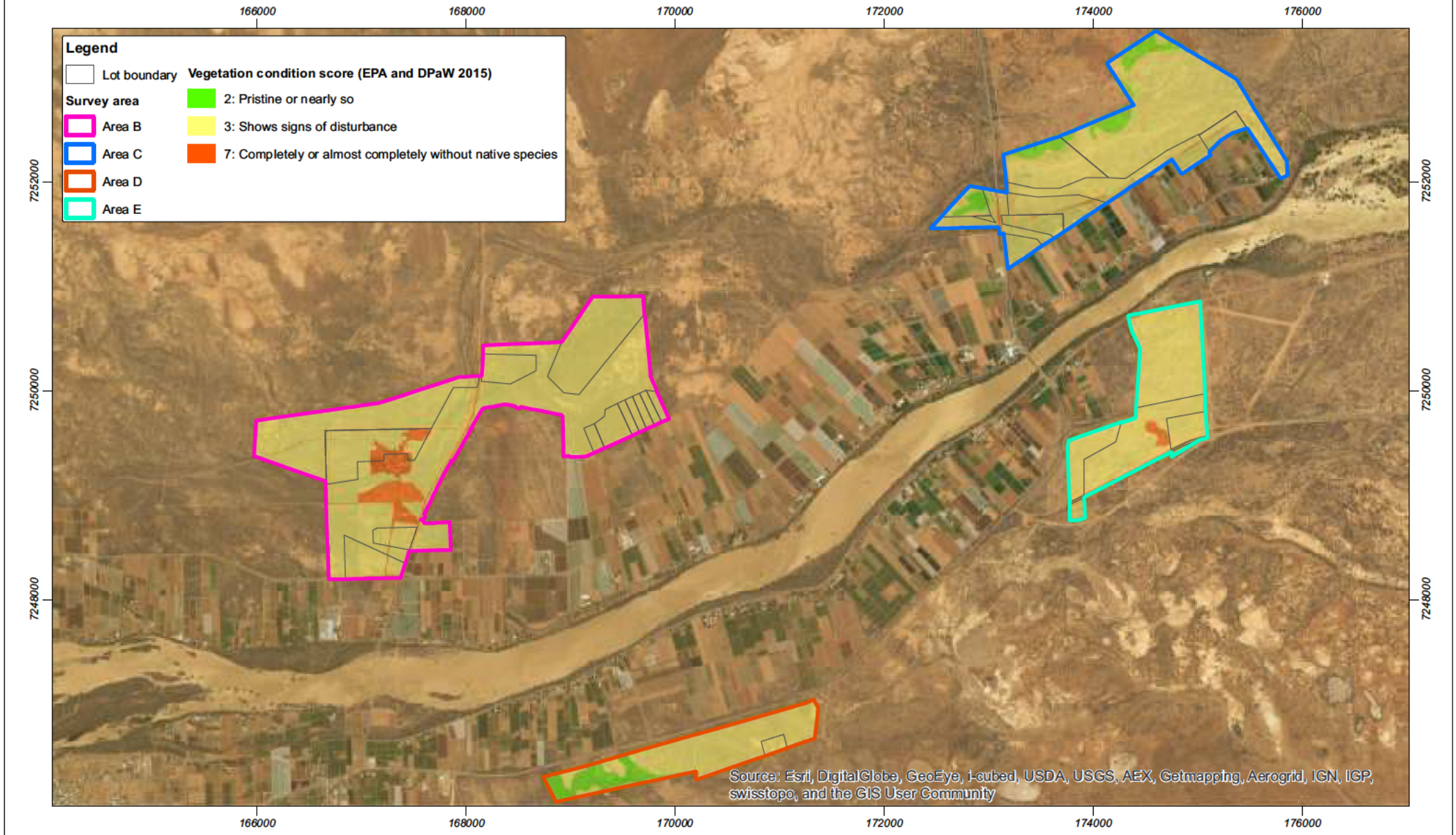

Figure 7: Vegetation condition mapped within the survey area

Scale 1:50,000 at A4

0 300 600 900 1,200 1,500 m

N

Coordinate System: GDA 1994 MGA Zone 50
Note that positional errors may occur in some areas
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Author: J Crute
Source: Aerial image: ESRI, approx. 2012.

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4.3 Vegetation types and Beard Vegetation Associations

Three of Beard's vegetation associations (VAs) occur in the Study Area (129, 308 and 1271) and the VTs mapped in these VAs are listed in Table 9. There is some similarity between the species and cover of the shrubs in the VAs with the VTs mapped in the VAs. Two of the VTs do not match the description for any of the VAs mapped in the survey area (EWL (3) and CDSL (6)). Both contain *Eucalyptus victrix* as a tree layer and the three VAs mapped in the survey area do not contain *E. victrix*. Grey cells in Table 9 indicate where one or more of the species in Beard's description also occur in the mapped VTs. Differences reflect the different scales at which the vegetation was mapped, quality of aerial photographs available for the mapping and the sampling carried out by Beard in the survey area and surrounds.

Table 9: Beard vegetation associations and mapped vegetation types

VT	VA (NVIS Level 5) and Maia vegetation types mapped within them (indicated by an "x")		
	129: *Acacia sclerosperma* Sparse Shrubland.	**308**: *Acacia sclerosperma*, *Hakea preissii* and *Senna* sp. Sparse Shrubland.	**1271**: *Atriplex* sp., *Maireana* sp. mixed Sparse Chenopod Shrubland.
ASL (1)	x	x	
ASL (2)	x	x	
EWL (3)			
CSL (4)		x	x
CSL (5)		x	x
CDSL (6)			

Note: VT = mapped vegetation type, VA = Beard vegetation association, VA source = Department of Agriculture and Food Western Australia (DAFWA) (2012).

4.4 Threatened and Priority Ecological Communities

No TECs or PECs occur within the survey area and none of the VTs identified during the survey resemble the TECs or PECs listed in the Midwest bioregion.

4.5 Groundwater Dependent Ecosystems and Inflow Dependent Ecosystems

Some of the species that occur in VTs EWL (3) and CDSL (6), particularly the trees and larger shrubs, are likely to use groundwater at least some time during the year. The Bureau of Meteorology Groundwater Dependent Atlas indicates that the entire survey area has a high potential for groundwater interaction (BoM 2017) (Figure 8).

Figure 9 indicates that there is low potential for a GDE reliant on surface expression of groundwater (rivers, springs, wetlands) across the majority of the survey area except for some of the southern portion of Area E (those areas associated with the McNeil Claypans), which show a moderate potential.

As indicated in Figure 10, all of Area D, most of Areas C and E and the southern portion of Area B are highly likely to be Inflow Dependent Ecosystems (IDEs) while the remaining areas are likely to be IDEs. As the survey area lies on the Gascoyne River flood plains, all of the VTs are likely to be dependent on seasonal surface water from high rainfall events. Inflow dependence refers to areas that are wetter than surrounding areas either seasonally or permanently, because they receive water from inflows (e.g. surface water, soil water etc.) in addition to rainfall. While these ecosystems are not listed as conservation significant communities, they have the potential to be impacted by drawdown and should be considered in an environmental impact assessment if such activities are proposed.

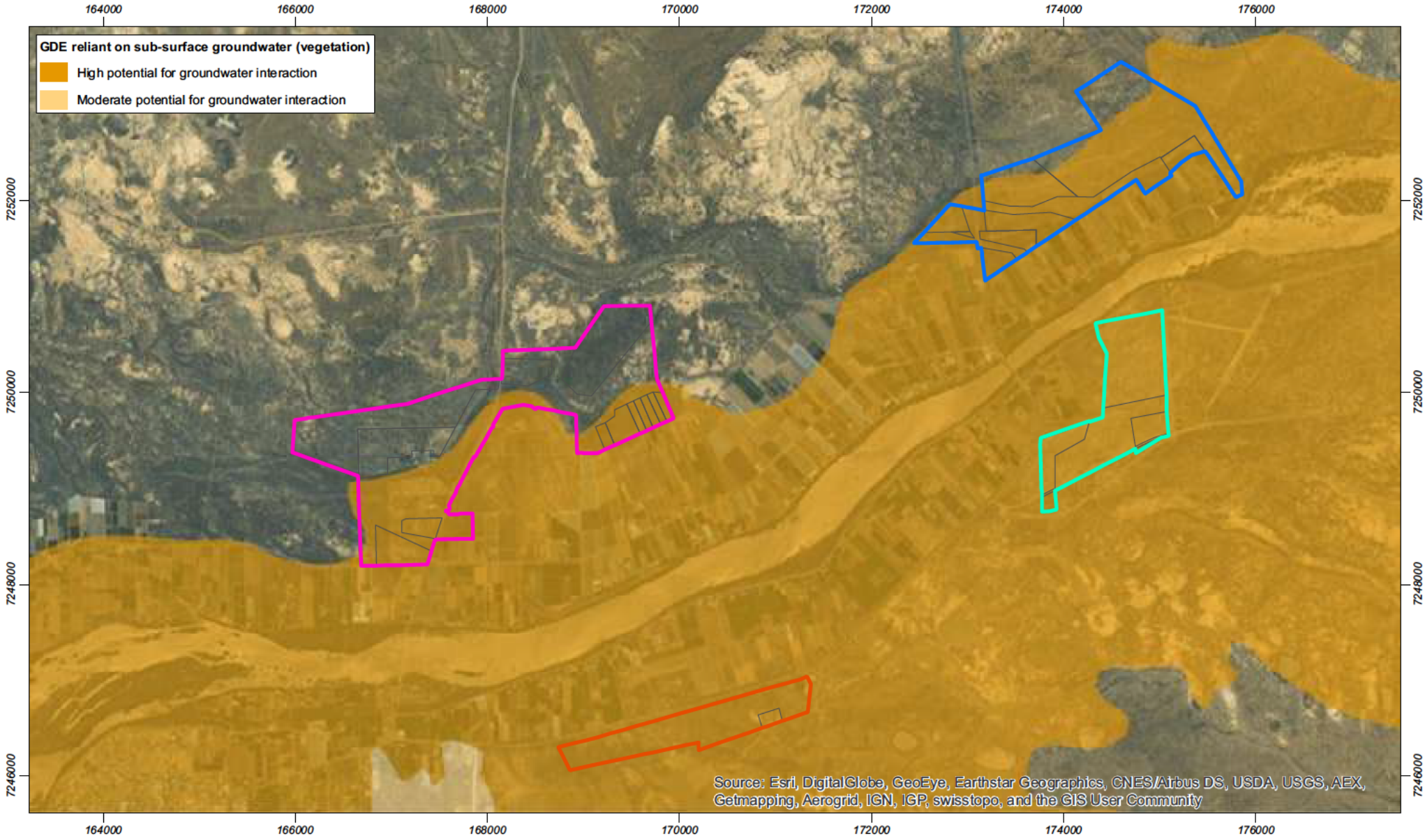

Figure 8: Groundwater Dependent Ecosystems (GDE) reliant on subsurface groundwater (vegetation)

Scale 1:55,000 at A4

0 300 600 900 1,200 1,500 m

N

Coordinate System: GDA 1994 MGA Zone 50
Note that positional errors may occur in some areas
Date: 21/02/2017
Author: JCrute
Source: Aerial image: ESRI, approx. 2012; GDE Subsurface data: BoM 2017.

Legend

Lot boundary
Area B
Area C
Area D
Area E

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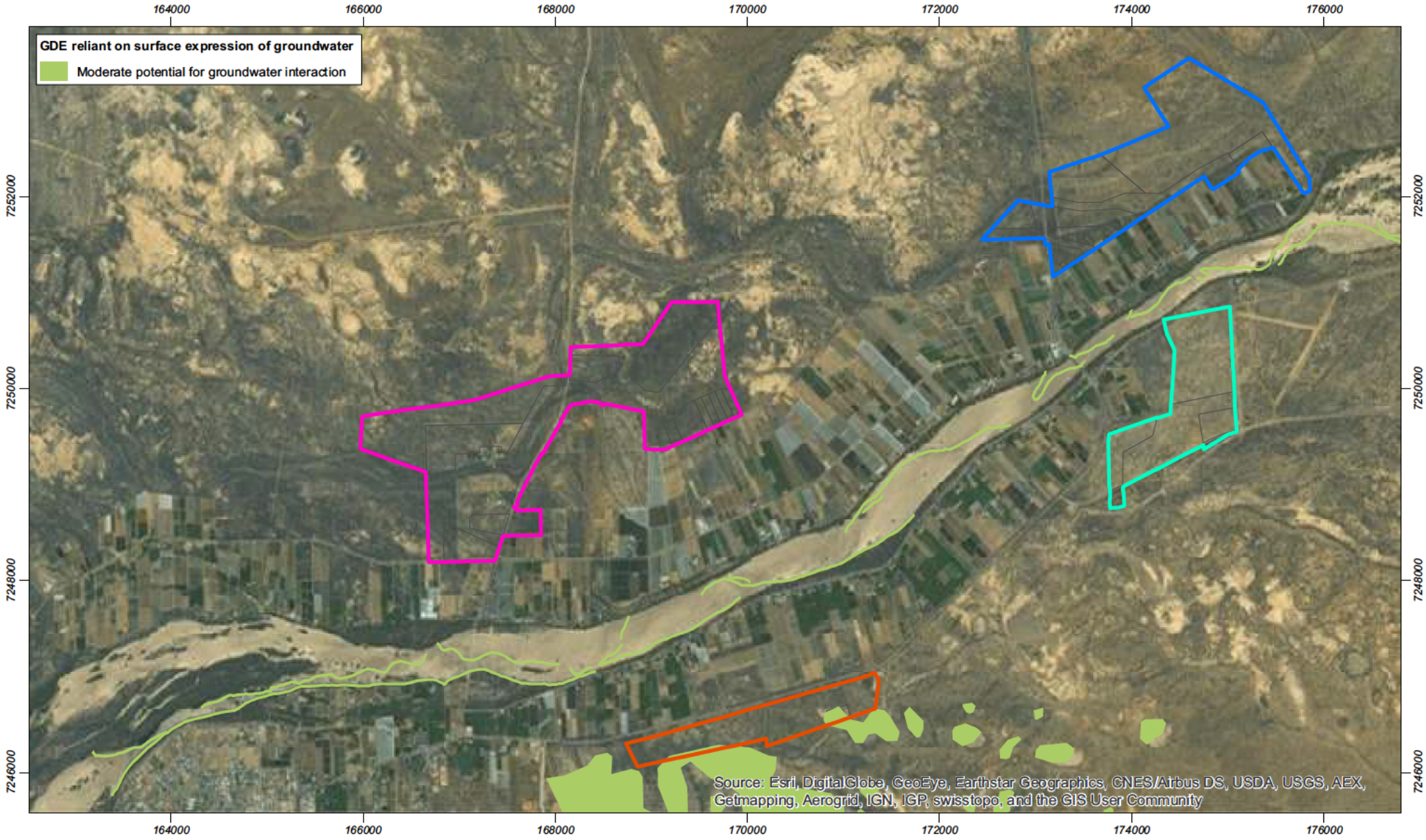

Figure 9: Groundwater Dependent Ecosystems reliant on surface expression of groundwater (rivers, springs, wetlands)

Scale 1:55,000 at A4

0 300 600 900 1,200 1,500 m

Coordinate System: GDA 1994 MGA Zone 50
Note that positional errors may occur in some areas
Date: 21/02/2017
Author: JCrute
Source: Aerial image: ESRI, approx. 2012; GDE surface data: BoM 2017.

Legend

- Survey area
- Area B
- Area C
- Area D
- Area E
- Lot boundary

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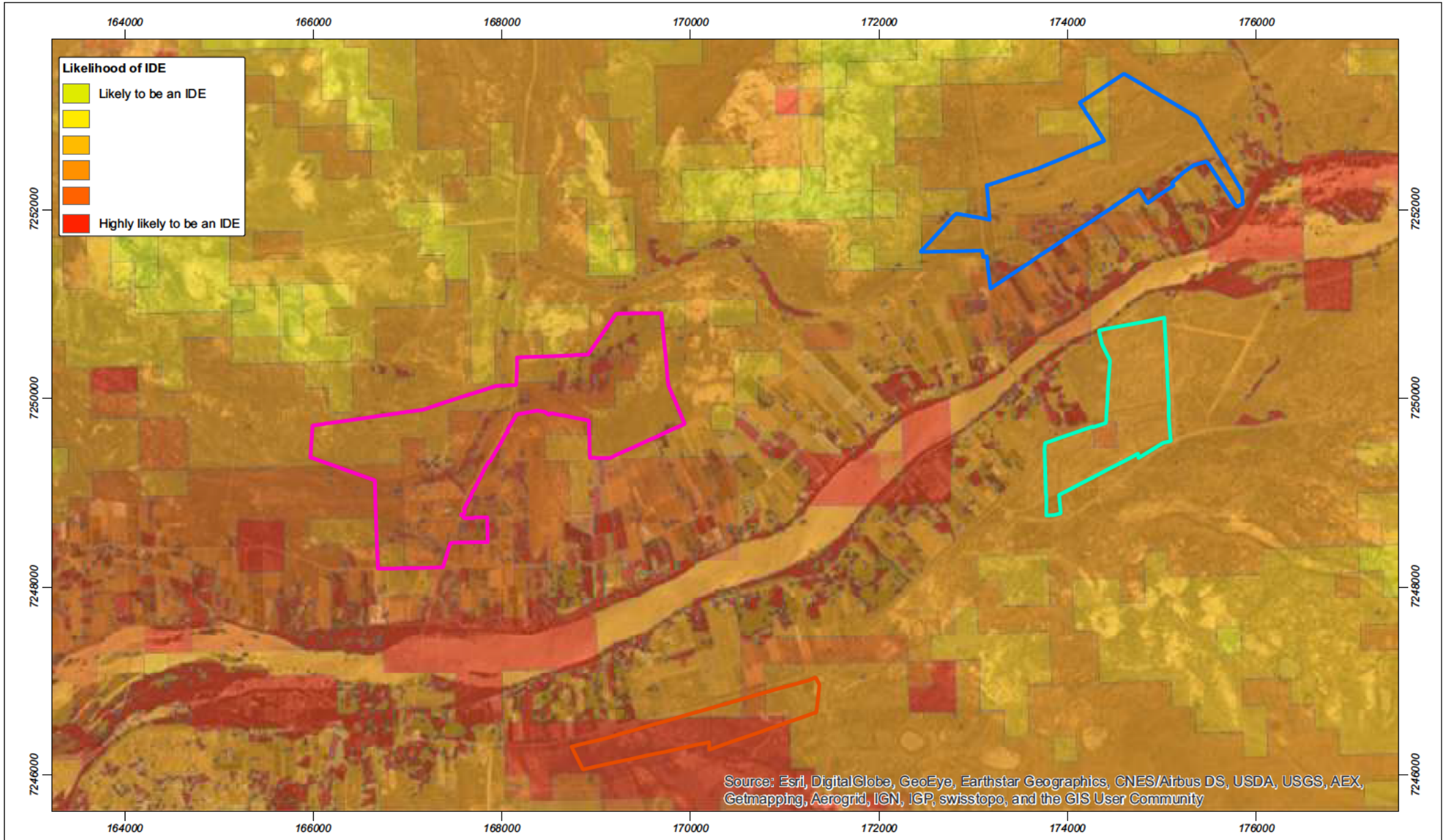

Figure 10: Inflow Dependent Ecosystems (IDE) reliant on other sources of water in addition to rainfall (e.g. surface water, soil water, irrigation)

Scale 1:55,000 at A4

0 300 600 900 1,200 1,500 m

N

Coordinate System: GDA 1994 MGA Zone 50
Note that positional errors may occur in some areas
Date: 27/02/2017
Author: JCrute
Source: Aerial image: ESRI, approx. 2012; GDE Subsurface data: BoM 2017.

Legend

Area B
Area C
Area D
Area E
Lot boundary

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4.6 Environmentally Sensitive Areas

One ESA, the McNeill Claypan System boundary, extends into parts of Area D (Figure 11). The McNeill Claypan is described in Australian Government (2017) as "*Flats low lying, covered in rushes and is completely inundated by water after rain, contains some water all year round in an area where permanent surface water is rare. Some run off from north side of Browne Range and Flats fringed by Euc sp. Bird life is profuse after good rains and contains better than average bird life for the area all year round".* Two VTs fall within the ESA boundary, CSL (4) and CDSL (6) (Figure 11). CSL (4) was also mapped in Area B and the areas mapped in the southern portion of Area D are part of the ESA, while those in Area B are not.

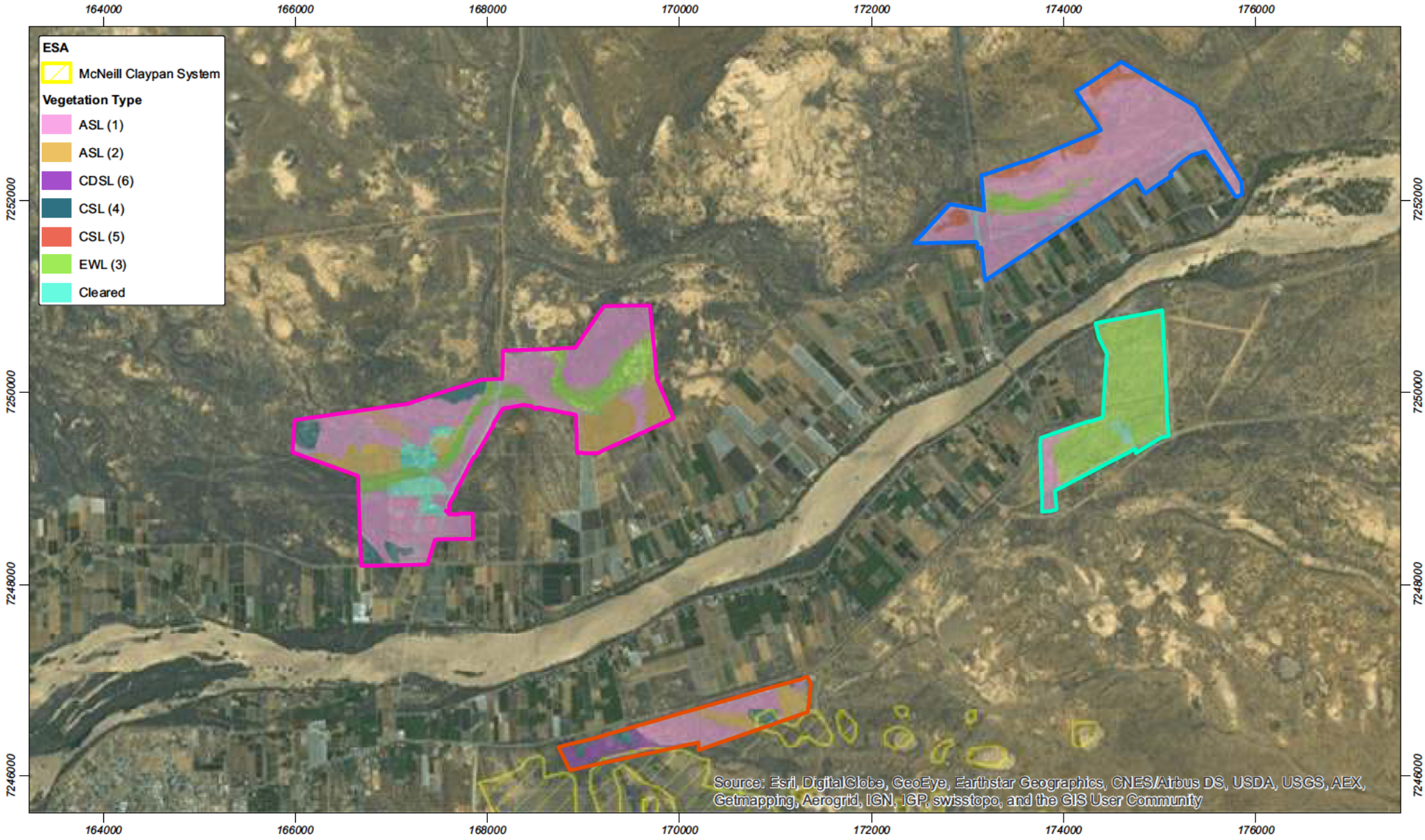

Figure 11: Environmentally Sensitive Areas (ESAs) within the survey area

Scale 1:55,000 at A4

0 300 600 900 1,200 1,500 m

N

Coordinate System: GDA 1994 MGA Zone 50
Note that positional errors may occur in some areas
Date: 21/02/2017
Author: JCrute
Source: Aerial image: ESRI, approx. 2012; GDE Subsurface data: BoM 2017.

Legend

Survey area
Area B
Area C
Area D
Area E
Lot boundary

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4.7 Conservation significant vegetation

The significance of the vegetation of the survey area is discussed in the following subsections. Regional or other vegetation mapping which extends over the survey area includes Beard's vegetation mapping and land systems mapping. The region used for this significance assessment is the Wooramel subregion of the Carnarvon bioregion.

Local significance of the vegetation of the survey area is assessed using predominantly vegetation types mapped in the survey area; however, an analysis of the local significance of the Vegetation Associations (VAs) mapped by Beard and of the land systems mapped in the survey area is also included.

4.7.1 Regional and Local Significance of Beard's Vegetation Associations

The regional and local significance assessments for the three VAs mapped in the survey area (VA 129, 308 and 1271) are included in Appendix 5.

Vegetation Association regional significance

The attributes and scoring systems used to assess the regional significance of the VAs of the survey area are listed in Appendix 5, Table A 1. The results of the significance assessment are listed in Appendix 5, Table A 2.

- Using this scoring system, VA 308 is rated as having high regional conservation significance and VAs 129 and 1271 as moderate regional conservation significance.

Vegetation Association local significance

The attributes and scoring systems used to assess the local significance of the VAs of the survey area are listed in Appendix 5, Table A 3. The results of the significance assessment are listed in Appendix 5, Table A 4.

- Using this system two VAs 129 and 308 are rated as having low local conservation significance and VA 1271 is rated as having moderate local conservation significance.

4.8 Regional and Local Significance of Land Systems

The regional and local significance of the three land systems mapped in the survey area (Chargoo, Delta and River) is assessed in Appendix 5.

Land System regional significance

The attributes and scoring systems used to assess the regional significance of the land systems of the survey area are listed in Appendix 5, Table A 5. The results of the significance assessment are listed in Appendix 5, Table A 6.

- Using this scoring system, Delta land system is rated as having high regional conservation significance and the Chargoo and River land systems as moderate regional conservation significance.

Land System local significance

The attributes and scoring systems used to assess the local significance of the land systems of the survey area are listed in Appendix 5, Table A 7. The results of the significance assessment are listed in Appendix 5, Table A 8.

- Using this scoring system the Delta and River land systems are rated as having low local conservation significance and the Chargoo land system as having moderate local conservation significance.

Vegetation Type local significance

The attributes and scoring system used to assess the local significance of the VTs mapped in the survey area are listed in Appendix 5, Table A 9 and the results of the significance assessment are listed and summarised in Appendix 5, Table A 10.

The local significance rating calculated using the conservation significance scoring system is moderate for the six vegetation types mapped in the survey area.

Table 10: Local conservation significance of mapped vegetation types

VT code	Cover of Survey (Local) Area (%)	# of quadrats assessed in VT	% of VT assessed by traverses	CSF in VT	# of CSF in VT	# of weed species in VT	Average veg. condition	Occurs outside survey area?	Any other attributes increasing CS?	Local CS
ASL (1)	55.33	19	13.32		0	6	3	Yes	GDE, IDE	Moderate
ASL (2)	8.92	3	12.16	C?c (?P3)	1	5	3	Yes	GDE, IDE	Moderate
EWL (3)	21.43	3	10.49		0	6	3	Yes	GDE, IDE	Moderate
CSL (4)	4.09	5	14.86		0	5	3	Yes	ESA, GDE, IDE	Moderate
CSL (5)	2.88	2	16.51		0	2	2	Yes	GDE, IDE	Moderate
CDSL (6)	2.19	3	16.51		0	2	2	Yes	GDE, IDE	Moderate

Notes: VT = vegetation type; % = percentage; # = number; CSF = conservation significant flora; veg. = vegetation; CS = conservation significance; IDE = Inflow dependent ecosystem; GDE = groundwater dependent ecosystem; C?c = Corchorus ?congener;?P3 = potential Priority 3.

5. Discussion

Vegetation within the survey area comprises six VTs and cleared areas. Transitions between VTs were generally discontinuous, though occasionally abrupt with margins representing admixtures of more than one VT. This discontinuity is primarily due to changes in soil profile and topography, and presence of cleared areas. At a broad scale, the majority of the survey area was observed to be in various states of degradation due to historical clearing within the survey area. The majority of the remnant vegetation shows signs of degradation and structural alteration.

The flora and vegetation assessment conducted within the survey area was undertaken during October 2016, during the prime flowering time for majority of species within the area with field reconnaissance focussing on traversing the entire survey area to delineate broad vegetation types. This is consistent with the requirements of a Level 2 flora and vegetation survey as specified in GS 51.

The number of species recorded within the survey area totalled 103 native vascular plant taxa from 68 plant genera and 29 plant families and 14 introduced taxa. No Declared Plant species pursuant to section 22 of the BAM Act were recorded within the survey area (DAFWA 2016).

No Threatened flora species as listed under section 178 of the EPBC Act or pursuant to Schedule 1 of the WC Act and as listed by Parks and Wildlife (2015) were recorded within the survey area. One Priority flora species (*Corchorus ?congener* [P3]) as listed by Western Australian Herbarium (1998-) was recorded within the survey area. Given that the survey was conducted during the prime flowering time for majority of the conservation significant species potentially occurring within the survey area, it is highly unlikely that occurrences of other conservation significant species are present within the survey area.

Vegetation condition within the survey area ranged from 7 (areas completely or almost completely without native species) to 2 (pristine or nearly so) as per the vegetation condition scale (EPA and Parks and Wildlife 2015). The majority of the survey area (approximately 93%) was mapped on the condition scale as 3 (Some signs of disturbance). It is worth noting that a large portion of vegetation within the survey area has experienced modification due to historical land use including clearing and cattle grazing over the area.

Vegetation recorded within the survey area did not resemble known TECs or PECs listed in the Midwest bioregion. The closest TEC to the survey area (*Subtropical and Temperate Coastal Saltmarsh*) is located 4 km from the survey area. Based on the statistical analyses undertaken as part of this assessment, it can be reasonably assumed that no TECs or PECs occur within the survey area. One ESA, the McNeill Claypan System boundary, extends into parts of Area D. Two VTs fall within the ESA boundary, CSL (4) and CDSL (6).

Three of Beard's Vegetation Associations (VA 129, 308 and 1271) occur within the survey area, corresponding to vegetation mapped within four out of the six VTs (ASL(1), ASL(2), CSL(4), CSL(5)). Based on the significance assessment, VA 308 has high regional conservation significance and VAs 129 and 1271 have moderate regional conservation significance. VA 1271 has moderate and VAs129 and 308 have low local conservation significance. The Delta land system within the survey area is rated as having high regional conservation significance, whilst the Chargoo and River land systems have moderate regional conservation significance. The Chargoo land system has moderate local conservation significance whilst the other land systems within the survey area are rated to have low local conservation significance. Using the conservation significance scoring system, the six vegetation types mapped within the survey area were rated as having moderate local conservation significance.

The survey area has a high potential for groundwater interaction and some of the species that occur in VTs EWL (3) and CDSL (6), particularly the trees and larger shrubs, are likely to directly access groundwater at least some time during the year. Area D, most of Areas C and E and the southern portion of Area B are highly likely to be Inflow Dependent Ecosystems (IDEs) while the remaining areas are likely to be IDEs. As the survey area lies on the Gascoyne River flood plains, all of the VTs mapped are likely to be dependent on seasonal surface water from high rainfall events. While IDEs are not listed as conservation significant communities, they have the potential to be impacted by drawdown and should be considered in an environmental impact assessment if such activities are proposed.

6. Conclusion

The Level 2 flora and vegetation survey (conducted October 2016) has been successful in collecting data to define and assess the presence, extent and significance of vegetation types within the survey area.

Approximately 878.5 ha of vegetation ranging in condition (scale 2- almost pristine to 7- almost no native species present) was recorded within the survey area (includes weed infested areas).

No Threatened flora species as listed under section 178 of the EPBC Act or pursuant to Schedule 1 of the WC Act and as listed by Parks and Wildlife (2015) were recorded within the survey area. One Priority flora species (*Corchorus ?congener* [P3]) as listed by Western Australian Herbarium (1998-) was recorded within the survey area. Given that the survey was conducted during the prime flowering time for majority of the conservation significant species potentially occurring within the survey area, it is highly unlikely that occurrences of other conservation significant species are present within the survey area.

The vegetation recorded within the survey area did not resemble known TECs or PECs listed in the Midwest bioregion. The closest TEC to the survey area (Subtropical and Temperate Coastal Saltmarsh) is located 4 km from the survey area. Based on the statistical analyses undertaken as part of this assessment, it can be reasonably assumed that no TECs or PECs occur within the survey area.

One ESA, the McNeill Claypan System boundary, extends into parts of Area D. Two VTs fall within the ESA boundary, CSL (4) and CDSL (6).

Using the conservation significance scoring system, the survey area contains VAs and land systems of moderate to high regional conservation significance and low to moderate local conservation significance. The six vegetation types mapped within the survey area were rated as having moderate local conservation significance.

As the survey area lies on the Gascoyne River flood plains, all of the VTs mapped are likely to be dependent on seasonal surface water from high rainfall events. Area D, most of Areas C and E and the southern portion of Area B are highly likely to be Inflow Dependent Ecosystems (IDEs).

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Appendix 1
Conservation significant flora and ecological community definitions

Conservation Codes for Western Australia (Western Australian Herbarium 1998-)

Under the *Wildlife Conservation Act* (1950), the Minister for the Environment may declare species of flora to be protected if they are considered to be in danger of extinction, rare or otherwise in need of special protection. Schedules 1 and 2 deal with those that are threatened and those that are presumed extinct, respectively.

T: Threatened Flora (Declared Rare Flora – Extant)

Species 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, and have been gazetted as such (Schedule 1 under the *Wildlife Conservation Act 1950*).

Threatened Flora (Schedule 1) are further ranked by the Department according to their level of threat using IUCN Red List Criteria:

- CR: Critically Endangered – considered to be facing an extremely high risk of extinction in the wild
- EN: Endangered – considered to be facing a very high risk of extinction in the wild
- VU: Vulnerable – considered to be facing a high risk of extinction in the wild
- X: Presumed Extinct Flora (Declared Rare Flora – Extinct).

Species that have been adequately searched for and there is no reasonable doubt that the last individual has died, and have been gazetted as such (Schedule 2 under the *Wildlife Conservation Act 1950*).

Priority Flora

Species that have not yet been adequately surveyed to be listed under Schedule 1 or 2 are added to the Priority Flora List 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 list for other than taxonomic reasons, are placed in Priority 4. These species require regular monitoring. Conservation Dependent species are placed in Priority 5.

Priority One: Poorly-known Species

Species that are known from one or a few collections or sight records (generally less than 5), all on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, Shire, Westrail and Main Roads WA road, gravel and soil reserves, and active mineral leases and under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes.

Priority Two: Poorly-known Species

Species that are known from one or a few collections or sight records, some of which are on lands not under imminent threat of habitat destruction or degradation, e.g. national parks, conservation parks, nature reserves, State forest, vacant Crown land, water reserves, etc. Species may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes.

Priority Three: Poorly-known Species

Species that are known from collections or sight records from several localities not under imminent threat, or from few but widespread localities with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and known threatening processes exist that could affect them.

Priority Four: Rare, Near Threatened and other species in need of monitoring

1. Rare: Species that are considered to be 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.
2. Near Threatened: Species that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable.
3. Species that have been removed from the list of threatened species during the past 5 years for reasons other than taxonomy.

Priority 5: 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 5 years.

Definition of Threatened Ecological Communities (DEC 2010)

Presumed Totally Destroyed (PD)

An ecological community will be listed as presumed totally destroyed if there are no recent records of the community being extant and either of the following applies:

- records within the last 50 years have not been confirmed despite thorough searches of known or likely habitats or
- all occurrences recorded within the last 50 years have since been destroyed.

Critically Endangered (CR)

An ecological community will be listed as Critically Endangered when it has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future. This will be determined on the basis of the best available information, by it meeting any one or more of the following criteria:

1. The estimated geographic range, and/or total area occupied, and/or number of discrete occurrences since European settlement have been reduced by at least 90% and either or both of the following apply:
   (a) geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is imminent (within approximately 10 years)
   (b) modification throughout its range is continuing such that in the immediate future (within approximately 10 years) the community is unlikely to be capable of being substantially rehabilitated.
2. Current distribution is limited, and one or more of the following apply:
   (a) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the immediate future (within approximately 10 years)
   (b) there are very few occurrences, each of which is small and/or isolated and extremely vulnerable to known threatening processes
   (c) there may be many occurrences but total area is very small and each occurrence is small and/or isolated and extremely vulnerable to known threatening processes.
3. The ecological community exists only as highly modified occurrences that may be capable of being rehabilitated if such work begins in the immediate future (within approximately 10 years).

Endangered (EN)

An ecological community will be listed as Endangered when it has been adequately surveyed and is not Critically Endangered but is facing a very high risk of total destruction in the near future. This will be determined on the basis of the best available information by it meeting any one or more of the following criteria:

1. The geographic range, and/or total area occupied, and/or number of discrete occurrences have been reduced by at least 70% since European settlement and either or both of the following apply:
   (a) the estimated geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is likely in the short term future (within approximately 20 years)
   (b) modification throughout its range is continuing such that in the short term future (within approximately 20 years) the community is unlikely to be capable of being substantially restored or rehabilitated.

2. Current distribution is limited, and one or more of the following apply"
    (a) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the short term future (within approximately 20 years)
    (b) there are few occurrences, each of which is small and/or isolated and all or most occurrences are very vulnerable to known threatening processes
    (c) there may be many occurrences but total area is small and all or most occurrences are small and/or isolated and very vulnerable to known threatening processes.
3. The ecological community exists only as very modified occurrences that may be capable of being substantially restored or rehabilitated if such work begins in the short-term future (within approximately 20 years).

Vulnerable (VU)

An ecological community will be listed as Vulnerable when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing a high risk of total destruction or significant modification in the medium to long-term future. This will be determined on the basis of the best available information by it meeting any one or more of the following criteria:

1. The ecological community exists largely as modified occurrences that are likely to be capable of being substantially restored or rehabilitated.
2. The ecological community may already be modified and would be vulnerable to threatening processes, is restricted in area and/or range and/or is only found at a few locations.
3. The ecological community may be still widespread but is believed likely to move into a category of higher threat in the medium to long term future because of existing or impending threatening processes.

Definition of Priority Ecological Communities (DEC 2010)

Priority One: Poorly-known ecological communities

Ecological communities with apparently few, small occurrences, all or most not actively managed for conservation (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) and for which current threats exist. Communities may be included if they are comparatively well-known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.

Priority Two: Poorly-known ecological communities

Communities that are known from few small occurrences, all or most of which are actively managed for conservation (e.g. within national parks, conservation parks, nature reserves, State forest, unallocated Crown land, water reserves, etc.) and not under imminent threat of destruction or degradation. Communities may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under threat from known threatening processes.

Priority Three: Poorly known ecological communities

- communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation
- communities known from a few widespread occurrences, which are either large or within significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat
- communities made up of large, and/or widespread occurrences, that may or not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, and inappropriate fire regimes.

Communities may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and/or are not well defined, and known threatening processes exist that could affect them.

Priority Four

Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list. These communities require regular monitoring. These include:

1. Rare. Ecological communities known from few occurrences that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These communities are usually represented on conservation lands.
2. Near Threatened. Ecological communities that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable.
3. Ecological communities that have been removed from the list of threatened communities during the past five years.

Priority Five: Conservation Dependent ecological communities

Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

Appendix 2
Desktop assessment results (Parks and Wildlife 2007-, DEE 2016c)

NatureMap Species Report

Created By Guest user on 03/02/2017

Kingdom	Plantae
Current Names Only	Yes
Core Datasets Only	Yes
Method	'By Circle'
Centre	[redacted]
Buffer	15km
Group By	Family

Family	Species	Records
Acanthaceae	2	9
Aizoaceae	4	7
Amaranthaceae	14	30
Apocynaceae	3	6
Asparagaceae	5	7
Asphodelaceae	1	2
Asteraceae	48	115
Boraginaceae	4	5
Brassicaceae	5	16
Cactaceae	4	5
Campanulaceae	4	6
Capparaceae	1	3
Caryophyllaceae	1	4
Chenopodiaceae	48	125
Convolvulaceae	7	17
Crassulaceae	3	4
Cymodoceaceae	2	4
Cyperaceae	11	21
Elatinaceae	1	1
Euphorbiaceae	7	16
Fabaceae	56	160
Frankeniaceae	2	5
Gentianaceae	1	1
Geraniaceae	2	4
Goodeniaceae	7	15
Gyrostemonaceae	1	3
Hemerocallidaceae	1	5
Juncaginaceae	1	1
Lamiaceae	2	18
Lauraceae	1	1
Loranthaceae	3	3
Lythraceae	2	3
Malvaceae	15	25
Marsileaceae	1	1
Martyniaceae	1	3
Molluginaceae	1	2
Moringaceae	1	1
Myrtaceae	8	31
Nitrariaceae	1	4
Nyctaginaceae	3	16
Oleaceae	1	4
Orobanchaceae	1	1
Papaveraceae	1	2
Passifloraceae	2	3
Phrymaceae	1	2
Phyllanthaceae	1	1
Plantaginaceae	3	6
Plumbaginaceae	1	3
Poaceae	42	114
Polygonaceae	3	6
Portulacaceae	3	7
Primulaceae	2	7
Proteaceae	2	3
Rhodomelaceae	1	1
Santalaceae	4	6
Sapindaceae	2	4
Scrophulariaceae	13	25
Solanaceae	8	16
Tamaricaceae	1	5
Thymelaeaceae	1	5
Typhaceae	1	1
Urticaceae	1	1
Zygophyllaceae	6	14
TOTAL	**386**	**942**

Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
Acanthaceae				

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
1.	6828	*Avicennia marina (White Mangrove)*			
2.	11320	*Dipteracanthus australasicus subsp. australasicus*			
Aizoaceae					
3.	2797	*Carpobrotus rossii (Karkalla)*			
4.	2810	*Gunniopsis septifraga*			
5.	2813	*Mesembryanthemum crystallinum (Iceplant)*	Y		
6.	2821	*Tetragonia diptera*			
Amaranthaceae					
7.	2646	*Aerva javanica (Kapok Bush)*	Y		
8.	2652	*Alternanthera nodiflora (Common Joyweed)*			
9.	2653	*Alternanthera pungens (Khaki Weed)*	Y		
10.	2666	*Amaranthus mitchellii (Boggabri Weed)*			
11.	2677	*Gomphrena celosioides (Gomphrena Weed)*	Y		
12.	18367	*Gomphrena kanisii*			
13.	2708	*Ptilotus chamaecladus*			
14.	2717	*Ptilotus divaricatus (Climbing Mulla Mulla)*			
15.	2731	*Ptilotus helipteroides (Hairy Mulla Mulla)*			
16.	41001	*Ptilotus nobilis subsp. nobilis (Yellow Tails)*			
17.	2747	*Ptilotus obovatus (Cotton Bush)*			
18.	34701	*Ptilotus polakii subsp. juxtus*			
19.	2751	*Ptilotus polystachyus (Prince of Wales Feather)*			
20.	2766	*Ptilotus villosiflorus*			
Apocynaceae					
21.	6584	*Cynanchum floribundum (Dumara Bush, Tjipa)*			
22.	16538	*Marsdenia graniticola*			
23.	13006	*Sarcostemma viminale subsp. australe*			
Asparagaceae					
24.	1208	*Acanthocarpus preissii*			
25.	1209	*Acanthocarpus robustus*			
26.	1211	*Acanthocarpus verticillatus*			
27.	1290	*Dichopogon tyleri*			
28.	46756	*Thysanotus exfimbriatus*			
Asphodelaceae					
29.	1364	*Asphodelus fistulosus (Onion Weed)*	Y		
Asteraceae					
30.	19902	*Actinobole drummondianum*			
31.	7822	*Angianthus acrohyalinus (Hook-leaf Angianthus)*			
32.	7832	*Angianthus milnei (Cone-spike Angianthus)*			
33.	7854	*Bidens bipinnata (Bipinnate Beggartick)*	Y		
34.	7871	*Brachyscome ciliaris*			
35.	7878	*Brachyscome iberidifolia*			
36.	7891	*Calocephalus francisii (Fine-leaf Beauty-heads)*			
37.	7905	*Calotis multicaulis (Many-stemmed Burr-daisy)*			
38.	19759	*Centipeda crateriformis subsp. crateriformis*			
39.	7918	*Centipeda cunninghamii (Common Sneezewood, Gukwonderuk, Old Man Weed)*			
40.	7919	*Centipeda minima (Spreading Sneezewood, Kanjirralaa, Inteng-inteng, Karengkal, Kata-palkalpa, Munyu-parnti-parnti)*			
41.	19762	*Centipeda minima subsp. macrocephala*			
42.	7934	*Chthonocephalus tomentellus*		P2	
43.	7939	*Conyza bonariensis (Flaxleaf Fleabane)*	Y		
44.	7951	*Cratystylis subspinescens (Australian Sage, Spiny Grey Bush)*			
45.	12739	*Erymophyllum ramosum*			
46.	7988	*Gnephosis arachnoidea (Cobwebby-headed Gnephosis)*			
47.	7995	*Gnephosis gynotricha*			
48.	7998	*Gnephosis macrocephala*			
49.	14349	*Gnephosis sp. Billabong (B. Nordenstam & A. Anderberg 203)*		P1	
50.	8002	*Gnephosis tenuissima*			
51.	29594	*Helichrysum luteoalbum (Jersey Cudweed)*			
52.	8045	*Helipterum craspedioides (Yellow Billy Buttons)*			
53.	8086	*Hypochaeris glabra (Smooth Catsear)*	Y		
54.	29046	*Lactuca serriola forma serriola*	Y		
55.	8109	*Minuria integerrima (Smooth Minuria)*			
56.	8119	*Myriocephalus nudus*		P1	
57.	17925	*Myriocephalus oldfieldii*			
58.	20611	*Pembertonia latisquamea*			
59.	17817	*Pluchea dunlopii*			
60.	17816	*Pluchea ferdinandi-muelleri*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
61.	8168	*Pluchea rubelliflora*			
62.	8170	*Pluchea tetranthera*			
63.	45240	*Podolepis aristata subsp. auriculata*			
64.	13242	*Rhodanthe chlorocephala subsp. splendida*			
65.	13300	*Rhodanthe citrina*			
66.	13246	*Rhodanthe humboldtiana*			
67.	13297	*Rhodanthe psammophila*			
68.	13254	*Rhodanthe stricta*			
69.	45154	*Roebuckiella cheilocarpa var. cheilocarpa*			
70.	45146	*Roebuckiella oncocarpa*			
71.	8200	*Schoenia cassiniana (Schoenia)*			
72.	13288	*Schoenia filifolia subsp. arenicola*		P1	
73.	8207	*Senecio glossanthus (Slender Groundsel)*			
74.	25883	*Senecio pinnatifolius var. pinnatifolius*			
75.	8231	*Sonchus oleraceus (Common Sowthistle)*	Y		
76.	8238	*Streptoglossa liatroides*			
77.	8254	*Urospermum picroides (False Hawkbit)*	Y		
Boraginaceae					
78.	17299	*Heliotropium ammophilum*			
79.	6727	*Trichodesma zeylanicum (Camel Bush, Kumbalin)*			
80.	13559	*Trichodesma zeylanicum var. grandiflorum*			
81.	11750	*Trichodesma zeylanicum var. zeylanicum*			
Brassicaceae					
82.	3000	*Brassica tournefortii (Mediterranean Turnip)*	Y		
83.	3002	*Cakile maritima (Sea Rocket)*	Y		
84.	3029	*Lepidium linifolium*			
85.	3030	*Lepidium lyratogynum*			
86.	3072	*Sisymbrium orientale (Indian Hedge Mustard)*	Y		
Cactaceae					
87.	20759	*Cylindropuntia fulgida var. mamillata*	Y		
88.	46204	*Opuntia dejecta*	Y		
89.	44779	*Opuntia ficus-indica*	Y		
90.	46205	*Opuntia microdasys*	Y		
Campanulaceae					
91.	7403	*Lobelia heterophylla (Wing-seeded Lobelia)*			
92.	36863	*Lobelia heterophylla subsp. heterophylla*			
93.		*Wahlenbergia sp.*			
94.	7393	*Wahlenbergia tumidifructa*			
Capparaceae					
95.	2976	*Capparis lasiantha (Split Jack, Balqarda)*			
Caryophyllaceae					
96.	2905	*Polycarpon tetraphyllum (Fourleaf Allseed)*	Y		
Chenopodiaceae					
97.	2450	*Atriplex amnicola (Swamp Saltbush)*			
98.	2453	*Atriplex codonocarpa (Flat-topped Saltbush)*			
99.	2459	*Atriplex holocarpa (Pop Saltbush)*			
100.	19894	*Atriplex lentiformis*	Y		Y
101.	2466	*Atriplex lindleyi*			
102.	11698	*Atriplex paludosa subsp. moquiniana*			
103.	2476	*Atriplex semilunaris (Annual Saltbush)*			
104.	2477	*Atriplex spinulosa*		P1	
105.	2481	*Atriplex vesicaria (Bladder Saltbush)*			
106.	2485	*Chenopodium auricomum (Queensland Bluebush)*			
107.	2489	*Chenopodium gaudichaudianum (Cottony Saltbush)*			
108.	2494	*Chenopodium murale (Nettle-leaf Goosefoot)*	Y		
109.	11632	*Dysphania glomulifera subsp. eremaea*			
110.	2505	*Dysphania platycarpa*			
111.	12064	*Enchylaena tomentosa var. tomentosa (Barrier Saltbush)*			
112.	2533	*Maireana amoena*			
113.	2534	*Maireana aphylla (Cotton Bush)*			
114.	2535	*Maireana appressa*			
115.	2538	*Maireana carnosa (Cottony Bluebush)*			
116.	2547	*Maireana lanosa (Woolly Bluebush)*			
117.	2557	*Maireana platycarpa (Shy Bluebush)*			
118.	2558	*Maireana polypterygia (Gascoyne Bluebush)*			
119.	11662	*Maireana tomentosa subsp. tomentosa*			
120.	11733	*Osteocarpum acropterum var. acropterum (Babbagia)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
121.	2582	*Rhagodia eremaea (Thorny Saltbush)*			
122.	11728	*Rhagodia latifolia subsp. latifolia*			
123.	11240	*Rhagodia preissii subsp. obovata*			
124.	30434	*Salsola australis*			
125.	2591	*Sarcocornia blackiana*			
126.	2593	*Sarcocornia quinqueflora (Beaded Samphire)*			
127.	2604	*Sclerolaena costata*			
128.	2607	*Sclerolaena densiflora*			
129.	2609	*Sclerolaena diacantha (Grey Copperburr)*			
130.	2612	*Sclerolaena eurotioides (Fluffy Bindii)*			
131.	8877	*Sclerolaena gardneri*			
132.	2628	*Sclerolaena recurvicuspis*			
133.	2641	*Tecticornia arborea (Bulli Bulli)*			
134.	31617	*Tecticornia bulbosa (Large-articled Samphire)*		T	
135.	31492	*Tecticornia disarticulata*			
136.	46513	*Tecticornia doliiformis*			
137.	33236	*Tecticornia halocnemoides (Shrubby Samphire)*			
138.	33238	*Tecticornia halocnemoides subsp. tenuis*			
139.	33319	*Tecticornia indica subsp. bidens*			
140.	33318	*Tecticornia indica subsp. leiostachya (Samphire)*			
141.	31674	*Tecticornia peltata*			
142.	31618	*Tecticornia pruinosa*			
143.	2642	*Tecticornia verrucosa*			
144.	2644	*Threlkeldia diffusa (Coast Bonefruit)*			
Convolvulaceae					
145.	11167	*Bonamia erecta*			
146.	6612	*Convolvulus clementii*			
147.	6614	*Convolvulus remotus*			
148.	6663	*Cuscuta epithymum (Lesser Dodder, Greater Dodder)*	Y		
149.	11783	*Ipomoea carnea subsp. fistulosa*	Y		
150.	6633	*Ipomoea muelleri (Poison Morning Glory, Yumbu)*			
151.	11312	*Ipomoea pes-caprae subsp. brasiliensis*			
Crassulaceae					
152.	3137	*Crassula colorata (Dense Stonecrop)*			
153.	3139	*Crassula exserta*			
154.	20271	*Crassula extrorsa*			
Cymodoceaceae					
155.	126	*Amphibolis antarctica (Sea Nymph)*			
156.	128	*Cymodocea angustata*			
Cyperaceae					
157.	750	*Bulbostylis barbata*			
158.	771	*Cyperus alterniflorus*			
159.	774	*Cyperus bifax (Downs Nutgrass)*			
160.	777	*Cyperus bulbosus (Bush Onion, Tjanmata)*			
161.	809	*Cyperus rigidellus*			
162.	810	*Cyperus rotundus (Nut Grass)*	Y		
163.	814	*Cyperus squarrosus*			
164.	818	*Cyperus vaginatus (Stiffleaf Sedge)*			
165.	822	*Eleocharis acuta (Common Spikerush)*			
166.	828	*Eleocharis pallens (Pale Spikerush)*			
167.	911	*Isolepis congrua*			
Elatinaceae					
168.	11642	*Bergia perennis subsp. obtusifolia*			
Euphorbiaceae					
169.	34237	*Beyeria cinerea subsp. borealis*			
170.	35307	*Euphorbia australis var. australis*			
171.	4629	*Euphorbia hirta (Asthma Plant)*	Y		
172.	4635	*Euphorbia myrtoides*			
173.	42869	*Euphorbia porcata*			
174.	4644	*Euphorbia sharkoensis*			
175.	12097	*Euphorbia tannensis subsp. eremophila (Desert Spurge)*			
Fabaceae					
176.	3209	*Acacia ampliceps*			
177.	13500	*Acacia coriacea subsp. coriacea*			
178.	3452	*Acacia murrayana (Sandplain Wattle)*			
179.	29016	*Acacia pyrifolia var. morrisonii*			
180.	29015	*Acacia pyrifolia var. pyrifolia*			

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181.	19499	*Acacia ramulosa var. ramulosa*			
182.	13071	*Acacia ryaniana*		P2	
183.	13078	*Acacia sclerosperma subsp. sclerosperma*			
184.	13070	*Acacia synchronicia*			
185.	3577	*Acacia tetragonophylla (Kurara, Wakalpuka)*			
186.	3680	*Aeschynomene indica (Budda Pea)*			
187.	3769	*Clitoria ternatea*	Y		
188.	3774	*Crotalaria cunninghamii (Green Birdflower, Bilbun)*			
189.	20175	*Crotalaria cunninghamii subsp. sturtii*			
190.	18147	*Crotalaria incana subsp. incana*	Y		
191.	20179	*Crotalaria medicaginea var. neglecta*			
192.	17117	*Cullen cinereum*			
193.	17417	*Cullen discolor*			
194.	17118	*Cullen leucanthum*			
195.	17116	*Cullen martinii*			
196.	3871	*Erythrina vespertilio (Yulbah)*			
197.	3938	*Glycine canescens (Silky Glycine)*			
198.	45436	*Indigofera chamaeclada subsp. pubens*			
199.	3973	*Indigofera colutea (Sticky Indigo)*			
200.	14884	*Indigofera occidentalis*			
201.	3994	*Isotropis forrestii*			
202.	4046	*Lablab purpureus (Lablab Bean)*	Y		
203.	4060	*Lotus australis (Austral Trefoil)*			
204.	4061	*Lotus cruentus (Redflower Lotus)*			
205.	4079	*Medicago polymorpha (Burr Medic)*	Y		
206.	4080	*Medicago sativa (Alfalfa)*	Y		
207.	4085	*Melilotus indicus*	Y		
208.	4097	*Mirbelia ramulosa*			
209.	33482	*Peltophorum pterocarpum*	Y		
210.	18373	*Prosopis glandulosa x velutina*	Y		
211.	3620	*Prosopis pallida (Mesquite, Algaroba)*	Y		
212.	4190	*Rhynchosia australis (Rhynchosia)*			
213.	12276	*Senna artemisioides subsp. filifolia*			
214.	12280	*Senna artemisioides subsp. oligophylla*			
215.	12305	*Senna glutinosa subsp. chatelainiana*			
216.	12309	*Senna glutinosa subsp. pruinosa*			
217.	4196	*Sesbania cannabina (Sesbania Pea)*			
218.	4217	*Swainsona beasleyana*			
219.	13592	*Swainsona calcicola*			
220.	4225	*Swainsona ecallosa*			
221.	4226	*Swainsona elegans*			
222.	12356	*Swainsona formosa*			
223.	4231	*Swainsona kingii*			
224.	13586	*Swainsona paucifoliolata*			
225.	4242	*Swainsona pterostylis*			
226.	19531	*Tephrosia rosea var. clementii*			
227.	15947	*Tephrosia sp. B Kimberley Flora (C.A. Gardner 7300)*			
228.	41815	*Tephrosia sp. Carnarvon (J.H. Ross 2681)*			
229.	39422	*Tephrosia sp. Onslow (K.R. Newbey 10571)*			
230.	4316	*Trigonella suavissima (Sweet Fenugreek)*			
231.	30716	*Vachellia farnesiana (Mimosa Bush)*	Y		
Frankeniaceae					
232.	5191	*Frankenia cinerea*			
233.	5209	*Frankenia pauciflora (Seaheath)*			
Gentianaceae					
234.	41660	*Schenkia australis*			
Geraniaceae					
235.	4333	*Erodium cicutarium (Common Storksbill)*	Y		
236.	4335	*Erodium cygnorum (Blue Heronsbill)*			
Goodeniaceae					
237.	11326	*Dampiera incana var. fuscescens*			
238.	7495	*Goodenia berardiana*			
239.	7501	*Goodenia corynocarpa*			
240.	7565	*Goodenia xanthosperma (Yellow-seeded Goodenia)*			
241.	7606	*Scaevola crassifolia (Thick-leaved Fan-flower)*			
242.	7644	*Scaevola spinescens (Currant Bush, Maroon)*			
243.	7648	*Scaevola tomentosa (Raggedleaf Fanflower)*			

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Gyrostemonaceae					
244.	2784	*Gyrostemon ramulosus (Corkybark)*			
Hemerocallidaceae					
245.	1286	*Corynotheca pungens*			
Juncaginaceae					
246.	146	*Triglochin minutissima*			
Lamiaceae					
247.	41063	*Quoya loxocarpa*			
248.	41061	*Quoya paniculata*			
Lauraceae					
249.	12073	*Cassytha aurea var. aurea*			
Loranthaceae					
250.	2383	*Amyema preissii (Wireleaf Mistletoe)*			
251.	11874	*Amyema sanguinea var. sanguinea*			
252.	12051	*Lysiana exocarpi subsp. exocarpi (Harlequin Mistletoe)*			
Lythraceae					
253.	5278	*Ammannia multiflora*			
254.	17848	*Lythrum wilsonii*			
Malvaceae					
255.	4892	*Abutilon geranioides*			
256.	4895	*Abutilon lepidum*			
257.	4902	*Abutilon oxycarpum (Flannel Weed)*			
258.	43021	*Abutilon sp. Pritzelianum (S. van Leeuwen 5095)*		P1	
259.	4904	*Alyogyne cuneiformis (Coastal Hibiscus)*			
260.	40916	*Androcalva lachna*			
261.	40910	*Androcalva luteiflora (Yellow-flowered Rulingia)*			
262.	18410	*Corchorus carnarvonensis*			
263.	4910	*Gossypium australe (Native Cotton)*			
264.	17782	*Hannafordia quadrivalvis subsp. recurva*			
265.	29316	*Hibiscus austrinus*			
266.	4962	*Malvastrum americanum (Spiked Malvastrum)*	Y		
267.	18149	*Sida rohlenae subsp. rohlenae*			
268.	16927	*Sida sp. Carnarvon (P.S. Short 2492)*			
269.	5106	*Waltheria indica*			
Marsileaceae					
270.	75	*Marsilea exarata*			
Martyniaceae					
271.	7121	*Proboscidea louisianica (Purple Flower Devil's Claw)*	Y		
Molluginaceae					
272.	2835	*Glinus lotoides (Hairy Carpet Weed)*			
Moringaceae					
273.	19717	*Moringa oleifera*	Y		
Myrtaceae					
274.	5640	*Eucalyptus eudesmioides (Malallie, Marlarli)*			
275.	14548	*Eucalyptus victrix*			
276.	5845	*Lamarchea hakeifolia*			
277.	5915	*Melaleuca glomerata*			
278.	44567	*Scholtzia obovata*			
279.	6041	*Scholtzia umbellifera*			
280.	44710	*Thryptomene dampieri*			
281.	6081	*Verticordia forrestii (Forrest's Featherflower)*			
Nitrariaceae					
282.	4366	*Nitraria billardierei (Nitre Bush)*			
Nyctaginaceae					
283.	2770	*Boerhavia coccinea (Tar Vine, Wituka)*			
284.	2775	*Boerhavia schomburgkiana*			
285.	2776	*Commicarpus australis (Perennial Tar Vine)*			
Oleaceae					
286.	6500	*Jasminum calcareum*			
Orobanchaceae					
287.	7103	*Striga curviflora*			

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Papaveraceae					
288.	17797	*Argemone ochroleuca subsp. ochroleuca*	Y		
Passifloraceae					
289.	5226	*Passiflora foetida (Stinking Passion Flower)*	Y		
290.	14096	*Passiflora foetida var. hispida*	Y		
Phrymaceae					
291.	7082	*Mimulus gracilis*			
Phyllanthaceae					
292.	45696	*Phyllanthus hamelinii (Shark Bay Phyllanthus)*			
Plantaginaceae					
293.	7098	*Stemodia grossa (Marsh Stemodia, Mindjaara)*			
294.		*Stemodia sp.*			
295.	7102	*Stemodia viscosa (Pagurda)*			
Plumbaginaceae					
296.	6490	*Muellerolimon salicorniaceum*			
Poaceae					
297.	207	*Aristida contorta (Bunched Kerosene Grass)*			
298.	226	*Arundo donax (Giant Reed)*	Y		
299.	229	*Astrebla pectinata (Barley Mitchell Grass)*			
300.	17237	*Austrostipa elegantissima*			
301.	258	*Cenchrus ciliaris (Buffel Grass)*	Y		
302.	259	*Cenchrus echinatus (Burrgrass)*	Y		
303.	272	*Chloris virgata (Feathertop Rhodes Grass)*	Y		
304.	273	*Chrysopogon fallax (Golden Beard Grass)*			
305.	275	*Chrysopogon pallidus (Ribbongrass)*			
306.	279	*Cymbopogon ambiguus (Scentgrass)*			
307.	283	*Cynodon dactylon (Couch)*	Y		
308.	290	*Dactyloctenium radulans (Button Grass)*			
309.	13741	*Dichanthium sericeum subsp. humilius*			
310.	353	*Eleusine indica (Crowsfoot Grass)*	Y		
311.	368	*Enteropogon ramosus (Windmill Grass, Curly Windmill Grass)*			
312.	369	*Eragrostis australasica (Canegrass)*			
313.	378	*Eragrostis dielsii (Mallee Lovegrass)*			
314.	388	*Eragrostis leptocarpa (Drooping Lovegrass)*			
315.	398	*Eragrostis tenellula (Delicate Lovegrass)*			
316.	399	*Eragrostis xerophila (Knotty-butt Neverfail)*			
317.	403	*Eriachne benthamii (Swamp Wanderrie)*			
318.	414	*Eriachne obtusa (Northern Wandarrie Grass)*			
319.	425	*Eriochloa procera (Cupgrass)*			
320.	11011	*Eulalia aurea*			
321.	471	*Leptochloa digitata (Whorled Cane Grass)*			
322.	19126	*Leptochloa fusca subsp. muelleri*			
323.	503	*Panicum decompositum (Native Millet, Kaltu-kaltu)*			
324.	513	*Paractaenum novae-hollandiae (Reflexed Panic Grass)*			
325.	11232	*Paractaenum novae-hollandiae subsp. novae-hollandiae*			
326.	514	*Paractaenum refractum*			
327.	522	*Paspalidium jubiflorum (Warrego Grass)*			
328.	11151	*Rostraria pumila*	Y		
329.	606	*Setaria dielsii (Diels' Pigeon Grass)*			
330.	612	*Setaria surgens (Pigeon Grass)*			
331.	625	*Spinifex longifolius (Beach Spinifex)*			
332.	13571	*Sporobolus blakei*		P3	
333.	633	*Sporobolus mitchellii (Ratstail Couch)*			
334.	635	*Sporobolus virginicus (Marine Couch)*			
335.	673	*Themeda triandra*			
336.	678	*Tragus australianus (Small Burrgrass)*			
337.	706	*Triraphis mollis (Needle Grass)*			
338.	717	*Urochloa piligera*			
Polygonaceae					
339.	44508	*Duma florulenta*			
340.	2434	*Rumex crystallinus (Shiny Dock)*		P2	
341.	46433	*Rumex spinosus*	Y		
Portulacaceae					
342.	2864	*Calandrinia ptychosperma*			
343.	2867	*Calandrinia remota*			
344.	2884	*Portulaca oleracea (Purslane, Wakati)*			

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Primulaceae					
345.	6484	*Samolus repens (Creeping Brookweed)*			
346.	14027	*Samolus sp. Millstream (M.I.H. Brooker 2076)*			
Proteaceae					
347.	2196	*Hakea preissii (Needle Tree, Dandjin)*			
348.	16897	*Hakea stenophylla subsp. stenophylla*			
Rhodomelaceae					
349.	26441	*Acanthophora spicifera*			
Santalaceae					
350.	2332	*Anthobolus foveolatus*			
351.	10977	*Exocarpos aphyllus (Leafless Ballart)*			
352.	2356	*Santalum acuminatum (Quandong, Warnga)*			
353.	2357	*Santalum lanceolatum (Northern Sandalwood, Yarnguli)*			
Sapindaceae					
354.	11487	*Alectryon oleifolius subsp. oleifolius*			
355.	4766	*Dodonaea inaequifolia*			
Scrophulariaceae					
356.	15051	*Eremophila crenulata*			
357.	15052	*Eremophila forrestii subsp. forrestii*			
358.	17152	*Eremophila forrestii subsp. hastieana (Grey Poverty Bush)*			
359.	16696	*Eremophila fraseri subsp. fraseri*			
360.	17175	*Eremophila glabra subsp. albicans*			
361.	17173	*Eremophila glabra subsp. psammophora*			
362.	14191	*Eremophila glabra subsp. tomentosa*			
363.	7227	*Eremophila laanii*			
364.	16734	*Eremophila mackinlayi subsp. mackinlayi*			
365.	16363	*Eremophila maculata subsp. brevifolia (Native Fuchsia)*			
366.	7238	*Eremophila maitlandii (Shark Bay Poverty Bush)*			
367.	15170	*Eremophila pterocarpa subsp. pterocarpa*			
368.	17158	*Myoporum montanum (Native Myrtle)*			
Solanaceae					
369.	6962	*Datura leichhardtii (Native Thornapple)*	Y		
370.	6974	*Nicotiana glauca (Tree Tobacco)*	Y		
371.	11331	*Nicotiana occidentalis subsp. obliqua*			
372.	11856	*Nicotiana occidentalis subsp. occidentalis*			
373.	7018	*Solanum lasiophyllum (Flannel Bush, Mindjulu)*			
374.	7026	*Solanum orbiculatum (Wild Tomato)*			
375.	11241	*Solanum orbiculatum subsp. orbiculatum (Round-leaved Solanum)*			
376.	7029	*Solanum phlomoides*			
Tamaricaceae					
377.	15741	*Tamarix aphylla (Athel Tree)*	Y		
Thymelaeaceae					
378.	11185	*Pimelea microcephala subsp. microcephala*			
Typhaceae					
379.	98	*Typha domingensis (Bulrush, Djandjid)*			
Urticaceae					
380.	12670	*Parietaria cardiostegia*			
Zygophyllaceae					
381.	4374	*Tribulus astrocarpus*			
382.	4377	*Tribulus hirsutus*			
383.	4380	*Tribulus occidentalis (Perennial Caltrop)*			
384.	4383	*Tribulus terrestris (Caltrop)*	Y		
385.	4390	*Zygophyllum fruticulosum (Shrubby Twinleaf)*			
386.	4395	*Zygophyllum retivalve*			

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.

Australian Government
Department of the Environment and Energy

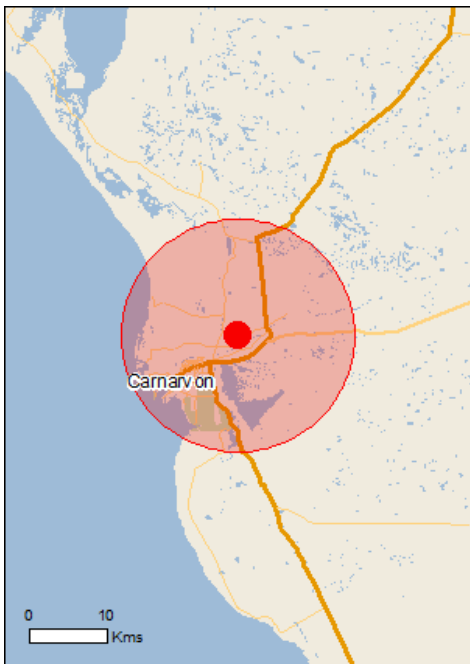
EPBC Act Protected Matters Report

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: 03/02/17 13:51:02



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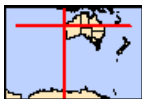

Summary

Matters of National Environmental Significance

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

World Heritage Properties:	1
National Heritage Places:	1
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	1
Listed Threatened Species:	25
Listed Migratory Species:	46

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:	2
Commonwealth Heritage Places:	None
Listed Marine Species:	73
Whales and Other Cetaceans:	10
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:	2
Regional Forest Agreements:	None
Invasive Species:	10
Nationally Important Wetlands:	2
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

World Heritage Properties [Resource Information]

Name	State	Status
Shark Bay, Western Australia	WA	Declared property

National Heritage Properties [Resource Information]

Name	State	Status
Natural		
Shark Bay, Western Australia	WA	Listed place

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
Subtropical and Temperate Coastal Saltmarsh	Vulnerable	Community likely to occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
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 tenuirostris Great Knot [862]	Critically Endangered	Species or species habitat known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat likely to occur within area
Limosa lapponica baueri Bar-tailed Godwit (baueri), Western Alaskan Bar-tailed Godwit [86380]	Vulnerable	Species or species habitat may occur within area
Limosa lapponica menzbieri Northern Siberian Bar-tailed Godwit, Bar-tailed Godwit (menzbieri) [86432]	Critically Endangered	Species or species habitat may occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area

Name	Status	Type of Presence
Pezoporus occidentalis Night Parrot [59350]	Endangered	Species or species habitat may occur within area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Species or species habitat may occur within area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Breeding likely to occur within area
Thalassarche cauta cauta Shy Albatross, Tasmanian Shy Albatross [82345]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta steadi White-capped Albatross [82344]	Vulnerable	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Mammals		
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat likely to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Congregation or aggregation known to occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Sharks		
Carcharias taurus (west coast population) Grey Nurse Shark (west coast population) [68752]	Vulnerable	Species or species habitat likely to occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Anous stolidus Common Noddy [825]		Species or species

Name	Threatened	Type of Presence
		habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat likely to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Puffinus carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [1043]		Species or species habitat likely to occur within area
Sterna caspia Caspian Tern [59467]		Foraging, feeding or related behaviour known to occur within area
Thalassarche cauta (sensu stricto) Shy Albatross, Tasmanian Shy Albatross [64697]	Vulnerable*	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable*	Species or species habitat may occur within area
Migratory Marine Species		
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Dugong dugon Dugong [28]		Species or species habitat known to occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat likely to occur within area
Lamna nasus Porbeagle, Mackerel Shark [83288]		Species or species habitat may occur within area
Manta alfredi Reef Manta Ray, Coastal Manta Ray, Inshore Manta Ray, Prince Alfred's Ray, Resident Manta		Species or species habitat known to occur

Name	Threatened	Type of Presence
Ray [84994]		within area
[Manta birostris](#) Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]		Species or species habitat may occur within area
[Megaptera novaeangliae](#) Humpback Whale [38]	Vulnerable	Congregation or aggregation known to occur within area
[Natator depressus](#) Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
[Orcinus orca](#) Killer Whale, Orca [46]		Species or species habitat may occur within area
[Rhincodon typus](#) Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area
Migratory Terrestrial Species		
[Hirundo rustica](#) Barn Swallow [662]		Species or species habitat known to occur within area
[Motacilla cinerea](#) Grey Wagtail [642]		Species or species habitat may occur within area
[Motacilla flava](#) Yellow Wagtail [644]		Species or species habitat known to occur within area
Migratory Wetlands Species		
[Actitis hypoleucos](#) Common Sandpiper [59309]		Species or species habitat known to occur within area
[Arenaria interpres](#) Ruddy Turnstone [872]		Species or species habitat known to occur within area
[Calidris alba](#) Sanderling [875]		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
[Calidris ruficollis](#) Red-necked Stint [860]		Species or species habitat known to occur within area
[Calidris tenuirostris](#) Great Knot [862]	Critically Endangered	Species or species habitat known to occur within area
[Charadrius leschenaultii](#) Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
[Charadrius veredus](#) Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
[Heteroscelus brevipes](#) Grey-tailed Tattler [59311]		Species or species

Name	Threatened	Type of Presence
		habitat known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]		Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Numenius phaeopus Whimbrel [849]		Species or species habitat known to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Pluvialis squatarola Grey Plover [865]		Species or species habitat known to occur within area
Tringa glareola Wood Sandpiper [829]		Species or species habitat known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
Xenus cinereus Terek Sandpiper [59300]		Species or species habitat 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 - Defence - CARNARVON TRAINING DEPOT

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Anous stolidus Common Noddy [825]		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

Name	Threatened	Type of Presence
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Arenaria interpres Ruddy Turnstone [872]		Species or species habitat known to occur within area
Calidris alba Sanderling [875]		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
Calidris ruficollis Red-necked Stint [860]		Species or species habitat known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Species or species habitat known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Charadrius ruficapillus Red-capped Plover [881]		Species or species habitat known to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat likely to occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Heteroscelus brevipes Grey-tailed Tattler [59311]		Species or species habitat known to occur within area
Himantopus himantopus Black-winged Stilt [870]		Species or species habitat known to occur within area
Hirundo rustica Barn Swallow [662]		Species or species habitat known to occur within area
Larus pacificus Pacific Gull [811]		Foraging, feeding or related behaviour known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]		Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may 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
Motacilla flava Yellow Wagtail [644]		Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Numenius phaeopus Whimbrel [849]		Species or species habitat known to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Pluvialis squatarola Grey Plover [865]		Species or species habitat known to occur within area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Species or species habitat may occur within area
Puffinus carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [1043]		Species or species habitat likely to occur within area
Recurvirostra novaehollandiae Red-necked Avocet [871]		Species or species habitat known to occur within area
Sterna caspia Caspian Tern [59467]		Foraging, feeding or related behaviour known to occur within area
Thalassarche cauta (sensu stricto) Shy Albatross, Tasmanian Shy Albatross [64697]	Vulnerable*	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable*	Species or species habitat may occur within area
Tringa glareola Wood Sandpiper [829]		Species or species habitat known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
Xenus cinereus Terek Sandpiper [59300]		Species or species

Name	Threatened	Type of Presence
		habitat known to occur within area
Fish		
Campichthys galei Gale's Pipefish [66191]		Species or species habitat may occur within area
Choeroichthys suillus Pig-snouted Pipefish [66198]		Species or species habitat may occur within area
Festucalex scalaris Ladder Pipefish [66216]		Species or species habitat may occur within area
Filicampus tigris Tiger Pipefish [66217]		Species or species habitat may occur within area
Halicampus brocki Brock's Pipefish [66219]		Species or species habitat may occur within area
Haliichthys taeniophorus Ribboned Pipehorse, Ribboned Seadragon [66226]		Species or species habitat may occur within area
Hippocampus angustus Western Spiny Seahorse, Narrow-bellied Seahorse [66234]		Species or species habitat may occur within area
Hippocampus histrix Spiny Seahorse, Thorny Seahorse [66236]		Species or species habitat may occur within area
Hippocampus planifrons Flat-face Seahorse [66238]		Species or species habitat may occur within area
Hippocampus trimaculatus Three-spot Seahorse, Low-crowned Seahorse, Flat-faced Seahorse [66720]		Species or species habitat may occur within area
Lissocampus fatiloquus Prophet's Pipefish [66250]		Species or species habitat may occur within area
Nannocampus subosseus Bonyhead Pipefish, Bony-headed Pipefish [66264]		Species or species habitat may occur within area
Solegnathus lettiensis Gunther's Pipehorse, Indonesian Pipefish [66273]		Species or species habitat may occur within area
Solenostomus cyanopterus Robust Ghostpipefish, Blue-finned Ghost Pipefish, [66183]		Species or species habitat may occur within area
Solenostomus paegnius Rough-snout Ghost Pipefish [68425]		Species or species habitat may occur within area
Stigmatopora argus Spotted Pipefish, Gulf Pipefish, Peacock Pipefish [66276]		Species or species habitat may occur within area
Stigmatopora olivacea a pipefish [74966]		Species or species habitat may occur within area
Syngnathoides biaculeatus Double-end Pipehorse, Double-ended Pipehorse,		Species or species

Name	Threatened	Type of Presence
Alligator Pipefish [66279]		habitat may occur within area
Trachyrhamphus bicoarctatus		
Bentstick Pipefish, Bend Stick Pipefish, Short-tailed Pipefish [66280]		Species or species habitat may occur within area
Mammals		
Dugong dugon		
Dugong [28]		Species or species habitat known to occur within area
Reptiles		
Aipysurus laevis		
Olive Seasnake [1120]		Species or species habitat may occur within area
Aipysurus pooleorum		
Shark Bay Seasnake [66061]		Species or species habitat may occur within area
Caretta caretta		
Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas		
Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Dermochelys coriacea		
Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Disteira kingii		
Spectacled Seasnake [1123]		Species or species habitat may occur within area
Disteira major		
Olive-headed Seasnake [1124]		Species or species habitat may occur within area
Emydocephalus annulatus		
Turtle-headed Seasnake [1125]		Species or species habitat may occur within area
Ephalophis greyi		
North-western Mangrove Seasnake [1127]		Species or species habitat may occur within area
Hydrophis elegans		
Elegant Seasnake [1104]		Species or species habitat may occur within area
Natator depressus		
Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Pelamis platurus		
Yellow-bellied Seasnake [1091]		Species or species habitat may occur within area

Whales and other Cetaceans [Resource Information]

Name	Status	Type of Presence
Mammals		
Balaenoptera acutorostrata		
Minke Whale [33]		Species or species habitat may occur within area
Balaenoptera edeni		
Bryde's Whale [35]		Species or species habitat may occur within area

Name	Status	Type of Presence
Delphinus delphis Common Dophin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat likely to occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Congregation or aggregation known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area

Extra Information

State and Territory Reserves [Resource Information]

Name	State
Chinamans Pool	WA
One Tree Point	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		
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Streptopelia senegalensis Laughing Turtle-dove, Laughing Dove [781]		Species or species habitat likely to occur within area
Mammals		
Capra hircus Goat [2]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species

Name	Status	Type of Presence
		habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		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		
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat likely to occur within area
Cylindropuntia spp. Prickly Pears [85131]		Species or species habitat likely to occur within area
Prosopis spp. Mesquite, Algaroba [68407]		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

Nationally Important Wetlands [Resource Information]

Name	State
McNeill Claypan System	WA
Shark Bay East	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

[redacted]

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

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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