Attachment Nine

Updated Environmental Assessment Report

360 environmental

Lot 11 and 700 Mandurah Road, Karnup

Environmental Assessment Report

Prepared for:
Rockingham Montessori School

September 2017

people • planet • professional

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Executive Summary

360 Environmental Pty Ltd was commissioned by Rockingham Montessori School to prepare an Environmental Assessment Report (EAR) for Lots 11 and 700 Mandurah Road, Karnup (Figure 1). The purpose of this report is to outline the key environmental features and proposed management measures to accompany a modification to the development application for a Montessori School at the property, approved in December 2015. The Site occupies an area of approximately 10.43 hectares (ha).

The scope of work for the EAR consisted of a desktop assessment of the key environmental features and a historical aerial photo review.

A summary of the key environmental factors is given below:

- **Groundwater:** Regional groundwater contour mapping and WIN bore records were obtained for the region surrounding the site. This information suggests that groundwater is expected to be between three and 37 m below ground level and thus has adequate separation distance from building floor level in accordance with the Department of Water guidelines for *Better Urban Water Management 2008.*
- **Flora and Vegetation:** No Threatened or Priority flora were encountered during the Level 2 flora and vegetation survey however suitable habitat is present onsite for two species with flowering periods outside of the period which the survey was undertaken. A targeted Spring flora survey will be undertaken in 2017 and the results will be provided.
- **Fauna:** Government database searches and a desktop habitat assessment identified the potential for several conservation significant fauna to occur within the site. A Black Cockatoo Habitat assessment was conducted across the site in November 2014 which identified areas of both foraging and potential future breeding habitat. Black Cockatoo foraging habitat in good condition over one ha and breeding habitat is considered a Matter of National Environmental Significance (MNES) and as such, the proposal has been referred to the Department of the Environment and Energy for assessment under the EPBC Act. Any impacts to fauna protected under State legislation will be considered through the Native Vegetation Clearing Permit approvals process.
- **Threatened and Priority Ecological Communities (TEC/PECs):** Floristic Community Type (FCT) analysis undertaken as part of the Level 2 Flora and Vegetation Survey has identified that the Site contains 2.22 ha of TEC, *Banksia Woodlands of the Swan Coastal Plain ecological community*. Approximately 0.84 ha of the Banksia Woodlands TEC will be cleared as part of the development.
- **Environmentally Sensitive Areas (ESAs):** The entire Site is mapped as wholly within the extent of an ESA. This is believed to be due to the presence of TECs,

PECs and their associated buffers within the vicinity of the Site. As such, the development is not eligible for an exemption of a clearing permit.

- **Revegetation and Landscape Plan:** Revegetation and landscaping will be undertaken to meet the Bushfire Attack Levels identified in the Bushfire Management Plan. The species selected are consistent with the current vegetation onsite.
- **Visual Impact Assessment:** The visual impact assessment undertaken for the updated development layout, which included minor changes to building location and orientations, has identified there are no significant changes to the line of sight to and from the proposed development and surrounding properties.

The proponent has taken the environmental characteristics of the site into consideration in the design of the development and in doing so is retaining the areas of best quality vegetation and habitat. Any potential impacts to flora and fauna which may result from the clearing of native vegetation will be assessed during the EPBC Act Referral and the Native Vegetation Clearing Permit approvals processes.

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1 Introduction

1.1 Background

360 Environmental Pty Ltd was commissioned by Rockingham Montessori School to prepare an Environmental Assessment Report (EAR) for Lots 11 and 700 Mandurah Road, Karnup (Figure 1). In total, the site occupies an area of approximately 10.43 ha. The purpose of this report is to outline the key environmental features and proposed management measures to accompany a modification to the JDAP development application for a Montessori School at the property, approved in December 2015. The Site occupies a development and clearing footprint of approximately 5.70 hectares (ha). The proposed Development Masterplan is provided in Figure 2 and the clearing footprint is provided in Figure 3.

1.2 Scope

The following was undertaken for the preparation of this EAR:

- Literature review of relevant documents, including City of Rockingham planning policies and environmental strategy documents; and relevant EPA and regulatory agency guidance statements and advice;
- Review of mapped conservation areas, that may exist on or nearby to the site, such as Bush Forever sites, Regional Conservation Parks and Environmentally Sensitive Areas (ESA);
- Summary of outcomes of the Flora, Vegetation and Black Cockatoo assessments;
- Preliminary Acid Sulfate Soil (ASS) assessment (desktop), including review of ASS risk mapping and local soil types/geology;
- Desktop assessment of mapped wetlands in the area and their conservation status, including potential buffer requirements
- Brief review of mapped heritage sites (Aboriginal and non-Aboriginal) that may be located within or nearby the site;
- Desktop review of the geology, surface hydrology and groundwater information using databases and digital mapping information will be undertaken including identification of:
    - Groundwater protection areas
    - Surface water protection areas
    - Watercourses
    - Areas subject to flooding/inundation

- Identification of environmental constraints and opportunities associated with the proposed development and the development of management actions in consultation with the client;
- Integration of the updated Landscape, Revegetation, Visual Impact and Water Letter Report; and
- Formulation of this report detailing the results of the points above.

2 Planning Context

2.1 Site Location

The site comprises of approximately 10.43 ha at Lots 11 and 700 Mandurah Road, Karnup within the local Government area of Rockingham located approximately 49 km east south-east of Perth (Figure 1).

2.2 Property and Zoning Information

The site is located within the local Government area of the City of Rockingham and is currently zoned as 'Rural' and 'Special Rural' under the Shire's Town Planning Scheme No. 2 (TPS2).

2.3 Draft Perth and Peel @3.5 Million Sub-regional Planning Framework

The draft Perth and Peel @ 3.5 million suite of strategic land use planning documents aim to accommodate 3.5 million people by the year 2050. The WAPC has identified Lot 700 has been identified as 'Rural Residential' in the draft sub-regional framework (WAPC 2015).

2.4 Draft Perth and Peel Green Growth Plan for 3.5 Million

In response to the draft Perth and Peel Sub-Regional Frameworks, the draft Perth and Peel Green Growth Plan for 3.5 Million (draft Green Growth Plan) has been prepared. The draft Green Growth Plan proposes to secure upfront Commonwealth environmental approvals and streamline State environmental approvals for development required to support growth to 3.5 million people. The Plan also aims to provide protection of bushland, rivers, wildlife and wetlands through implementation of a strategic conservation plan (DPC 2015).

Lot 11 is within the Rural Residential Class of Action area and Lot 700 has been identified as an 'Area Not within the Urban, Industrial or Rural Residential Classes of Action'.

A portion of Lot 11 has been identified as having 'Broad Commitments and Values' under the Plan (DPLH 2017).The draft Broad Commitments and Values relate to seeking an overall conservation outcome where further work is needed to determine when intervention is required to reach an outcome. Draft Broad Commitments include the following environmental aspects:

- Threatened Fauna;
- Vegetation complexes or more than 10 % and less than 30 % remaining

- Negotiated planning solution and rural complementary Bush Forever areas within the three classes of action mapped;
- Resource Enhancement wetlands with remnant vegetation and a 50 m buffer; and
- Conservation Category Wetlands.

The area identified as 'Broad Commitments and Values' within the Site corresponds Black Cockatoo foraging habitat.

The draft commitment values do not apply to areas where works are already approved (while such approvals remain valid) for State environmental values under Part IV or Part V Division 2 of the *Environmental Protection Act 1986* (EP Act), or under subdivision approval, or for Matters of National Environmental Significance under Part 9 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

3 Site Description and Assessment

3.1 Current Land Use and Features

Lot 700 is currently utilised as a function centre with planted lawn and gardens known as 'Munja Gardens' and Lot 11 is occupied by a single rural residential dwelling and shed. Limited clearing has occurred to necessitate the construction of these dwellings, sheds and the function centre, with much of the site containing remnant native vegetation, namely Lot 11.

3.2 Surrounding Land Use

The areas immediately surrounding the site are zoned as either 'Rural' or Special Rural' under the City's TPS2 (Figure 4). The western boundary of the site abuts Mandurah Road which is a 'Primary Regional Road' and approximately 200 m east of the site is the Perth to Mandurah railway line. Areas to the north and south of the site are zoned as Parks and Recreation and include Lark Hill horse training facility which is located approximately 500 m north-west of the site.

Additional land uses which are located in the vicinity of the site have been identified in Figure 3 and summarised in Table 1 along with the EPA recommended generic separation distance which is intended to be used in the absence of site specific data (EPA 2005).

Table 1. Surrounding Land uses

Land use	Generic Separation Distance (EPA 2005)	Approximate Separation distance from site	Potential Impacts (EPA 2005)
Horse Stables	100-500 m depending on size	The closest property with horse stables is approximately 60 m west of the site.	Noise, Dust and Odour.
Vineyard	500 m	300 m east of site.	Gaseous, Noise, Dust and Odour.
Nursery	100 m	95 m south-west of site.	Noise (assuming no composting onsite).
Market Gardens	300-500 m depending on size.	490 m south-east of site.	Gaseous, noise, dust and odour.
Orchard	500 m	350 m south-west of site.	Gaseous and noise.

Despite the above EPA recommendations, sensitive land uses (residential properties) to the south-west of the site in Development Control Area 1 exist within the recommended buffer distances to land uses described in Table 1 above.

3.3 Topography

The topography of the Site ranges from undulating to hilly with slopes increasing from 5 m AHD to 28 m AHD west to east within Lot 700. The topography of Lot 11 ranges from 7 m AHD to 37 m AHD, with elevation increasing towards the centre and eastern portions of the Lot (Figure 5).

3.4 Regional Geology and Soils

1:250 000 surface geology profile mapping (GSWA 2008) indicates the geology of the Site is typically as follows:

- **Safety Bay Sand:** Unlithified sand of mollusc and foram fragments, quartz and heavy mineral grains; and
- **Tamala Limestone:** Unconsolidated to strongly lithified calcarenite with calcrete/kankar soils, Aeolian. Locally quartzrose, feldspathic or heavy mineral bearing.

Regional soil subsystem mapping indicates that the site occurs within the following four broad soil subsystems (DAFWA 2012) (Figure 6):

- **211Qu_Qf2, Quindalup South Qf2 Phase:** Relict foredunes and gently undulating beach ridge plain with deep uniform calcareous sands;
- **211Qu_Qp2, Quindalup South Qp2 Phase:** Long walled discrete parabolic dunes with moderate to steep slopes and uniform calcareous sands showing variable depths of surface darkening;
- **211Sp_S1d, Spearwood S1d Phase:** Dune ridges with rare limestone outcrop and slopes at 3 – 20 % occurring on the eastern slipface and moderately deep to very deep brown siliceous yellow-brown sands; and
- **211Sp_S1b, Spearwood S1b Phase:** Dune ridges with slopes up to 15% and deep siliceous yellow-brown sands or pale sands with yellow-brown subsoil.

The characteristic sandy nature of each of these four soil subsystems is favourable to infiltration and drainage.

3.5 Acid Sulfate Soils and Contamination

Acid Sulfate Soil (ASS) mapping sourced from the (then) Department of Environment Regulation (DER 2014) indicates that there is no known risk of ASS within the site (Figure 7). Given this information, no further ASS investigation is likely to be required to facilitate the development. The nearest areas of identified ASS risk are 'High to Moderate' areas approximately 400 meters (m) west of the site.

A search of the Department of Water and Environmental Regulation (DER)'s *Contaminated Sites Database* did not identify any registered contaminated sites within the property. The closest registered contaminated site is located approximately four

kilometres (km) south of the site (DWER 2017a). It is considered that the separation distance from this contaminated property is adequate to mitigate any resultant environmental impacts to the project site.

3.6 Surface Hydrology and Wetlands

A review of available surface water feature mapping did not identify any known water bodies within the site (Figure 8) (DPaW 2014, DoW 2010). Several geomorphic wetlands were located in the vicinity of the site, the closest of which is a Multiple Use Wetland located approximately 240 m east of the site. The closest wetland of conservation significance is a Conservation Category Wetland located approximately 570 m north-east of the site (DPaW 2014).

The Ramsar Convention on Wetlands (1971) is an intergovernmental treaty dedicated to the conservation and use of wetlands listed under the Wetlands of International Importance (Ramsar Sites). These sites require management to ensure their ecological values are maintained or improved (CCWA 2005). One Ramsar wetland exists within 5 km of the Site: Becher Point Wetlands located approximately 1.5 km west of the Site.

In the absence of site specific data, the Western Australian Planning Commission (WAPC) *Guideline for the Determination of Wetland Buffer Requirements* 2005 recommends a generic buffer distance of up to 100 m in order to mitigate potential wetland degradation (DPI 2005). The separation distance of the site to conservation significant water bodies is considerably above this recommendation and therefore development of the site is not considered likely to impact these wetlands.

3.7 Groundwater

3.7.1 Separation to Groundwater

Regional groundwater contour mapping by the DWER identifies the depth to groundwater across the Site range between approximately 6.0 to 37.0 m below ground level (mbgl) (Figure 9) (DWER 2017b).

The Department of Water's WIN (Water Information Network) Bore Dataset (2012) did not identify any bores as falling within the boundaries of the site. Several WIN bore records were obtained for the broader region surrounding the site with recorded groundwater levels ranging between 3.0 and 12.8 m below ground level (Figure 8).

The Department of Water guidelines for *Better Urban Water Management 2008* recommend a minimum of 1.2 m separation between groundwater levels and any building floor level (DoW 2008). The above information suggests that the site has adequate separation to groundwater without the requirement for importation of fill and/or subsurface drainage.

3.7.2 Groundwater Allocation

DWER's online *Water Register* system indicates that there is an existing groundwater allocation licence for Lot 700 however no licence currently exists for Lot 11. Lot 700 also has a drawdown bore attached to the licence. The *Water Register* indicates that there may be allocation available in the area although consultation with the DWER's regional office would be required to determine the quantities available (DWER 2017c).

A number of WIN groundwater bores are located within the vicinity of the Site, these are displayed in Figure 9.

3.8 Public Drinking Water Source Areas

Mapping indicates that the Site is not located within or in the vicinity of any Public Drinking Water Source Areas (PDWSAs) and therefore the development is not considered to conflict with these areas (DoW 2016). The nearest PDWSA is located in excess of 17 km from the Site.

3.9 Flora and Vegetation

3.9.1 Broad Vegetation Types

Mapping of the vegetation of the Perth of WA was completed on a broad scale (1:250,000) by Beard (1981). These vegetation units were re-assessed by Shepherd et al. (2001) to account for clearing in the intensive land use zone, dividing some larger vegetation units into smaller units.

There are two Beard/Shepherd vegetation units in the Site (Figure 9). The Shepherd et al. (2001) vegetation type is described below, and its representation within the State, IBRA region, IBRA subregion and Local Government are shown in Table 2.

- **Spearwood 998:** Medium woodland; Tuart
- **Rockingham 3048:** Shrublands; scrub-heath on the Swan Coastal Plain

Table 2: Broad Vegetation Types and its State and Regional Representation (Government of Western Australia 2016)

	Pre–European (ha)	Current Extent (ha)	Remaining (%)	Remaining in DPaW reserves (%)
IBRA Region Total Swan Coastal Plain	1,501,221.93	578,432.17	38.53	37.85
Statewide/IBRA Region – Swan Coastal Plain				
Beard Veg Assoc. No. 998	50,867.50	18,523.20	36.41	45.91
Beard Veg Assoc. No. 3048	10,417.99	3,060.60	29.38	27.98

In IBRA Region SWA02				
Beard Veg Assoc. No. 998	50,867.50	18,523.20	36.41	45.91
Beard Veg Assoc. No. 3048	10,417.99	3,060.60	29.38	27.98
Local Government Authority – City of Rockingham				
Beard Veg Assoc. No. 998	5,319.33	1,742.72	32.76	-
Beard Veg Assoc. No. 3048	9,147.49	2,721.98	29.76	28.82

The EPA's Guidance Statement No. 33: Environmental Guidance for Planning and Development has set a threshold for retention of 10% of the pre-existing extent of native vegetation (EPA 2008). The Site is considered to be constrained as it is within the Perth MRS and is within close proximity to urban areas. Both vegetation associations in Table 1 have current extents that are greater than the abovementioned 10 % threshold.

3.9.2 Surveyed Vegetation Associations

A Level 2 Flora and Vegetation survey was undertaken across the site by 360 Environmental in November 2014. The survey identified three natural vegetation associations were described for the Site during the survey, a description of these associations are provided in Table 3 and Figure 12. The majority of the Proposed Disturbance Area is dominated by BaBm vegetation association (Figure 11) (360 Environmental 2015).

Table 3: Surveyed Vegetation Associations within the Site.

Vegetation Association Code	Name	Description	Extent (%)	Extent (ha)
BaBm	*Banksia attenuata*, *B. menziesii* woodland	Low open woodland of B. attenuata over tall shrubland of Acacia rostellifera over low open shrubland of Kunzea glabrescens, Hemiandra pungens and Conostylis aculeate over Grassland of *Ehrharta calycina.	42.9	4.48
EgBa	*E. gomphocephala – Banksia* woodland	Woodland of E. gomphocephala over Tall Shrubland of B. attenuata and B. menziesii over Open Shrubland of Hibbertia hypericoides and Kunzea glabrescens, over Very Open Sedgeland of Lepidosperma gladiatum, over Grassland of *Ehrharta calycina.	6.6	0.69

Vegetation Association Code	Name	Description	Extent (%)	Extent (ha)
AsOa	*Acacia saligna*, *Olearia axilaris* shrubland	Tall Shrubland of A. saligna over Open Shrubland of O. axilaris, over Shrubland of K. glabrescens, Scaevola thesioides and H. hypericoides over Very Open Grassland of *E. calycina	3.9	0.41
Ne	Non-endemic species	Non-endemic species and/or garden species and/or weedy tracks and/or revegetation	28.7	3.0

*Site includes the Proposed Disturbance Area

3.9.3 Floristic Community Types

Statistical analysis and data interpretation of the survey results identified the following floristic community type (FCT) as occurring in the Survey Area (360 Environmental 2015):

- FCT21a: Central *Banksia attenuata – E. marginata* woodlands

As the Site contained low diversity of native species and covered a small area, the following FCTs have been inferred based on indicator species, soil types and landform position (360 Environmental 2015):

- FCT25: Southern *E. gomphocephala – Agonis flexuosa* woodlands; and
- FCT24: Northern Spearwood shrublands and woodlands.

All three of these FCTs are listed as sub-communities of the Threatened Ecological Community (TEC), Banksia Woodlands of the Swan Coastal Plain (DotEE 2016).

3.9.4 Vegetation Condition

The vegetation condition within the Proposed Disturbance Area ranges from 'Completely Degraded' to 'Good'. The majority in 'Completely Degraded' and 'Degraded' condition (1.97 ha and 1.42 ha respectively) (Figure 12). Portions of Lot 11 have been highly disturbed and has been subject to vegetation clearing associated with the building of a house, tracks and sheds as well as establishment of gardens and non-endemic revegetation. Lot 700 has limited native vegetation except for a couple of *Banksia attenuata*, *Conostylis aculeata* and *Acacia pulchella* that are interspersed with garden plants along the southern fence line. The property is used as a function centre with established tropical and landscaped gardens.

The average fire age of the vegetation was considered very old (> 12 years since last fire).

3.10 Threatened / Priority Ecological Communities

A search of the EPBC PMST and DPaW's TEC and PEC database has identified the following as occurring within a 5 km radius of the Site (DotEE 2017; 360 Environmental 2015):

- Sedgelands in Holocene dune swales of the southern Swan Coastal Plain Threatened Ecological Community (SCP19a); and
- Banksia Woodlands of the Swan Coastal Plain Threatened Ecological Community.

DPaW's TEC and PEC database identified that the Site is within the extent of several buffers associated with the 'Sedgelands in Holocene dune swales of the southern Swan Coastal Plain' ecological community.

The Sedgelands in Holocene dune swales of the southern Swan Coastal Plain TEC requires specific water regime requirements, and is typically found in coastal or wetland environments. Due to the Site's distance from the coast and the lack of wetland habitat, it is not likely that the Sedgelands in Holocene dune swales TEC will occur.

3.10.1 Banksia Woodlands of the Swan Coastal Plain

'Banksia Woodlands of the Swan Coastal Plain' is listed (16 September 2016) as an Endangered community under the EPBC Act. A Level 2 Flora and Vegetation survey was undertaken and a subsequent desktop assessment determined that the TEC is considered to occur on the Site.

The statistical analysis identified vegetation associations; BaBm, AsOa and EgBa as having the most affiliation with FCT 21a, FCT 25 and FCT 24 respectively.

These FCTs are listed as sub-communities of the Banksia Woodlands TEC (DotEE 2016) The FCT must meet key diagnostic characteristics to be considered a TEC. In regards to the presence of the Banksia Woodlands TEC, the Approved Conservation Advice for the threshold state that (DotEE 2016):

- Vegetation in Excellent condition should have a minimum patch size of 0.5 ha;
- Vegetation in Very Good condition should be a minimum of 1 ha; and
- Vegetation in Good condition should be a minimum of 2 ha.

In addition, patches that within 30 m of another patch in the same condition class, the patch areas are combined. Vegetation patches considered Degraded or worse are excluded and not protected under the EPBC Act (DotEE 2016).

Based on this information and the survey results, the vegetation in Degraded condition has been excluded. Vegetation mapped in 'Good' condition is considered to represent the Banksia Woodlands TEC in the Site and equates to 2.22 ha (Figure 13).

Approximately 0.84 ha of the Banksia Woodlands TEC will be cleared as part of the development and bushfire protection footprint.

3.10.2 Conservation Significant Flora

Database searches were undertaken to identify the conservation significant flora species occurring within a 5 km radius of the Site, including the Department of Biodiversity Conservation and Attractions (DBCA) NatureMap database and Department of the Environment and Energy (DotEE)'s Protected Matters Search Tool (PMST) (DBCA 2017; DotEE 2017).

Review of the database searches identified 17 conservation significant flora species as potentially occurring within a 5 km radius of the Site and a likelihood assessment of the species occurring within the Site was undertaken (Table 4). Two species were considered 'Likely' to occur due to the presence of suitable habitat and the close proximity to the Site of previous records. Four species were considered 'Possible' to occur and nine considered 'Unlikely'. Two flora species were identified as potentially occurring within the Site based on database searches, however, the likelihood of occurrence is not known due to a lack of information on their preferred habitat or known closest record to the Site.

Table 4. Conservation Significant Flora Likelihood Assessment

Taxa	State Status	EPBC Status	Nearest Record (km)	Likelihood
Andersonia gracilis (Slender Andersonia)	Threatened	Endangered	42.65	Unlikely
Caladenia huegelii (King Spider Orchid)	Threatened	Endangered	11.73	Possible
Diuris micrantha (Dwarf Bee-orchid)	Threatened	Vulnerable	16.96	Unlikely
Diuris purdiei (Purdie's Donkey-orchid)	Threatened	Endangered	21.53	Unlikely
Drakaea elastica (Glossy-leafed Hammer Orchid)	Threatened	Endangered	6.58	Unlikely
Drakaea micrantha (Dwarf Hammer Orchid)	Threatened	Vulnerable	28.67	Possible
Lepidosperma rostratum (Beaked Lepidosperma)	Threatened	Endangered	19.16	Unlikely
Thelymitra variegata	Priority 2	-	30.39	Unlikely
Acacia benthamii	Priority 2	-	1.13	Unlikely
Beyeria cinerea subsp. cinerea	Priority 3	-	1.71	Unknown
Calandrinia oraria	Priority 3	-	4.43	Unknown
Dillwynia dillwynioides	Priority 3	-	4.66	Likely

Taxa	State Status	EPBC Status	Nearest Record (km)	Likelihood
Schoenus capillifolius	Priority 3	-	4.48	Unlikely
Sphaerolobium calcicola	Priority 3	-	1.64	Possible
Jacksonia sericea (Waldjumi)	Priority 4	-	2.25	Likely
Stylidium longitubum	Priority 4	-	3.82	Unlikely
Dodonaea hackettiana	Priority 4	-	12.87	Possible

Threatened species that have statutory protection under the EPBC Act are matters of national environmental significance (protected matters) under the EPBC Act's assessment and approval provisions, without approval from the Minister. Under the act A person must not take an action that has, will have, or is likely to have, a significant impact on a listed threatened species the WC Act, a person may not remove any rare flora unless they are a holder of a licence under the Act or have obtained written consent from the Minister.

Priority Flora species do not have any statutory protection. Priority 1, 2 and 3 species are those that have not yet been adequately surveyed to be listed under Schedule 1 or 2. 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 are given consideration during the State approvals and decision making process.

No Threatened or Priority flora pursuant to the EPBC Act and/or gazetted as DRF pursuant to the *Wildlife Conservation Act 1950* (WC Act) was encountered during the 2015 survey. However the survey was undertaken outside of the flowering period for *Caladenia huegelii* and *Drakaea micrantha* therefore this species may have been undetectable at the time of the survey. A targeted Spring flora survey will be undertaken in 2017 and will be provided to the City of Rockingham.

3.10.3 Weeds

A desktop search of the PMST database indicates that a total of 13 weed species may occur within a 5 km radius of the Site (DotEE 2017) (Table 5).

Nine of these weed species are listed under the Commonwealth's *Weeds of National Significance* (WONS) list and seven of these species are Declared under the *Biosecurity and Agriculture Management Act* 2007 (BAM Act).

Table 5. Weed Species Likely to Occur within 5 km of the Site (DotEE 2017)

SPECIES	COMMON NAME	WONS	DECLARED UNDER BAM ACT 2007*
*Asparaguys asparagoides	Bridal Creeper	Yes	s22(2) C3
*Brachiaria mutica	Para Grass	No	-
*Cenchrus ciliaris	Buffel-Grass	No	-
*Chrysanthemoides monilifera	Bitou Bush	Yes	s12 C1
*Chrysanthemoides monilifera subsp. monilifera	Boneseed	Yes	s12 C1
*Genista sp. X Genista monspessulana	Broom	Yes	-
*Lantana camara	Lantana, Sage	Yes	s22(2) C3
*Olea europaea	Common olive	No	-
*Pinus radiata	Monterey Pine	No	-
*Rubus fruticosus aggregate	Blackberry	Yes	-
*Salix spp. except S. babylonica, S.x. calodendron & S.x. reichardtii	Willows except Weeping Willow, Pussy Willow & Sterile Pussy Willow	Yes	s12 C1
*Salvinia molesta	Salvinia, Kariba weed	Yes	s12 C2
*Tamarix aphylla	Athel Pine	Yes	s22(2) C3

*The (then) DAFWA maintains a list of Declared Plants for Western Australia under the BAM Act. If a plant is declared for the whole of the State or for particular Local Government Areas, all landholders are obliged to comply with the relevant species-specific control measures.

[1]Declared Pest - s22(2)

Declared pests must satisfy any applicable import requirements when imported, and may be subject to an import permit if they are potential carriers of high-risk organisms. They may also be subject to control and keeping requirements once within Western Australia.

Under the BAM Act, all declared pests are placed in one of three categories, namely C1 (exclusion), C2 (eradication) or C3 (management).

C1 category (Exclusion) - Pests will be assigned to this category if they are not established in Western Australia and control measures are to be taken, including border checks, in order to prevent them entering and establishing in the State.

C2 category (Eradication) – Pests will be assigned to this category if they are present in Western Australia in low enough numbers or in sufficiently limited areas that their eradication is still a possibility.

C3 category (Management) – Pests will be assigned to this category if they are established in Western Australia but it is feasible, or desirable, to manage them in order to limit their damage. Control measures can

prevent a C3 pest from increasing in population size or density or moving from an area in which it is established into an area which currently is free of that pest (DAF 2016).

During the survey, it was observed that grass weeds were dominant across the site, particularly **Ehrharta calycina* and **Lagurus ovatus*. Weeds were present also around the edge of the site and along the fence line and track (360 Environmental 2015).

3.11 Fauna

Desktop searches of NatureMap and PMST databases identified a number of conservation significant fauna species potentially occurring within a 5 km radius of the Site.

The searches returned a number of marine birds and waders that require specific habitats including wetlands, oceans, shorelines and waterways. These listings may be associated with wetlands to the northeast of the Site. As the Site does not contain suitable habitat, these species have been omitted from further discussion. In addition, a number of species returned in the databases were historical records of extinct species (e.g. Malleefowl) and these have been omitted from further discussion.

A likelihood assessment was undertaken to determine the likelihood of these species occurring within the Site based on suitable habitat present and the species known distribution.

The likelihood assessment identified 13 conservation significant fauna species as potentially occurring within the Site (Table 6).

Table 6. Likelihood Assessment of Conservation Significant Fauna Occurring within the Site (DotEE 2017; DBCA 2017)

TAXA	STATE STATUS	EPBC STATUS	LIKELIHOOD
Forest Red-tailed Black Cockatoo *(Calyptorhynchus banksii naso)*	Threatened	Vulnerable	Likely
Baudin's Cockatoo *(Calyptorhynchus baudinii)*	Threatened	Vulnerable	Likely
Carnaby's Cockatoo *(Calyptorhynchus latirostris)*	Threatened	Endangered	Likely
Brush-tailed Bettong *(Bettongia penicillata)*	Threatened	Endangered	Unlikely
Chuditch *(Dasyurus geoffroii)*	Threatened	Vulnerable	Possible
Western Ringtail Possum *(Pseudocheirus occidentalis)*	Threatened	Vulnerable	Possible
Lined Skink *(Lerista lineata)*	Priority 3	-	Unknown
Southern Brown Bandicoot *(Isoodon obesulus)*	Priority 4	-	Unlikely

Taxa	State Status	EPBC Status	Likelihood
Quenda *(Isoodon obesulus fusciventer)*	Priority 4	-	Unlikely
Graceful Sun Moth *(Synemon gratiosa)*	Priority 4	-	Unlikely
Red-necked Stint *(Calidris ruficollis)*	International Agreement	Marine/Migratory	Unlikely
Rainbow Bee-eater *(Merops ornatus)*	International Agreement	Marine	Possible
Grey Plover *(Pluvialis squatarola)*	International Agreement	Marine/Migratory	Unlikely

3.11.1 Black Cockatoos

A Black Cockatoo Assessment was undertaken during November 2014 where potential foraging and breeding habitat was identified within the Site. Foraging habitat consisted of Tuart, Banksia and Acacia, all known dietary items of the Black Cockatoos and potential breeding habitat consisted of Tuart trees (Johnstone & Kirkby 2011). No Black Cockatoos were observed or heard during the Survey.

Foraging Habitat

Carnaby's Cockatoo feed on a wide range of foods including seeds, flower buds, flowers and nectar of *Banksia spp*. *Eucalyptus spp*. and *Acacia spp*. (Johnstone & Kirkby 2011). The Forest Red-tailed Black Cockatoo fees mostly on Jarrah and Marri seeds, Allocasuarina cones and some introduced Eucalypts. Baudin's Cockatoos mainly feed on Marri, nectar, introduced fruits and insect larvae and the tips of *Pinus spp* (DSEWPaC 2012).

Three natural vegetation associations were identified within the Site that is consistent with foraging habitat for all three Black Cockatoo species:

- **BaBm** – Banksia attenuata and B. menziesii woodland;
- **EgBa** – Eucalyptus gomphocephala over Banksia woodlands;
- **AsOa** – Acacia saligna and Olearia axilaris shrubland.

The Black Cockatoo foraging habitat within the Site covers 5.41 ha and the development will involve the clearing of 2.56 ha consisting of species such as *Banksia, Acacia* and Tuart (Figure 14). The foraging habitat within the Project Area ranges between 'Completely Degraded' and 'Good' condition. No indirect or direct evidence of foraging was observed during the survey suggesting that the Site is not extensively used by the Black Cockatoos and may not be a primary habitat (360 Environmental 2015).

Breeding Habitat

Black Cockatoos breed in large hollow-bearing trees, generally within woodlands or forests (Johnstone et al. 2013). The size of the tree can be a useful indication of the

hollow-bearing potential. Trees of a suitable Diameter at Breast Height (DBH) are potentially important for maintaining breeding in the long-term, through maintaining the integrity of the habitat and allowing trees to provide future nest hollows. Maintaining the long term supply of trees of a size to provide suitable nest hollows is particularly important in woodland stands known to support Black Cockatoo breeding (DSEWPaC 2012).

The Black Cockatoo assessment identified the Site contains a total of seven Tuart trees (including one dead tree) with a DBH > 500 mm and are therefore considered potential breeding trees under the EPBC Act Black Cockatoo referral guidelines (DSEWPaC 2012) (Figure 14). None of these trees contained hollows, suggesting that the Site is not utilised by the Black Cockatoos for breeding. However, these potential breeding trees have the potential to develop hollows to be utilised by the Black Cockatoos in the future. Only one potential breeding tree is located within the Proposed Disturbance Area, the remaining six trees will be retained.

Although the Site contains suitable habitat important to all three threatened Black Cockatoo species, no Black Cockatoos were heard calling or observed flying overhead. In addition, no direct or indirect foraging evidence was recorded during the survey. This suggests that the site is not extensively used by the Black Cockatoos and therefore not a primary breeding or foraging habitat.

3.12 Conservation Areas

Review of available conservation area mapping shows that the Site is not within any conservation areas, including Bush Forever Sites, Regional Reserves and DBCA Managed Lands. A number of conservation areas are located within the surrounding area of the Site, including three Bush Forever Sites (278, 356 and 379) within 1 km radius (Figure 15).

No Ecological Linkages intersect the Site, however, one Ecological Linkage (ID: 76) is located approximately 60 m to the west of the Site.

Environmentally Sensitive Areas (ESAs) are identified and protected under the *Environmental Protection (Environmentally Sensitive Areas) Notice 2005*. Under the Notice, it is an offence to kill or destroy vegetation within an ESA. Mapping undertaken by the (then) DER indicates the Site is wholly within the extent of an ESA (Figure 15). The presence of the ESA is believed to be due to the presence of TECs and their associated buffers in the vicinity of the Site. Thereby, the proposal is not eligible for a clearing permit exemption and will require a Native Vegetation Clearing Permit (NVCP).

3.13 Heritage

3.13.1 Aboriginal Heritage

According to the Department of Aboriginal Affairs (DAA) Aboriginal Heritage Inquiry System, no Aboriginal heritage records were reported within or in the vicinity of the site.

The closest registered Aboriginal heritage area identified is located approximately 3.5 km east of the site (Figure 16). This heritage area was identified as Site No. 3582 (Serpentine River). Given the considerable separation distance of the site to any registered Aboriginal heritage sites or 'Other Heritage Places' the proposed development and land use at the site are not expected to impact any Aboriginal heritage areas (DAA 2017).

3.13.2 European Heritage

The Government of Western Australia's State Heritage Office (SHO) did not identify any known State Heritage sites within or in the vicinity of the site (SHO 2017). The proposed development and operations at the site are not expected to impact any European heritage sites.

4 Environmental Constraints and Management

Any potential environmental impacts that may result from change in land use and development of the site are discussed below, along with management measures intended to mitigate any possible impacts.

4.1 Vegetation and Fauna

2.22 ha of the Site were identified as containing the TEC; Banksia Woodlands of the Swan Coastal Plain ecological community, listed as Endangered under the EPBC Act. The development will impact on 0.84 ha this ecological community.

The remnant vegetation within the site was found to contain species which may provide foraging and potential breeding habitat for conservation significant fauna, including Black Cockatoos. The total area of Black Cockatoo foraging habitat is 5.40 ha across the Site, with only 2.56 ha occurring within the development footprint. The development layout aims to retain areas of better quality vegetation, particularly the Banksia Woodlands TEC and those that offer future potential habitat to the Black Cockatoos.

A targeted flora survey will be conducted in Spring 2017 in accordance with any requirements of the State's Clearing Permit approvals process.

The Black Cockatoo habitat and Banksia Woodlands TEC are considered Matters of National Environmental Significance (MNES) and as such, the proposal has been referred to the DotEE for assessment. Any impacts to flora and vegetation as a result of the clearing for the development will be assessed through a Native Vegetation Clearing Permit approvals process with the DWER.

4.2 Landscaping and Revegetation Design

A Landscaping and Revegetation plan illustrates the areas nominated for rehabilitation in Figure 17 and corresponding Species List in Appendix D.

The overall purpose of revegetation and landscaping is to improve the condition of existing vegetation on site and maintain the rural landscape of the area through:

- Infill planting within degraded areas (where vegetation structure has previously been removed); and
- Replacement of weed species with native vegetation.

The objectives of the revegetation and landscaping are as follows:

- To revegetate the site with native species of local provenance;
- Minimise soil erosion;
- Comply with bushfire requirements;

- Minimise future maintenance needs; and
- Enhance the visual amenity of the Site.

4.2.1 Site Preparation

4.2.1.1 Hazard Protection Zone

Fuel loads within the HPZ will be reduced as shown in the revegetation figure in line with current Bushfire Guidelines. The design of the landscape plan ensures that aggregate size of tree groups will be no more than 5 m in width measured perpendicular to the closest building. Individual tree groups shall be less than 5 m^2 in area, being 0.0005 of a hectare. Tree species including *Banksia attenuata*, *B. menziesii* and *Eucalyptus gomphocephala* will be retained within the APZ where they are located four or more metres from the nearest building. All understorey plants within the APZ will be cleared.

Additional planting of *Banksia attenuata* and *B. menziesii* will be undertaken in bare areas of the APZ where possible to provide screening of buildings from surrounding properties and roads.

On completion of clearing, the APZ will be mulched at a depth of 75 mm. Any imported composed mulch materials shall comply with AS 4454. The mulch (chipped vegetation materials) shall be free of fine or fibrous particles and suitable for placing on soil surfaces. All sourced mulch should be certified Dieback free.

4.2.1.2 Asset Protection Zone and Retained Native Vegetation

A number of annual weed species have been recorded outside the APZ and within the retained native vegetation that have the potential to severely limit the success of revegetation if left uncontrolled. These species include:

- *Arctotheca calendula* (Cape Weed);
- *Avena barbata* (Wild Oats);
- *Briza maxima* (Blowfly Grass);
- *Briza minor* (Shivery Grass);
- *Bromus diandrus* (Great Brome);
- *Ehrharta calycina* (Perennial Veldt Grass);
- *Fumaria capreolata* (Whiteflower Fumitory);
- *Lagurus ovatus* (Hare's Tail Grass);
- *Pelargonium capitatum* (Rose Pelargonium); and
- *Ursinia anthemoides* (Ursinia).

Herbicide will be applied to areas to be revegetated in May, prior to planting.

4.2.2 Vegetation Establishment

4.2.2.1 Species Selection

The plant species selection consists of native species which are known to be local (endemic) to the site. Species mixes used for the site are representative of the vegetation communities recorded by 360 Environmental during the Flora and Vegetation Survey (360 Environmental 2015) (Appendix D). All tubestock will be obtained from nurseries accredited under the Nursery Industry Accreditation Scheme of Australia. Any tubestock that is unable to be supplied by in the quantities required may be replaced with another native species.

4.2.2.2 Planting

Planting of tubestock will be undertaken between May and July after the break of the season, when sufficient soil moisture is present to adequately support the establishment of tubestock. Timing of planting and seeding should occur just prior to and during expected rain events to maximise soil moisture levels. Tubestock will be hardened, vigorous and free of disease and insect pests at the time of planting and will have adequate and healthy root mass readily evident when removed from the tube, sufficient to hold the potting medium together.

Revegetation will be in line with the Bushfire vegetation classifications as identified in the Bushfire Management Plan (BMP) to ensure the BAL ratings are not altered. This will involve revegetation planted to 30% trees, 20% shrubs and 50% groundcover. Within the Class B – Woodland vegetation areas, the tree canopy will be at 30% and the understorey will be planted at 0.5 plants per m^2 in line with current Bushfire Guidelines,

4.3 Visual Impacts – Rural Zoning

The school proposal has raised concerns around the project's suitability for a rural zoning area, in particular to the rural landscape character. The minor changes of the development layout and building orientations has required an investigation to determine if there will be any significant changes to the lines of sight from the surrounding properties.

This section has been written with reference to a number of planning guidelines and other assessments, specifically:

- City of Rockingham 2013, *Planning Policy No. 3.1.1 – Rural Land Strategy*;
- WAPC 2012, State Planning Policy 2.5 – Land Use Planning in Rural Areas; and
- AECOM 2011, *Visual Landscape Evaluation – Singleton, Golden Bay and Secret Harbour*.

The preparation of this assessment has been in accordance with industry assessment and management guidelines, specifically:

- Department of Planning and Infrastructure 2007, *Visual Landscape Planning in Western Australia: a manual for evaluation, assessment, siting and design*; and

- The Landscape Institute 2013, *Guidelines for Landscape and Visual Impact Assessment (Third Edition)*.

4.3.1 Current Site Condition

At present, the site consists of Lots 700 and 11 Mandurah Road, Karnup. Lot 700 currently operates as the Munja Gardens Function Centre, whereas Lot 11 is a rural property that contains a residential dwelling and associated outbuilding. The current condition of the site consists of:

- Lot 700 is almost completely devoid of native vegetation and does not blend in with surrounding properties (consisting of cleared pastures or remnant native vegetation shrublands and low woodlands, while Lot 700 is dominated by tall trees);
- Lot 700 and some areas of Lot 11 is filled with exotic tree species such as palms which do not conform with landscape characters of rural areas;
- Various areas of Lot 11, in particular the southern and western portions are highly degraded and weed infested, presenting a marked contrast between remnant vegetation on site and disturbed areas; and
- A stand of high quality native vegetation exists toward the eastern section of Lot 11, but is not visible from nearby areas.

4.3.2 Assessment Methodology

A site visit was conducted in June 2015 to gather information vegetation types, screening capabilities, sensitive receptor locations and digital photographs, and the visual impact model was run. In 2017, the visual impact assessment was re-done to reflect the slight change in the building locations and orientations.

There are two primary areas of interest, which includes Mandurah Road and the rural properties located on the southern boundary. In particular, the potential impact of the development on valued rural landscape characteristics has been assessed. Valued landscape characteristics are related to remnant native vegetation, clearing and revegetation, identified by the (then) Department of Planning as largely being centred around:

- Shapes of vegetated areas;
- Height, density, form, colour, texture and diversity of plant communities and species;
- Species appearance in relation to local native vegetation;
- Planting pattern and/or layout;
- Shape of cleared areas;

- Edges of cleared areas; and
- Contrast of cleared areas to surrounding vegetation.

To enable assessment of impacts to these characteristics, the site was modelled in 3D software using designs and dimensions from EIW Architects. These building models were inset onto a 1m Light Detection and Ranging (LiDAR) derived Digital Elevation Model (DEM).

4.3.3 Assessment Outcomes

Referring to Figure 18, the visual impact assessment undertaken for the updated building locations and orientations has identified there are no significant changes to the sight lines to the surrounding properties.

4.4 Wastewater Disposal Area

Wastewater from the site will be treated using a BioMAX system which converts the sewage into high quality, B-class recycled water which is colourless, odourless and can be used for restricted irrigation. The quality of the effluent produced by the unit is an average quality as shown below:

- 5 Day Biochemical Oxygen Demand (BOD5) <5mg/L
- Suspended Solids (SS) <10mg/L
- Faecal Coliform organisms per 100 mL 0 per 100ml

Nitrogen loads from the effluent are reduced by 80-100% and with Alum Dosing complete phosphorus is removed.

The irrigation area has been shown on Figure 1. This area is not located in a public drinking water source area or wellhead protection zone. However in accordance with the (then) DoW's *Water Quality Protection Note Land use compatibility in Public Drinking Water Source Areas*, irrigation of treated wastewater is allowable (with conditions) in a Priority 3 (P3) area. The P3 classifications are area defined to manage this risk of pollution from catchment activities. They are usually declared over land where water supply sources co-exist with other land uses such as residential, commercial or light industrial. However as mentioned previously, there are no protection areas on the site or surrounding areas.

This area can be mulched and planted dependant on the irrigation volume and on site soils. Additional planting will be undertaken to reduce the visual impact of the irrigation area.

5 Conclusion

The proponent has taken the environmental characteristics of the site into consideration in the design of the development and in doing so is retaining the areas of best quality vegetation and habitat. Any potential impacts to flora and fauna which may result from the clearing of native vegetation will be assessed during the Clearing Permit and EPBC approvals processes.

The minor changes to the building locations and orientations are not considered a significant change in terms of the visual impact assessment for the surrounding properties. It is therefore concluded that the development is generally environmentally unconstrained.

6 Limitations

This report is produced strictly in accordance with the scope of services set out in the contract or otherwise agreed in accordance with the contract. 360 Environmental makes no representations or warranties in relation to the nature and quality of soil and water other than the visual observation and analytical data in this report.

In the preparation of this report, 360 Environmental has relied upon documents, information, data and analyses ("client's information") provided by the client and other individuals and entities. In most cases where client's information has been relied upon, such reliance has been indicated in this report. Unless expressly set out in this report, 360 Environmental has not verified that the client's information is accurate, exhaustive or current and the validity and accuracy of any aspect of the report including, or based upon, any part of the client's information is contingent upon the accuracy, exhaustiveness and currency of the client's information. 360 Environmental shall not be liable to the client or any other person in connection with any invalid or inaccurate aspect of this report where that invalidity or inaccuracy arose because the client's information was not accurate, exhaustive and current or arose because of any information or condition that was concealed, withheld, misrepresented, or otherwise not fully disclosed or available to 360 Environmental.

Aspects of this report, including the opinions, conclusions and recommendations it contains, are based on the results of the investigation, sampling and testing set out in the contract and otherwise in accordance with normal practices and standards. The investigation, sampling and testing are designed to produce results that represent a reasonable interpretation of the general conditions of the site that is the subject of this report. However, due to the characteristics of the site, including natural variations in site conditions, the results of the investigation, sampling and testing may not accurately represent the actual state of the whole site at all points.

It is important to recognise that site conditions, including the extent and concentration of contaminants, can change with time. This is particularly relevant if this report, including the data, opinions, conclusions and recommendations it contains, are to be used a considerable time after it was prepared. In these circumstances, further investigation of the site may be necessary.

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FIGURES

Legend

- Site Location (10.43 ha)
- Major Roads

- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS
- LOCALITY MAP SOURCED LANDGATE 2006
- AERIAL PHOTOGRAPHY SOURCED LANDGATE 2017
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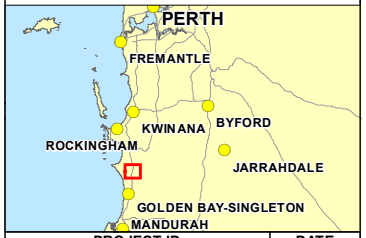
LOCALITY MAP



PROJECT ID	DATE
785	27/07/2017

HORIZONTAL DATUM AND PROJECTION
GDA 1994 MGA Zone 50

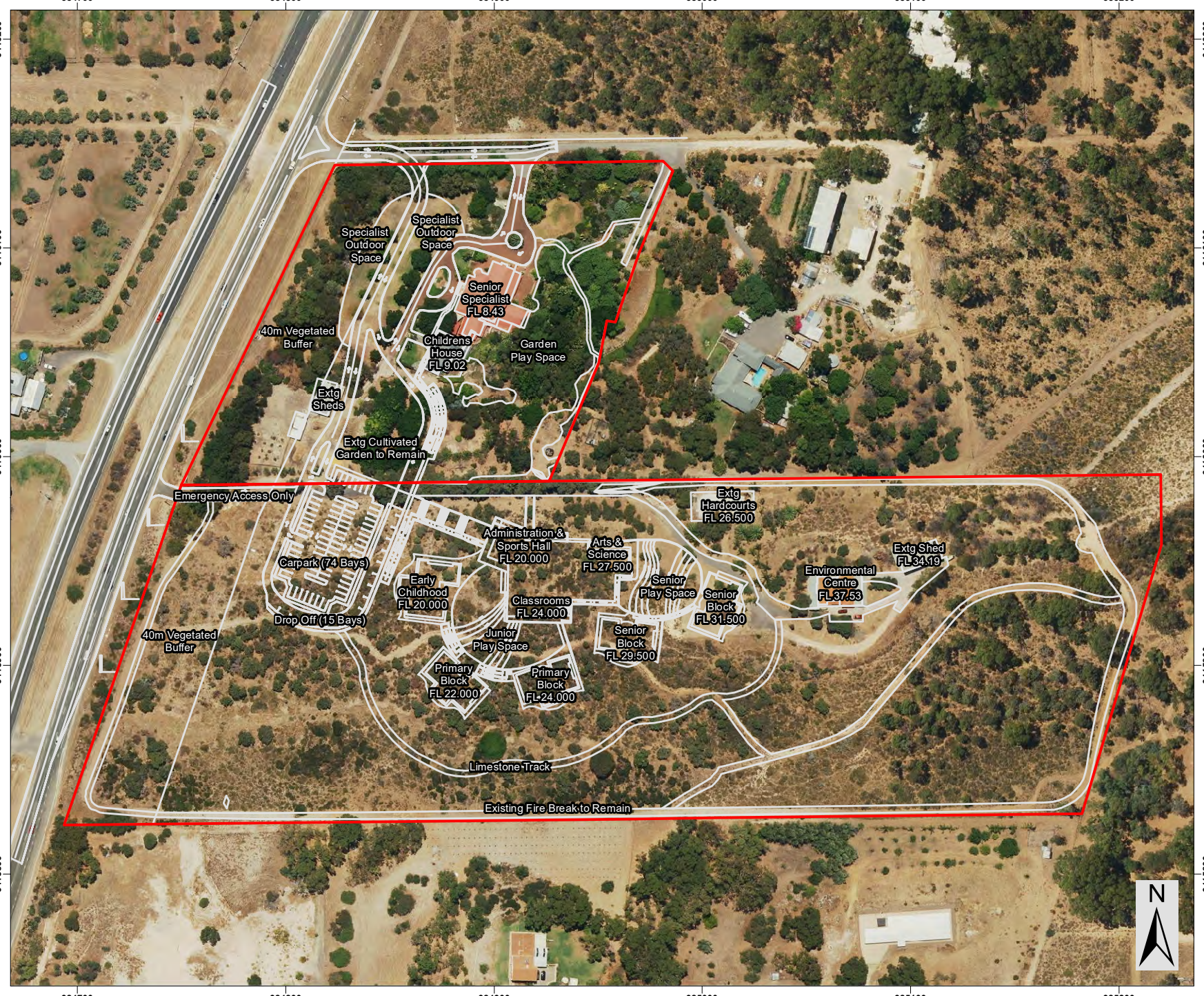
CREATED	CHECKED	APPROVED	REVISION
EW	CM	TS	0

Rockingham Montessori School
Lots 11 & 700 Mandurah Road, Karnup

Environmental Assessment Report

Figure 1
Site Location

K:\Projects\9.0 APP\785 Mandurah Road Karnup EAR\Figures\EPBC\785 EPBC Figure 1 Site Location.mxd



Legend

- Site Boundary (10.43 ha)
- Development Masterplan

- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS
- LOCALITY MAP SOURCED LANDGATE 2006
- AERIAL PHOTOGRAPHY SOURCED LANDGATE 2017
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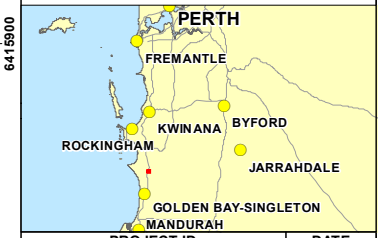
LOCALITY MAP



PROJECT ID	DATE
785	5/09/2017

HORIZONTAL DATUM AND PROJECTION
GDA 1994 MGA Zone 50

CREATED	CHECKED	APPROVED	REVISION
EW	CM	TS	0

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Environmental Assessment Report

Figure 2
Development Masterplan

K:\Projects\9.0 APP\785 Mandurah Road Karnup EAR\Figures\785 EAR Figure 2 - Development Masterplan.mxd

Legend

- Site Location (10.43 ha)
- Clearing Footprint (5.70 ha)
- Major Roads

- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS
- LOCALITY MAP SOURCED LANDGATE 2006
- AERIAL PHOTOGRAPHY SOURCED LANDGATE 2017
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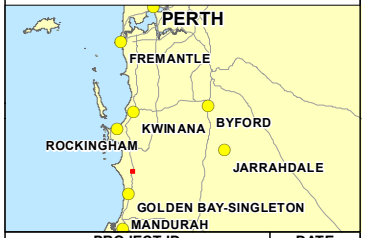
LOCALITY MAP



PROJECT ID	DATE
785	31/08/2017

HORIZONTAL DATUM AND PROJECTION
GDA 1994 MGA Zone 50

CREATED	CHECKED	APPROVED	REVISION
EW	CM	TS	0

Rockingham Montessori School
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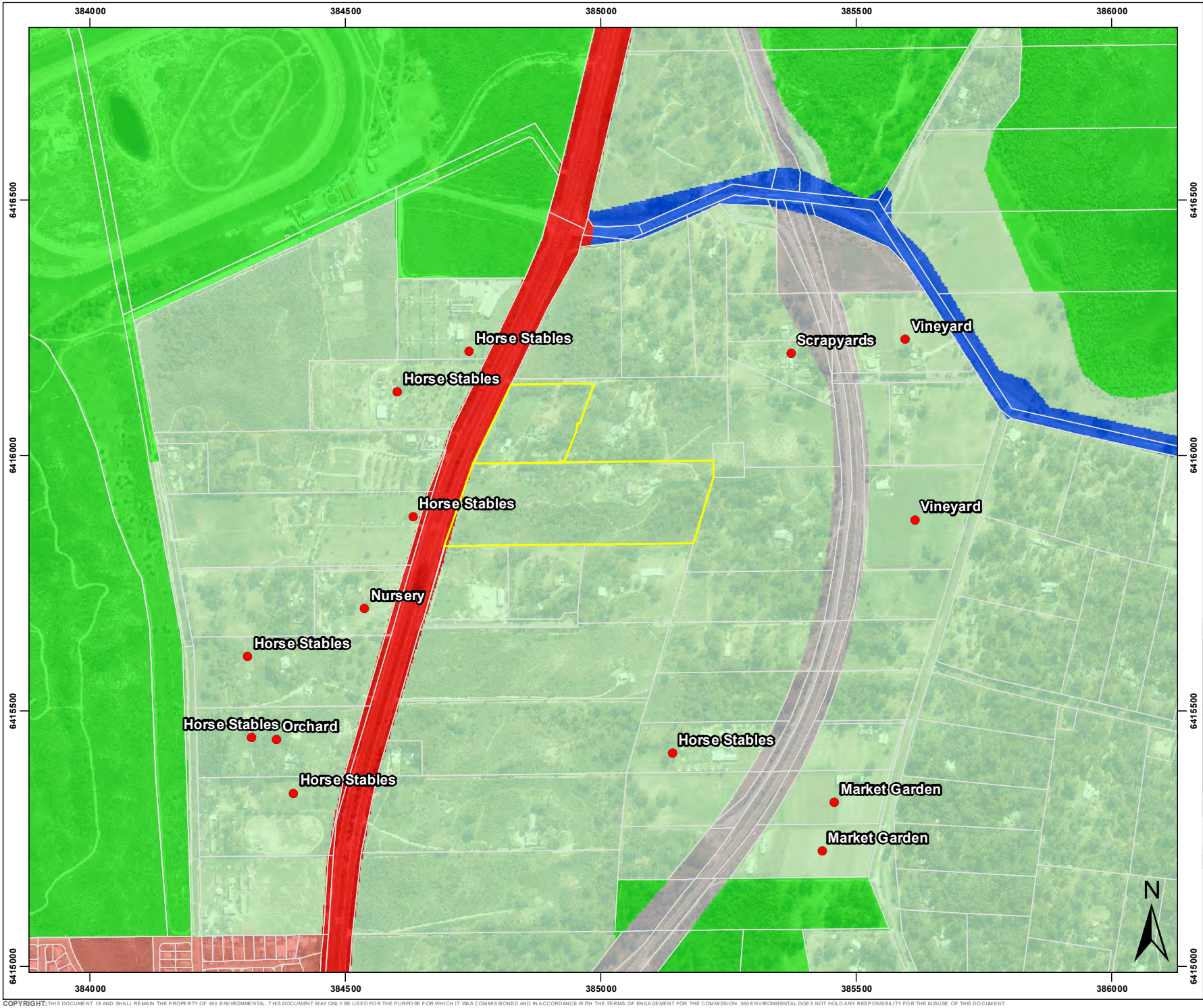
Environmental Assessment Report

Figure 3
Clearing Footprint

K:\Projects\9.0 APP\785 Mandurah Road Karnup EAR\Figures\EPBC\785 EPBC Figure 2 Project Area.mxd



Legend

- Site Location
- Surrounding Land Uses

Scheme Legend

- Scheme boundary

Reserved Lands

- Parks and recreation
- Resricted public access
- Railways
- Port installations
- State forests
- Water catchments
- Civic and cultural
- Waterways
- Primary regional roads
- Other regional roads
- Public purposes - denoted as follows:

H	Hospital	CG	Commonwealth Government
HS	High school	SEC	State Energy Commission
TS	Technical school	SU	Special uses
CP	Car park	WSD	Water Authority of WA
U	University	P	Prison

Zones

- Urban
- Urban deferred
- Central city area
- Industrial
- Special industrial
- Rural
- Rural - water protection
- Private recreation

Redevelopment schemes

- Redevelopment scheme / act area

- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS
- LOCALITY MAP SOURCED FROM LANDGATE 2006
- MRS ZONING FROM LANDGATE, CURRENT AS OF 12 NOV 2014
- AERIAL PHOTOGRAPHY SOURCED FROM LANDGATE AUG 2014 (© Western Australian Land Information Authority 2014)

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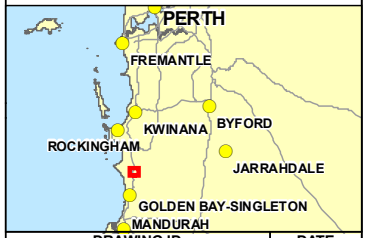
LOCALITY MAP



DRAWING ID	DATE
785 F12 Heritage.mxd	07-Nov-2014

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GDA 1994 MGA Zone 50

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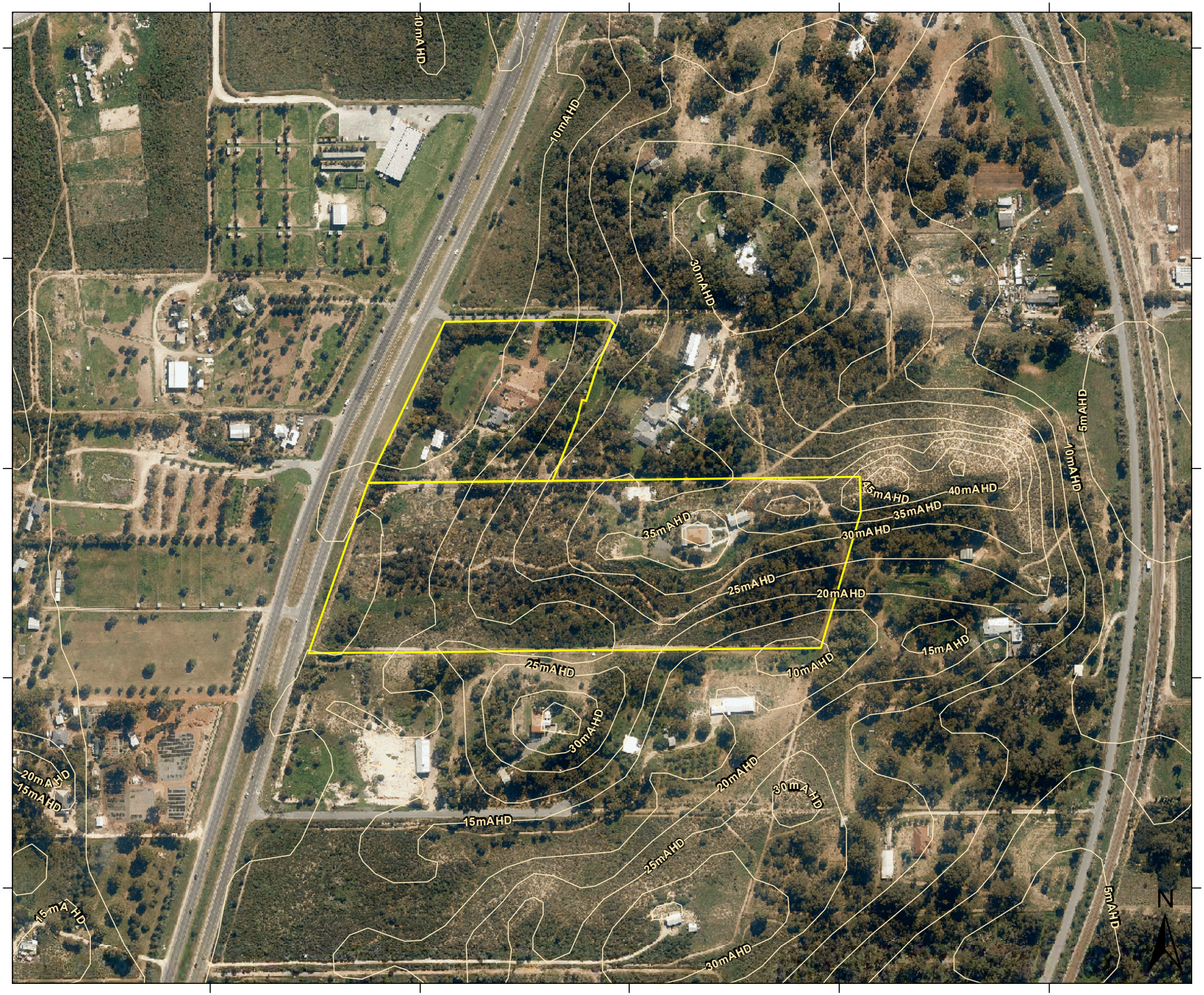
Figure 4 Surrounding Land Uses



Legend

- Site Location
- Ground Surface Contours

- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS
- LOCALITY MAP SOURCED FROM LANDGATE 2006
- TOPOGRAPHY SOURCED FROM GSWA 2008
- AERIAL PHOTOGRAPHY SOURCED FROM LANDGATE 2014 (© Western Australian Land Information Authority 2014)

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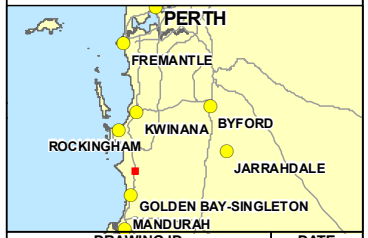
LOCALITY MAP



DRAWING ID	DATE
785 F3 Topography.mxd	07-Nov-2014

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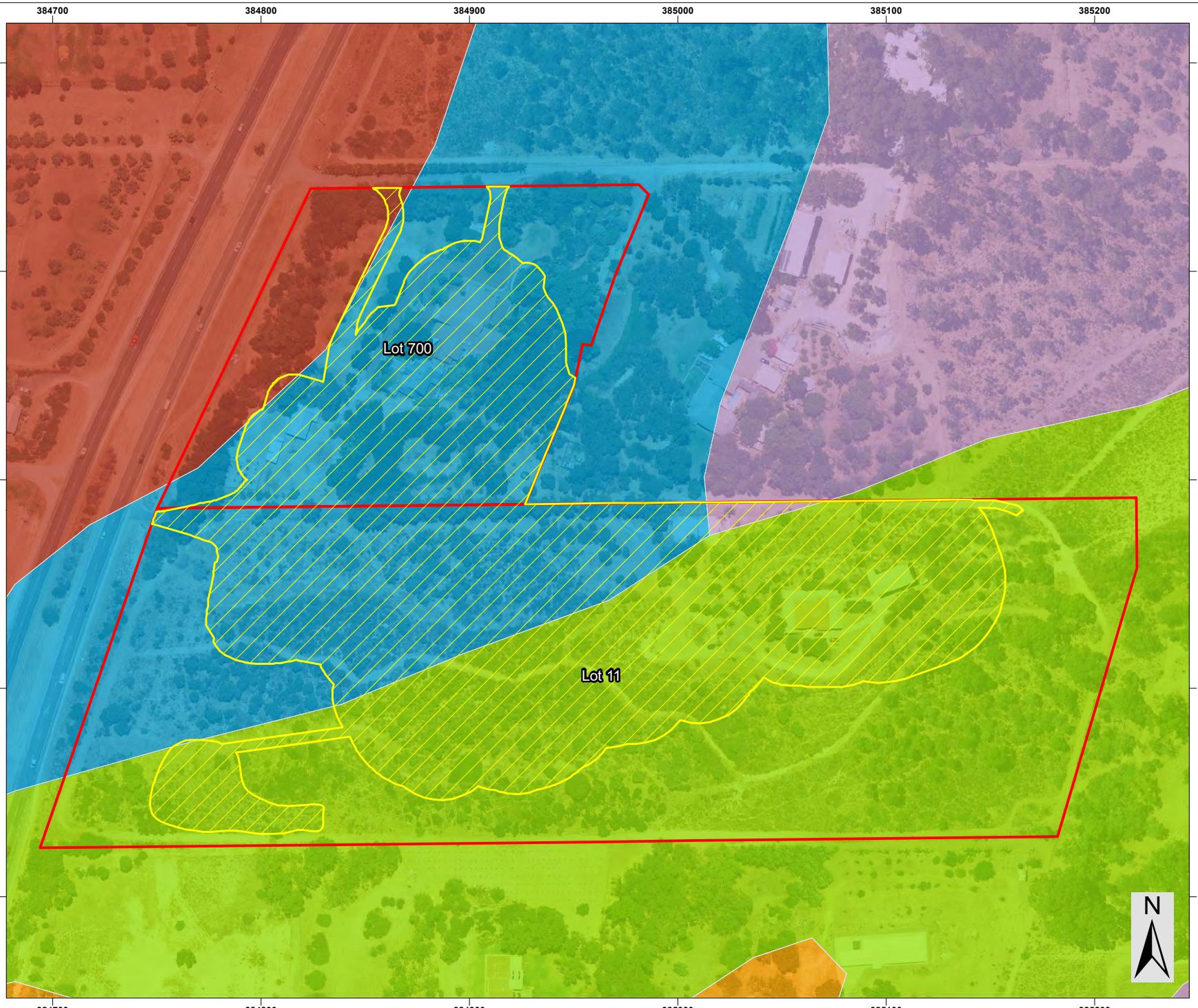
Figure 5 Topography



Legend

Site Location (10.43 ha)

Clearing Area (5.70 ha)

Soil Subsystems

211Qu__Qf2: Relict foredunes and gently undulating beach ridge plain with deep uniform calcareous sands.

211Qu__Qp1: Complex of nested low relief parabolic dunes with moderate to steep slopes and uniform calcareous sands showing variable depths of surface darkening.

211Qu__Qp2: Long walled discrete parabolic dunes with moderate to steep slopes and uniform calcareous sands showing variable depths of surface darkening.

211Sp__S1b: Dune ridges with deep siliceous yellow brown sands or pale sands with yellow-brown subsoil and slopes up to 15%.

211Sp__S1d: Dune ridges with moderately deep to very deep siliceous yellow-brown sands, rare limestone outcrop and slopes 3-20% occurring on the eastern slipface.

- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS
- LOCALITY MAP SOURCED LANDGATE 2006
- AERIAL PHOTOGRAPHY SOURCED LANDGATE 2017
- SOIL SUBSYSTEMS SOURCED DAFWA 2012
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LOCALITY MAP

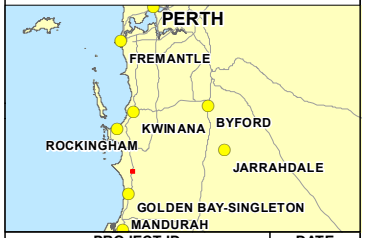

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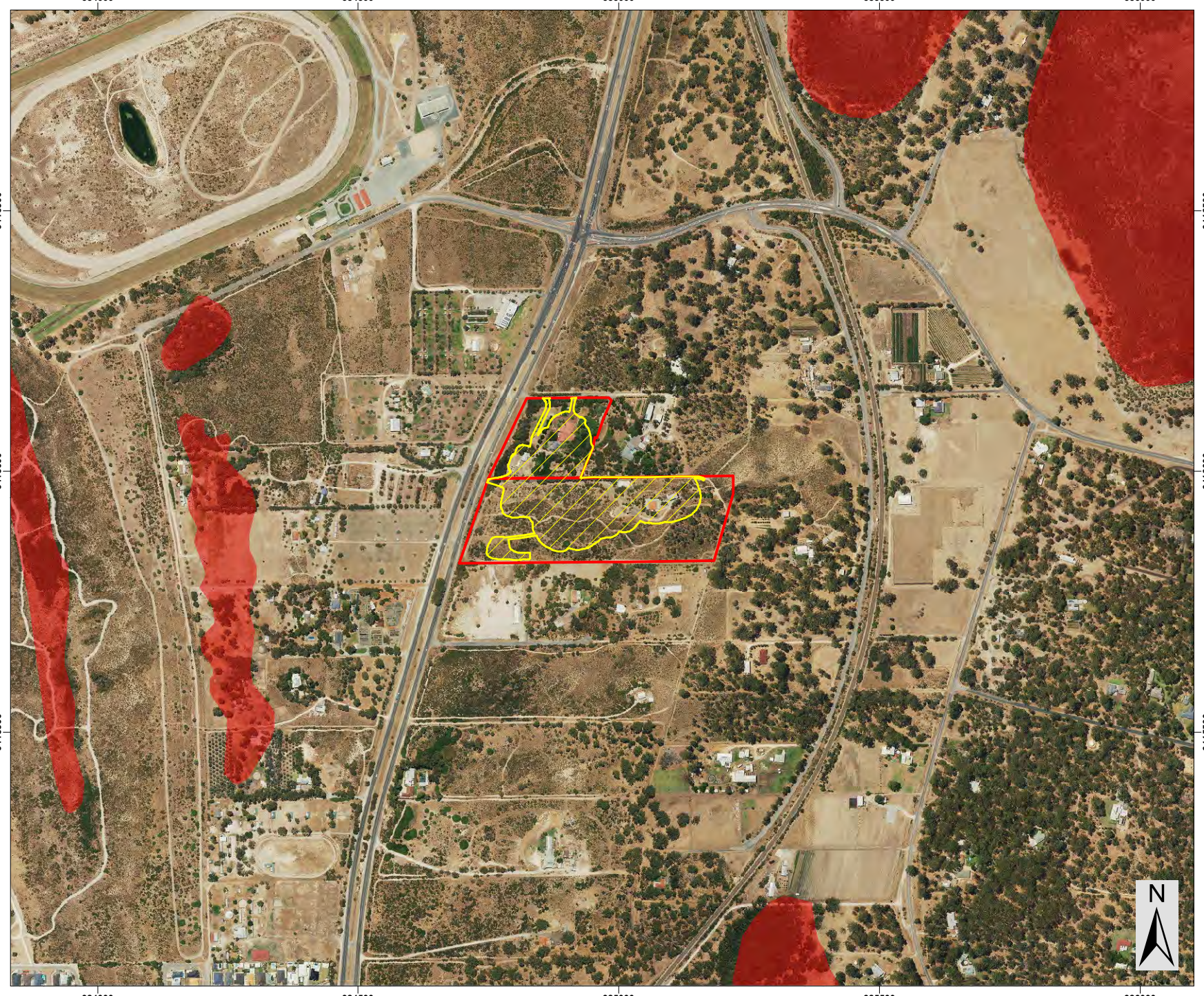
Figure 6
Soil Subsystems

K:\Projects\9.0 APP\785 Mandurah Road Karnup EAR\Figures\EPBC\785 EPBC Figure 4 Soil Subsystems.mxd



Legend

- Site Location (10.43 ha)
- Clearing Area (5.70 ha)

Acid Sulfate Soils

Disturbance Risk

- High to moderate risk

- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS
- LOCALITY MAP SOURCED LANDGATE 2006
- AERIAL PHOTOGRAPHY SOURCED LANDGATE 2017
- ASS RISK SOURCED DER 2014

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LOCALITY MAP

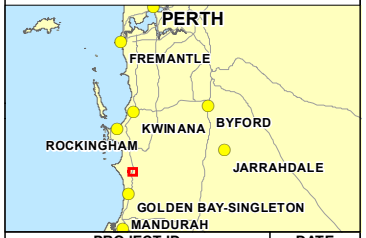

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Figure 7
Contamination

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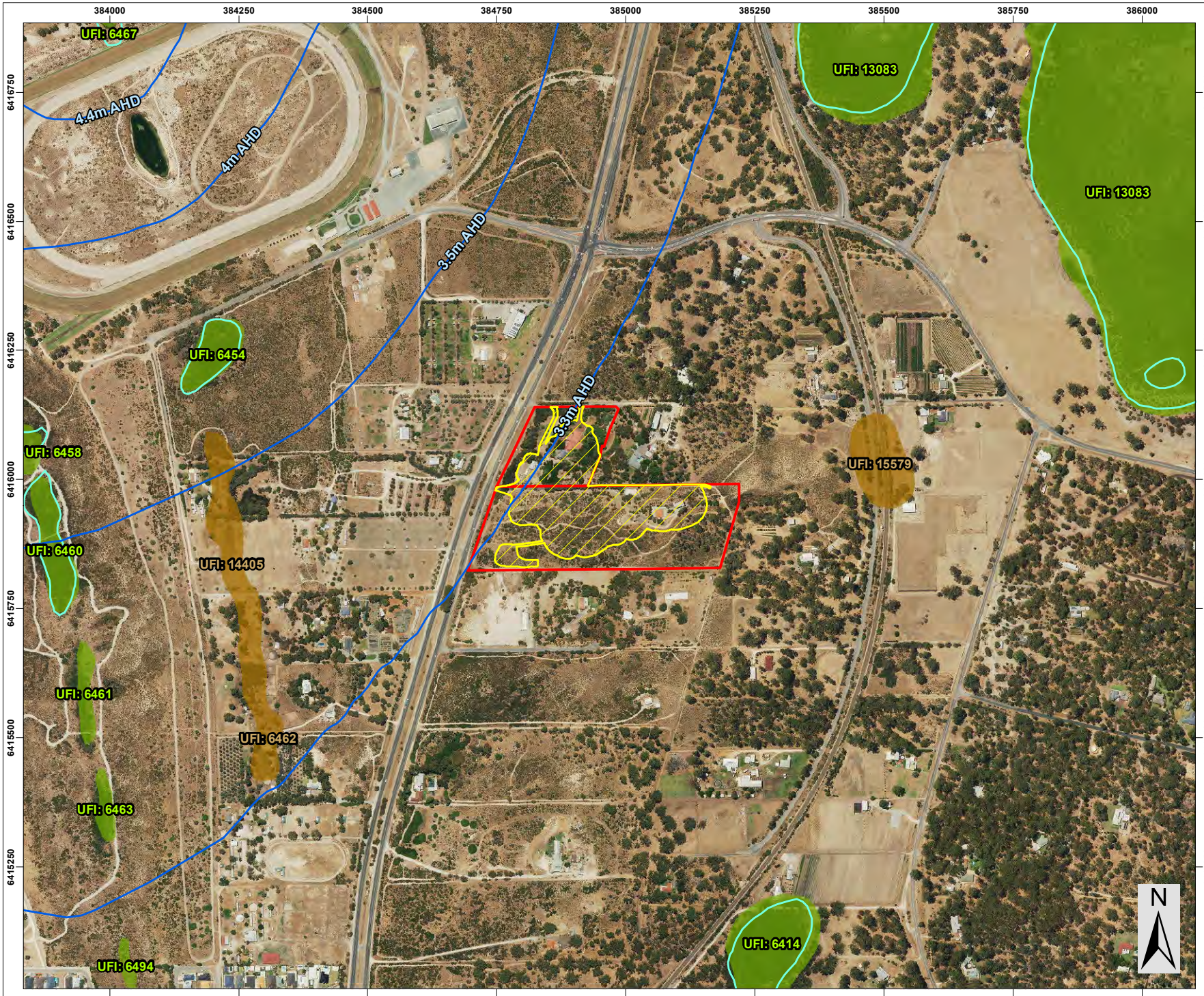

Legend

- Site Location (10.43 ha)
- Clearing Area (5.70 ha)
- Major Roads
- Groundwater Contour (Max)

Surface Water Features

- Swamp (Perennial)

Geomorphic Wetlands

- Conservation
- Resource Enhancement
- Multiple Use
- Not Assessed

- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS
- LOCALITY MAP SOURCED LANDGATE 2006
- AERIAL PHOTOGRAPHY SOURCED LANDGATE 2017
- GROUNDWATER CONTOUR SOURCED DOW 2015
- HYDROGRAPHY SOURCED DOW 2015
- GEOMORPHIC WETLANDS SOURCED DPAW 2016

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LOCALITY MAP

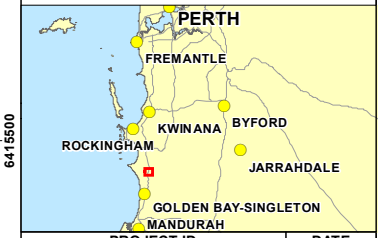

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Figure 8
Surface Hydrology

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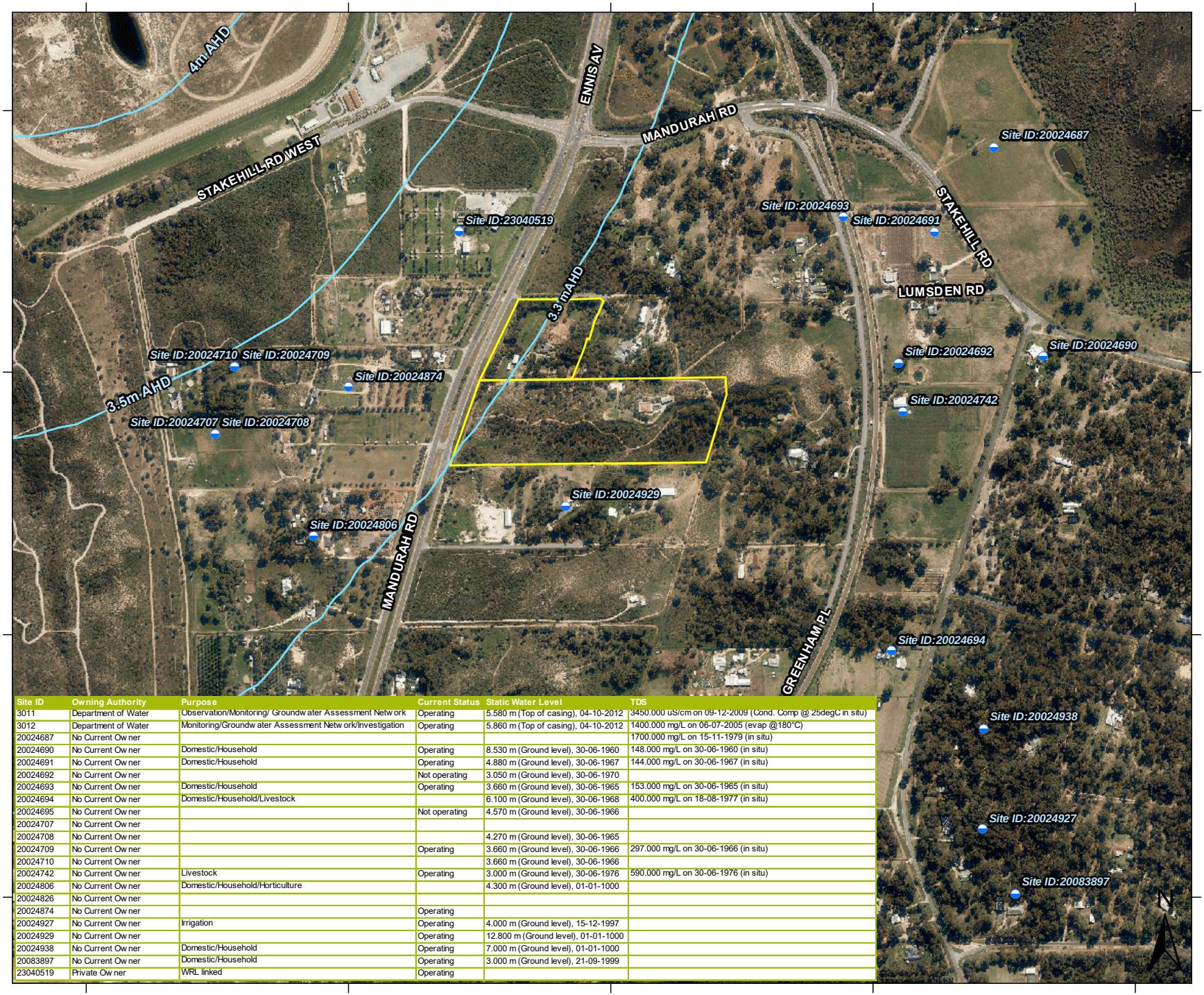

Site ID	Owning Authority	Purpose	Current Status	Static Water Level	TDS
3011	Department of Water	Observation/Monitoring/ Groundwater Assessment Network	Operating	5.580 m (Top of casing), 04-10-2012	3450.000 uS/cm on 09-12-2009 (Cond. Comp @ 25degC in situ)
3012	Department of Water	Monitoring/Groundwater Assessment Network/Investigation	Operating	5.860 m (Top of casing), 04-10-2012	1400.000 mg/L on 06-07-2005 (evap @180°C)
20024687	No Current Owner				1700.000 mg/L on 15-11-1979 (in situ)
20024690	No Current Owner	Domestic/Household	Operating	8.530 m (Ground level), 30-06-1960	148.000 mg/L on 30-06-1960 (in situ)
20024691	No Current Owner	Domestic/Household	Operating	4.880 m (Ground level), 30-06-1967	144.000 mg/L on 30-06-1967 (in situ)
20024692	No Current Owner		Not operating	3.050 m (Ground level), 30-06-1970	
20024693	No Current Owner	Domestic/Household	Operating	3.660 m (Ground level), 30-06-1965	153.000 mg/L on 30-06-1965 (in situ)
20024694	No Current Owner	Domestic/Household/Livestock		6.100 m (Ground level), 30-06-1968	400.000 mg/L on 18-08-1977 (in situ)
20024695	No Current Owner		Not operating	4.570 m (Ground level), 30-06-1966	
20024707	No Current Owner				
20024708	No Current Owner			4.270 m (Ground level), 30-06-1965	
20024709	No Current Owner		Operating	3.660 m (Ground level), 30-06-1966	297.000 mg/L on 30-06-1966 (in situ)
20024710	No Current Owner			3.660 m (Ground level), 30-06-1966	
20024742	No Current Owner	Livestock	Operating	3.000 m (Ground level), 30-06-1976	590.000 mg/L on 30-06-1976 (in situ)
20024806	No Current Owner	Domestic/Household/Horticulture		4.300 m (Ground level), 01-01-1000	
20024826	No Current Owner				
20024874	No Current Owner		Operating		
20024927	No Current Owner	Irrigation	Operating	4.000 m (Ground level), 15-12-1997	
20024929	No Current Owner		Operating	12.800 m (Ground level), 01-01-1000	
20024938	No Current Owner	Domestic/Household	Operating	7.000 m (Ground level), 01-01-1000	
20083897	No Current Owner	Domestic/Household	Operating	3.000 m (Ground level), 21-09-1999	
23040519	Private Owner	WRL linked	Operating		

Legend

- Site Location
- WIN Bores
- Groundwater Contours (Hist. Max)

- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS
- LOCALITY MAP SOURCED FROM LANDGATE 2006
- WIN BORES SOURCED FROM DOW 2012
- GROUNDWATER CONTOURS SOURCED FROM DOW 2010
- AERIAL PHOTOGRAPHY SOURCED FROM LANDGATE 2014 (© Western Australian Land Information Authority 2014)

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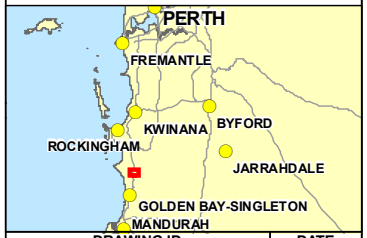
LOCALITY MAP



DRAWING ID	DATE
785 F7 Groundwater.mxd	07-Nov-2014

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GDA 1994 MGA Zone 50

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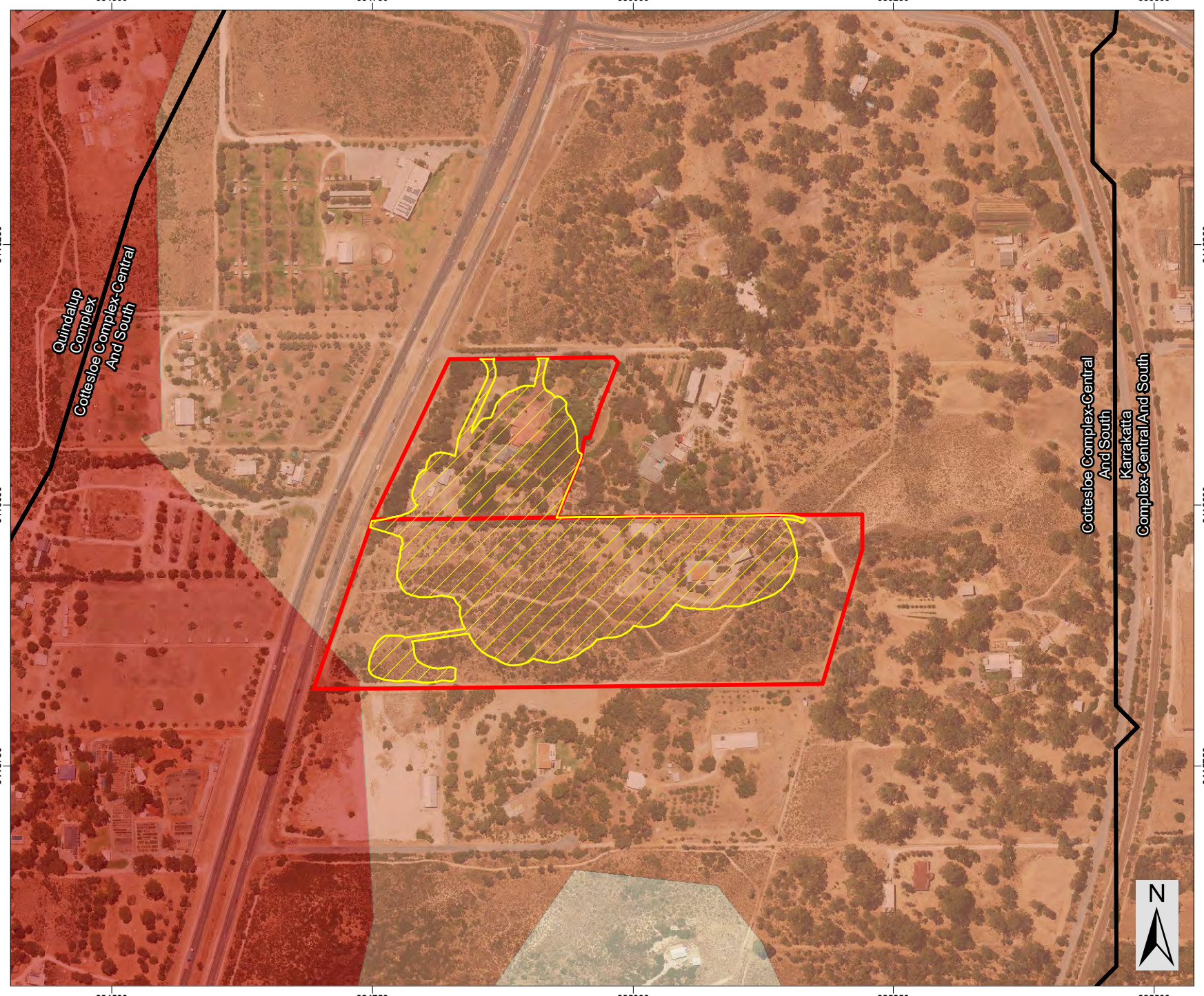
Figure 9 - Groundwater



Legend

- Site Location (10.43 ha)
- Clearing Area (5.70 ha)
- Heddle (1980) Vegetation Complexes

Pre-European Vegetation Complexes

- Rockingham: 3048
- Spearwood: 998
- Spearwood: 1001

- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS
- LOCALITY MAP SOURCED LANDGATE 2006
- AERIAL PHOTOGRAPHY SOURCED LANDGATE 2017
- PRE EUROPEAN VEGETATION SOURCED DAFWA 2012
- HEDDLE VEGETATION SOURCED CALM 1980

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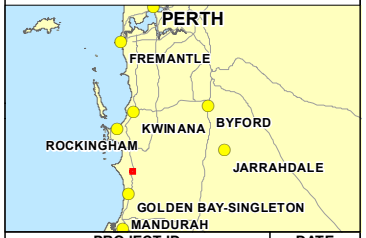
LOCALITY MAP



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GDA 1994 MGA Zone 50

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Figure 9
Broad Vegetation Associations

K:\Projects\9.0 APP\785 Mandurah Road Karnup EAR\Figures\EPBC\785 EPBC Figure 6 Vegetation.mxd

Legend

Site Boundary (10.43 ha)

Clearing Area (5.70 ha)

Vegetation Associations

AsOa: Tall Shrubland of *Acacia saligna* over Open Shrubland of *Olearea axilaris*, over Shrubland of *Kunzea glabrescens*, *Scaevola thesioides* and *Hibbertia hypericoides* over Very Open Grassland of *Ehrharta calycina* (0.41 ha)

BaBm: Low Open Woodland of *Banksia attenuata* over Tall Shrubland of *Acacia rostellifera* over Low Open Shrubland of *Kunzea glabrescens*, *Hemiandra pungens* and *Conostylis aculeata* over Grassland of *Ehrharta calycina* (4.48 ha)

EgBa: Woodland of *Eucalyptus gomphocephala* over Tall Shrubland of *Banksia attenuata* and *Banksia menziesii* over Open Shrubland of *Hibbertia hypericoides* and *Kunzea glabrescens*, over Very Open Sedgeland of *Lepidosperma gladiatum*, over Grassland of *Ehrharta* (0.69 ha)

Ne: Non-endemic species and/or Garden species and/or weedy tracks and/or revegetation (3.00 ha)

Cl: Cleared (1.85 ha)

- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS
- LOCALITY MAP SOURCED LANDGATE 2006
- AERIAL PHOTOGRAPHY SOURCED LANDGATE 2017
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LOCALITY MAP

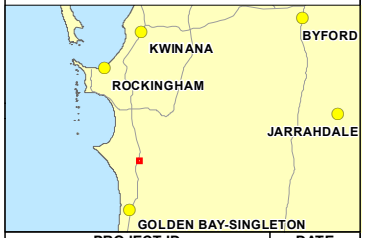

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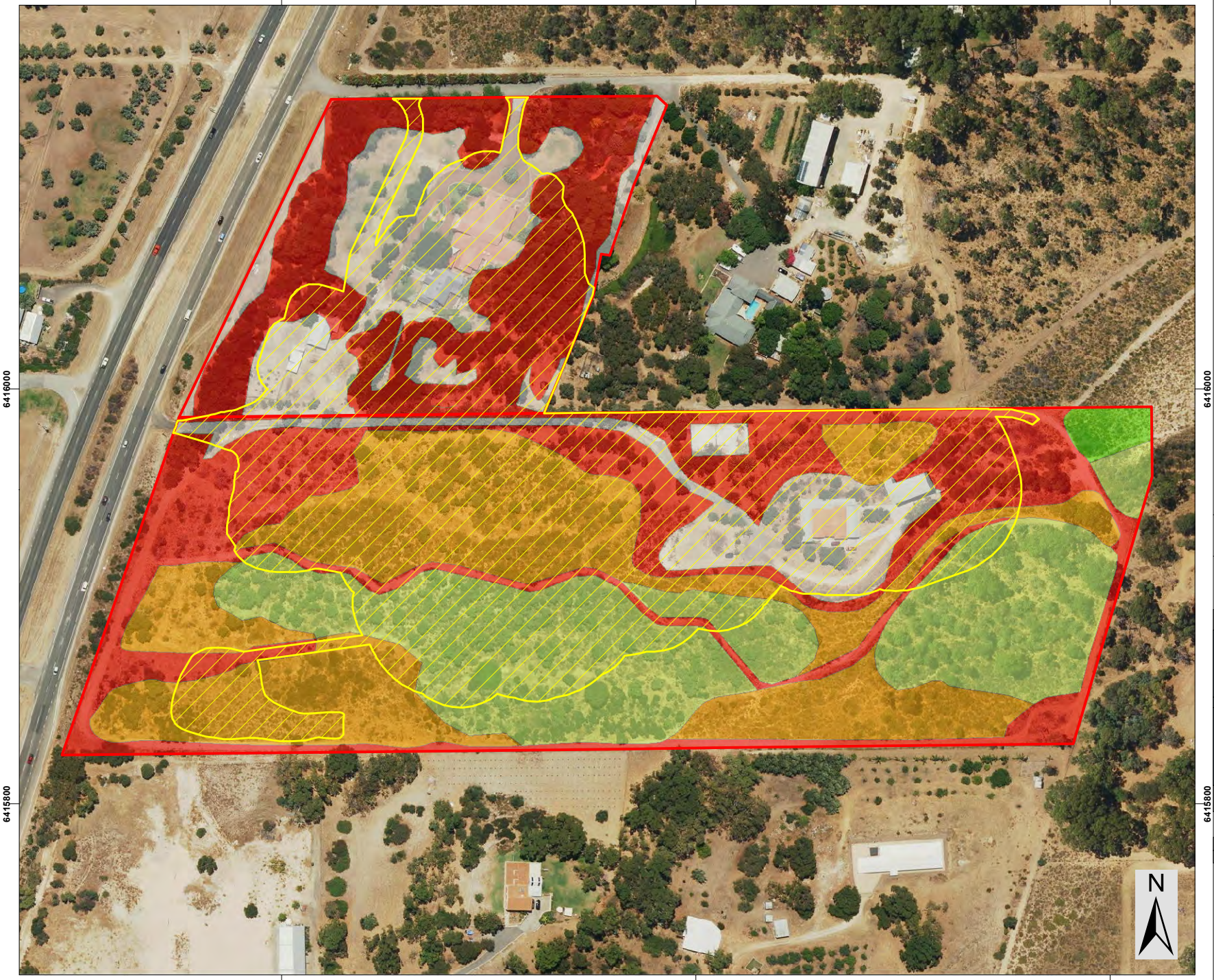
Figure 11
Surveyed Vegetation Associations

K:\Projects\9.0 APP\785 Mandurah Road Karnup EAR\Figures\NVCP\785 NVCP Figure 7 Surveyed Vegetation Associations.mxd



Legend

- Site Location (10.43 ha)
- Clearing Area (5.70 ha)

Vegetation Condition (Clearing Area)

- Cleared (1.47 ha)
- Completely Degraded (1.97 ha)
- Degraded (1.42 ha)
- Good (0.84 ha)

Vegetation Condition (Remaining)

- Cleared (0.38 ha)
- Completely Degraded (1.62 ha)
- Degraded (1.18 ha)
- Good (1.46 ha)
- Excellent (0.09 ha)

- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS
- LOCALITY MAP SOURCED LANDGATE 2006
- AERIAL PHOTOGRAPHY SOURCED LANDGATE 2017 (© Western Australian Land Information Authority 2017)

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LOCALITY MAP

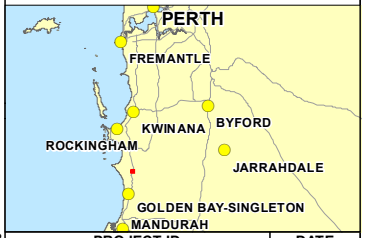

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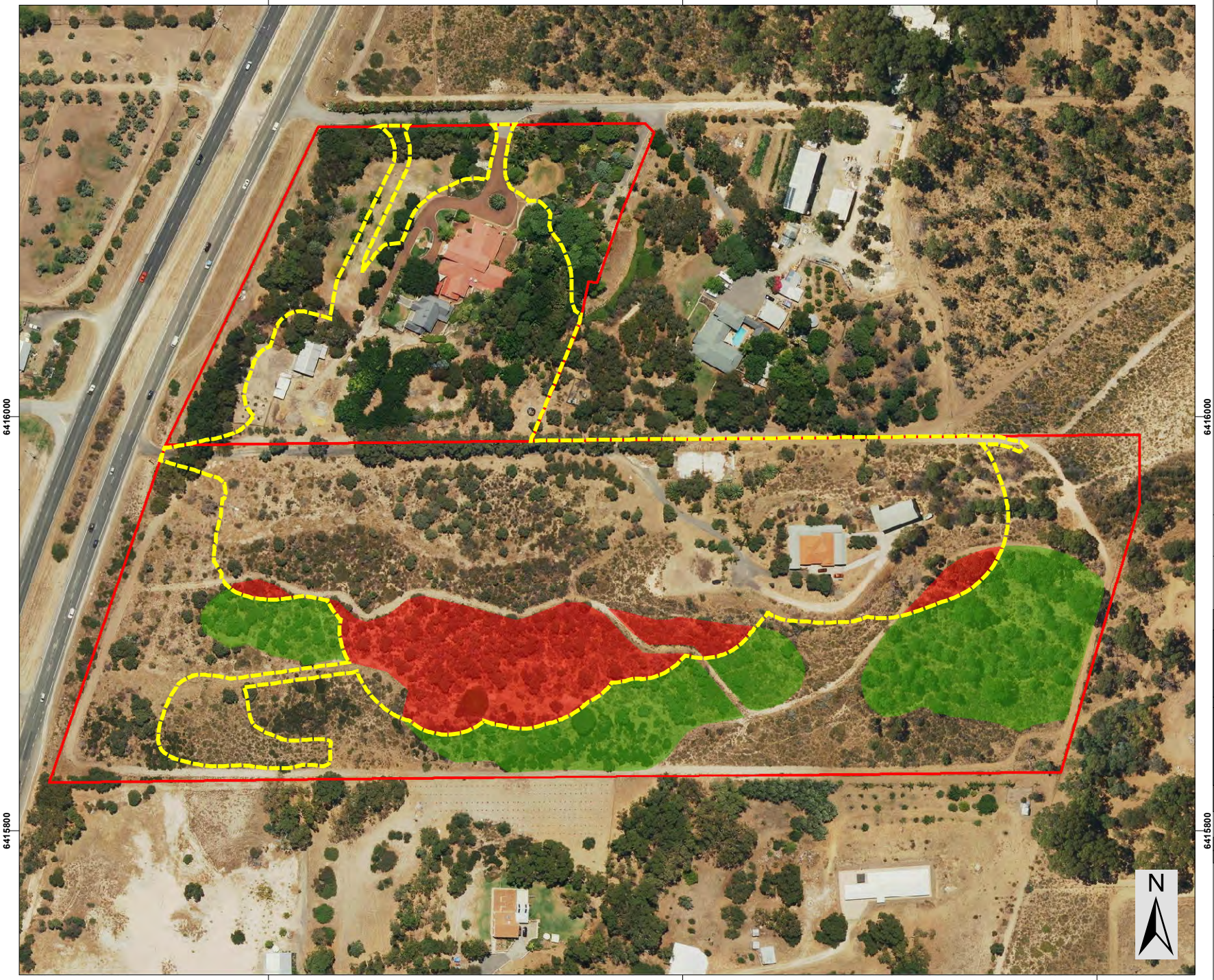
Figure 12
Vegetation Condition

K:\Projects\9.0 APP\785 Mandurah Road Karnup EAR\Figures\EPBC\785 EPBC Figure 10 Vegetation Condition.mxd



Legend

- Site Location (10.43 ha)
- Clearing Area (5.70 ha)

Banksia Woodlands

- **TEC:** Clearing Area (0.84 ha)
- **TEC:** Remaining (1.38 ha)

- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS
- LOCALITY MAP SOURCED LANDGATE 2006
- AERIAL PHOTOGRAPHY SOURCED LANDGATE 2017
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LOCALITY MAP

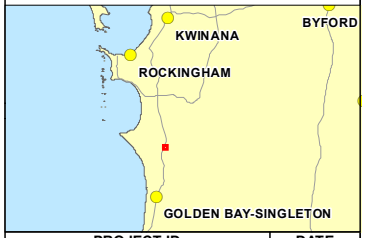

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Figure 13
Banksia Woodlands TEC

K:\Projects\9.0 APP\785 Mandurah Road Karnup EAR\Figures\NVCP\785 NVCP Figure 9 Banksia Woodlands TEC.mxd

Legend

- Site Boundary (10.43 ha)
- Clearing Area (5.70 ha)

Black Cockatoo Foraging Habitat

- Clearing Area (2.56 ha)
- Remaining (2.85 ha)

Potential Breeding Trees

- *Eucalyptus gomphocephala*
- *Eucalyptus gomphocephela* (dead)

- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS
- LOCALITY MAP SOURCED LANDGATE 2006
- AERIAL PHOTOGRAPHY SOURCED LANDGATE 2017 (© Western Australian Land Information Authority 2017)

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LOCALITY MAP

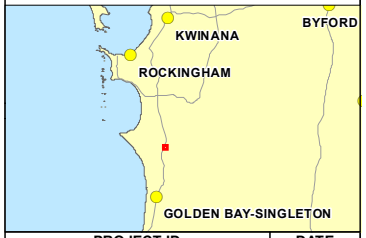

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Figure 14
Black Cockatoo Habitat

K:\Projects\9.0 APP\785 Mandurah Road Karnup EAR\Figures\NVCP\785 NVCP Figure 10 Black Cockatoo Habitat.mxd

Legend

- Site Location (10.43 ha)
- 4km Buffer
- Bush Forever Sites
- DBCA Managed Lands
- Environmentally Sensitive Areas
- Perth Regional Ecological Linkages

- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS
- LOCALITY MAP SOURCED LANDGATE 2006
- AERIAL PHOTOGRAPHY SOURCED LANDGATE 2017
- BUSH FOREVER SITES SOURCED DOP 20
- ENVIRONMENTALLY SENSITIVE AREAS SOURCED DER 2015
- DPAW MANAGED LANDS SOURCED DPAW 2014
- PERTH REGIONAL ECOLOGICAL LINKAGES SOURCED WALGA 2014

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LOCALITY MAP

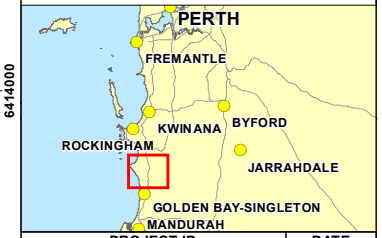

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Figure 15
Conservation Areas

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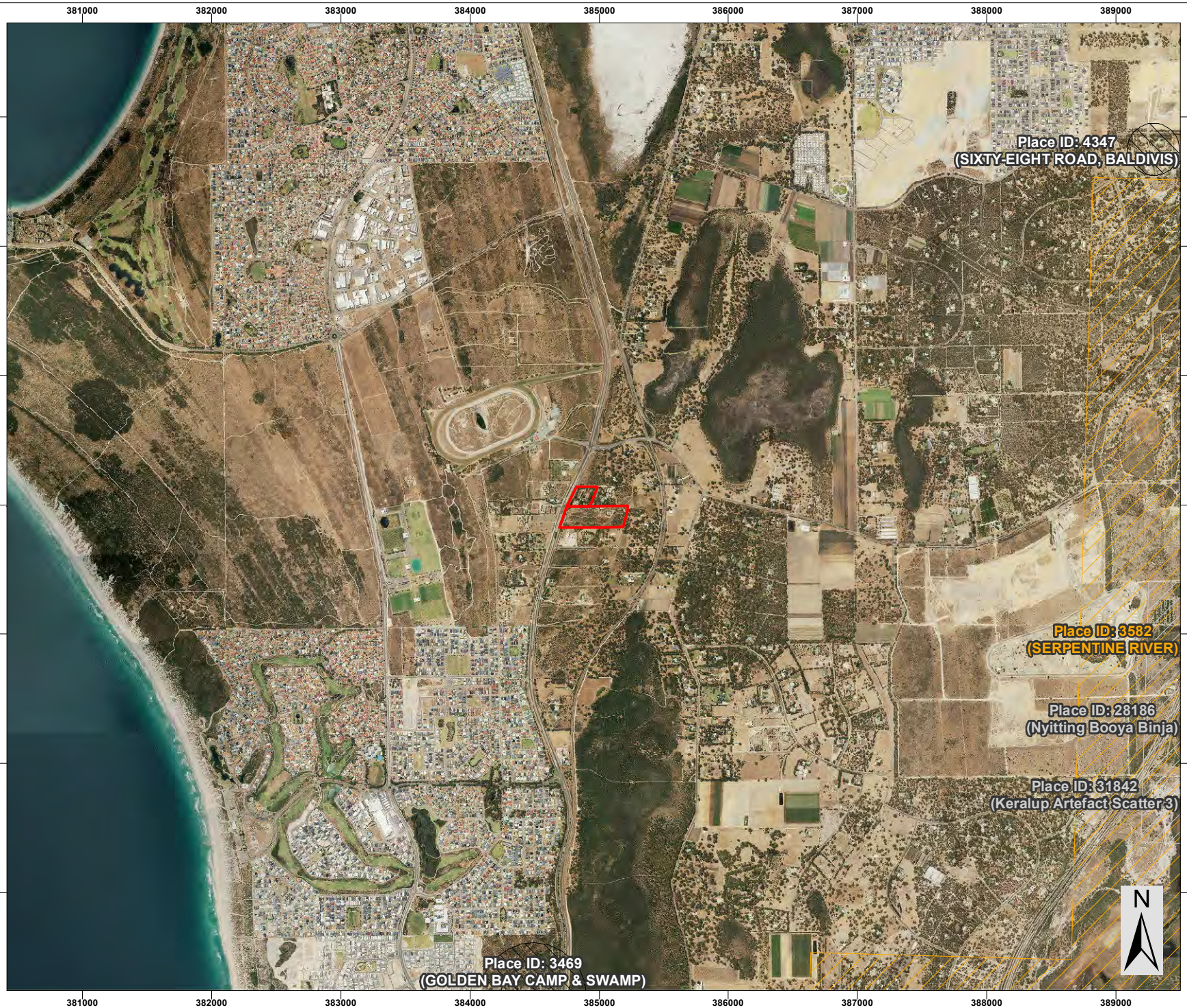

Legend

- Site Location (10.43 ha)

Aboriginal Heritage Site

STATUS

- Lodged
- Registered Site
- Stored Data / Not a Site

- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS
- LOCALITY MAP SOURCED LANDGATE 2006
- AERIAL PHOTOGRAPHY SOURCED LANDGATE 2017
- ABORIGINAL HERITAGE SOURCED DAA 2015
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f (08) 9381 2360
w www.360environmental.com.au

0 500 1,000 1,500
Metres
1:40,000 @ A4

LOCALITY MAP

PROJECT ID	DATE
785	27/07/2017

HORIZONTAL DATUM AND PROJECTION
GDA 1994 MGA Zone 50

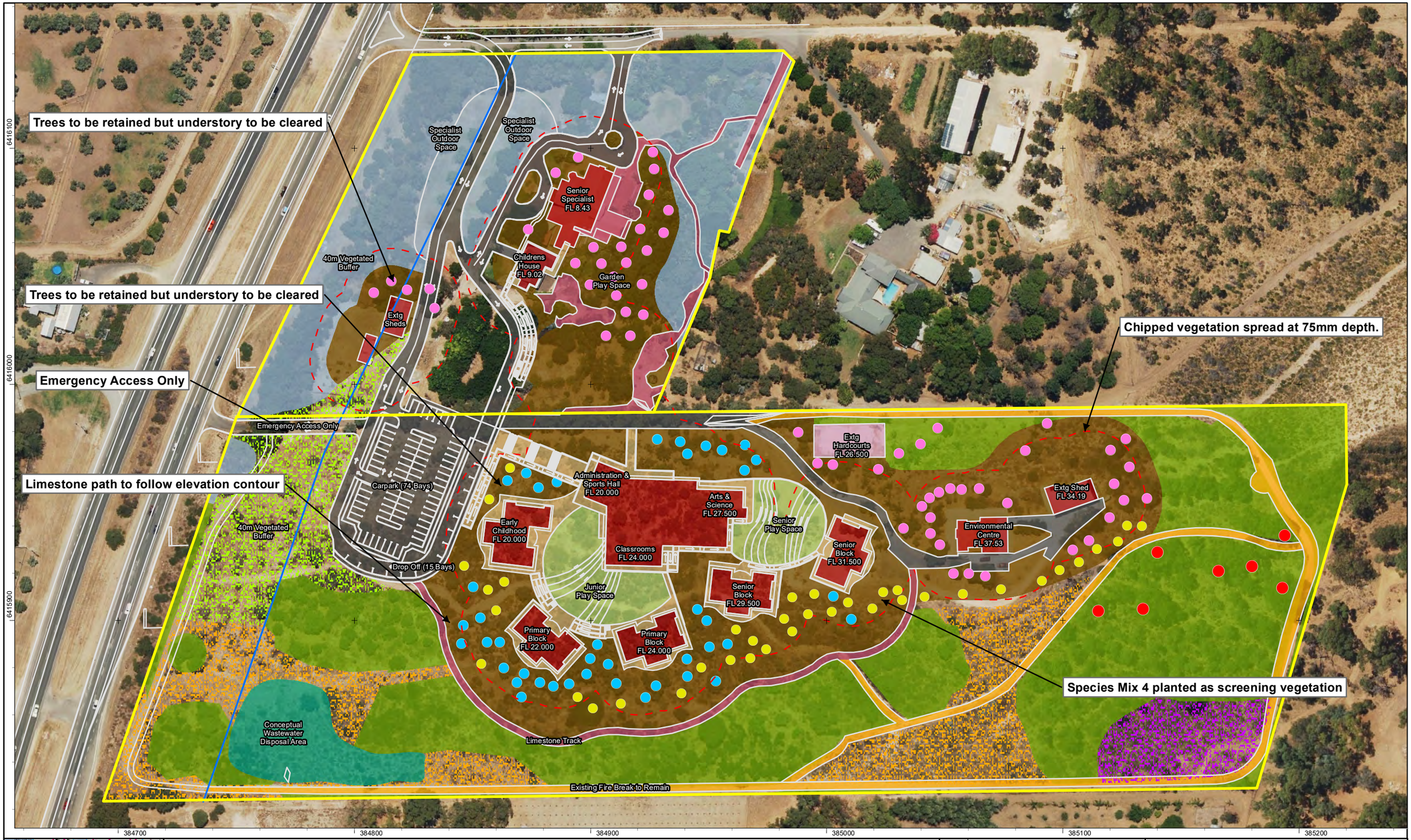
CREATED	CHECKED	APPROVED	REVISION
EW	CM	TS	0

Rockingham Montessori School
Lots 11 & 700 Mandurah Road, Karnup

Environmental Assessment Report

Figure 16
Heritage

K:\Projects\9.0 APP\785 Mandurah Road Karnup EAR\Figures\EPBC\785 EPBC Figure 8 Heritage.mxd



LEGEND

- Site Boundary
- Potential Black Cockatoo Habitat Trees
- 20 m Separation Distance Guide

Rehabilitation Elements

- Species Mix 1
- Species Mix 2
- Species Mix 3
- Species Mix 4
- 40m Vegetated Buffer

Vegetation Management

- Mulched or Cleared Understory
- Retained Native Vegetation
- Retained Non-Endemic Vegetation

Development Layout

- 2500m² Wastewater Disposal Area
- Existing and Proposed Buildings
- Deck
- Firebreak - Existing
- Hardcourt - Existing
- Limestone Path or Paving
- Recreation Area
- Carpark/Access
- Estimated Road Batters
- Wastewater Easement

DATA SOURCES
AERIAL IMAGERY: LANDGATE FEB 2015
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HORIZONTAL DATUM	SCALE	REVISION	VERT. DATUM
GDA MGA ZONE 50	1:1,500	A	-

DRAWN	CHECKED	APPROVED	STATUS	DATE	SIZE
EW	CM	TS	FINAL	22/10/2015	A3

0 10 20 40 60 80
Meters

PROJECT NUMBER	DRAWING NO.
785	1

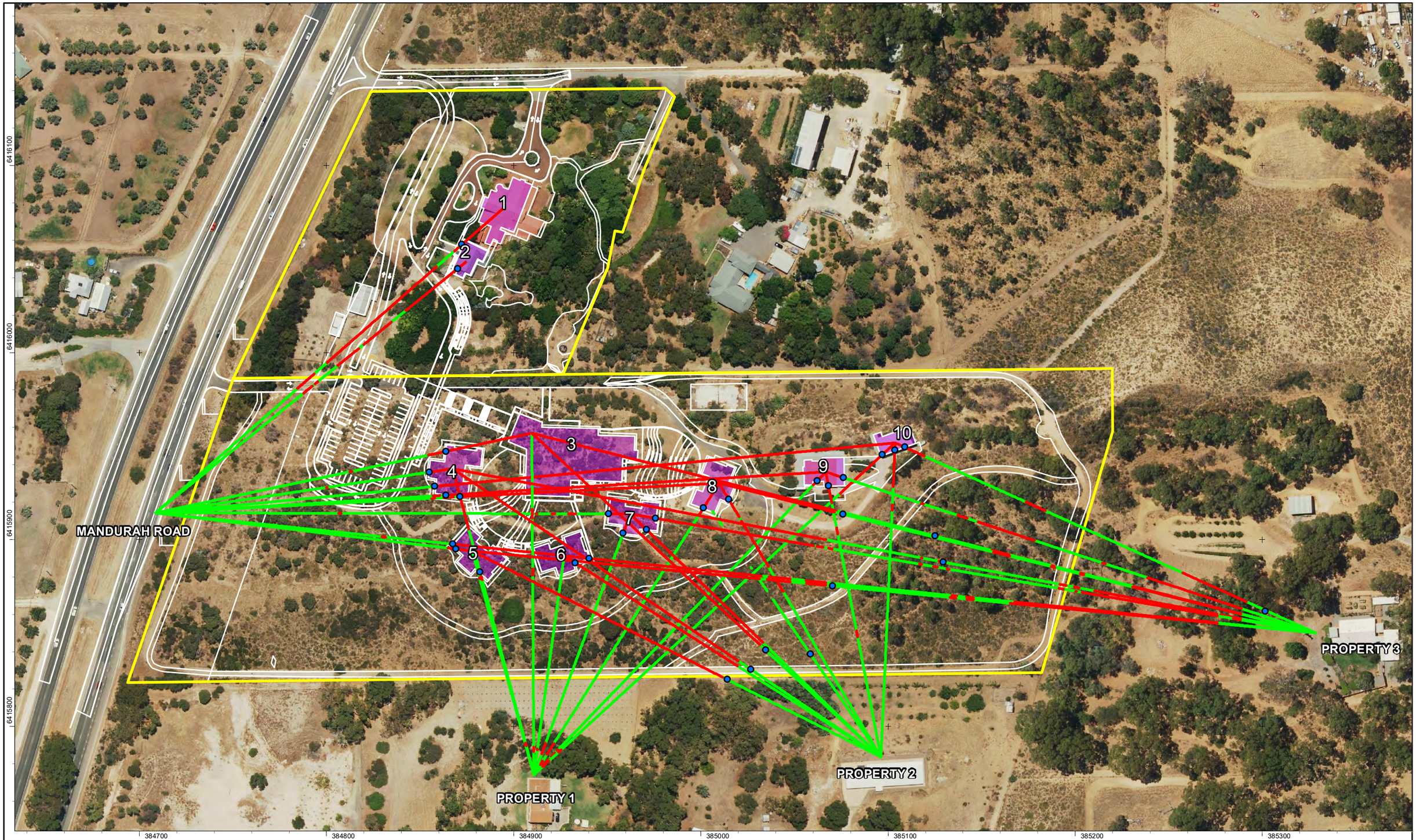
Rockingham Montessori School

Lots 11 and 700, Mandurah Road, Karnup

Environmental Assessment Report

Figure 17 - Landscaping and Revegetation

K:\Projects\9.0 APP\785 Mandurah Road Karnup EAR\Figures\Prelim Water, Visual and Rehab\785 F1 Landscape Plan Elements Sept 2017.mxd



LEGEND

- Site Boundary
- Buildings

Line of Sight

- Visible
- Not visible
- Obstruction Points

DATA SOURCES
AERIAL IMAGERY: LANDGATE FEB 2015
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NORTH

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w www.360environmental.com.au

HORIZONTAL DATUM	SCALE	REVISION	VERT. DATUM
GDA MGA ZONE 50	1:1,900	A	-

DRAWN	CHECKED	APPROVED	STATUS	DATE	SIZE
EW	CM	TS	DRAFT	13-Sept-2017	A3

0 10 20 40 60 80
Meters

PROJECT NUMBER	DRAWING NO.
785	2

Rockingham Montessori School

Lots 11 and 700, Mandurah Road, Karnup

Environmental Assessment Report

Figure 18 - Lines of Sight

K:\Projects\9.0 APP\785 Mandurah Road Karnup EAR\Figures\Prelim Water, Visual and Rehab\785 Figure 4 Lines of Sight.mxd

APPENDIX A

PMST Search Report

Australian Government
Department of the Environment and Energy

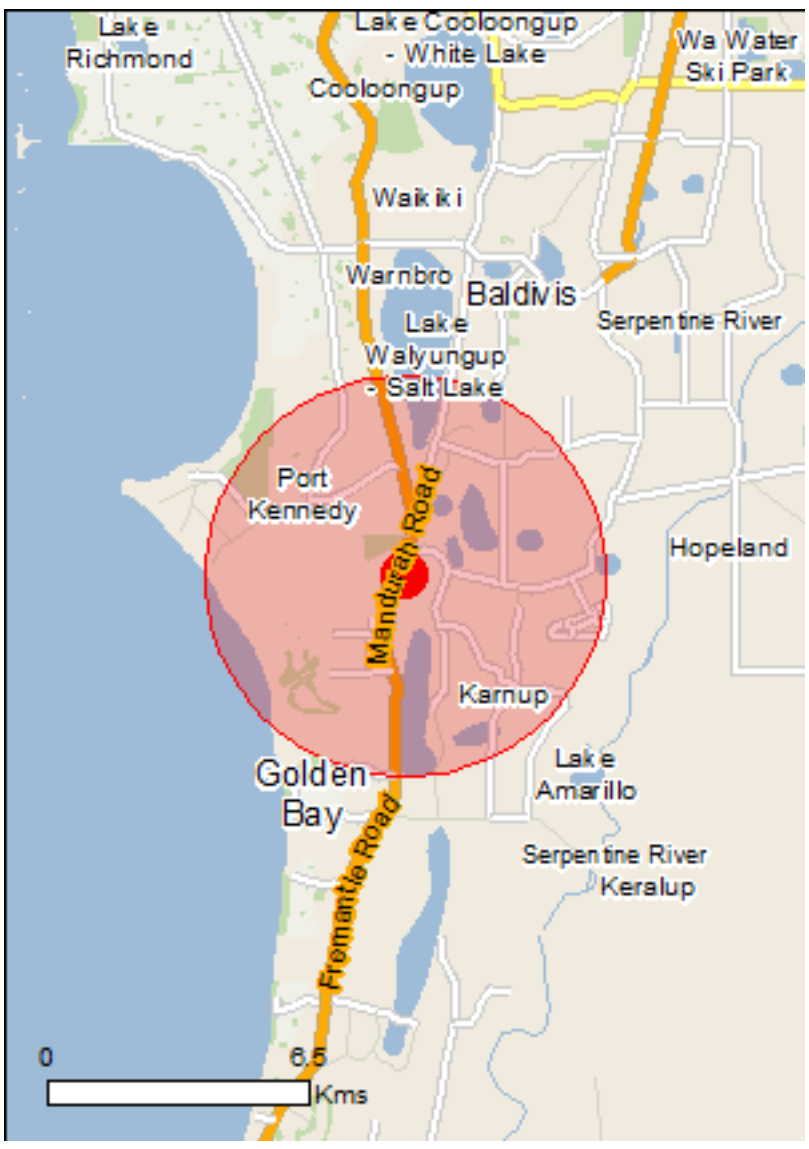
EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

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

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

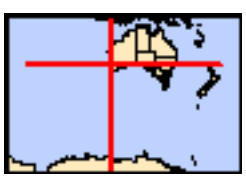
Report created: 04/07/17 13:57:13



This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2010

Coordinates

Buffer: 5.0Km



Summary

Matters of National Environmental Significance

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

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	2
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	2
Listed Threatened Species:	47
Listed Migratory Species:	39

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	1
Commonwealth Heritage Places:	None
Listed Marine Species:	68
Whales and Other Cetaceans:	12
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:	1
Regional Forest Agreements:	None
Invasive Species:	33
Nationally Important Wetlands:	1
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar) [Resource Information]

Name	Proximity
Becher point wetlands	Within Ramsar site
Peel-yalgorup system	10 - 20km upstream

Listed Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Banksia Woodlands of the Swan Coastal Plain ecological community	Endangered	Community likely to occur within area
Sedgelands in Holocene dune swales of the southern Swan Coastal Plain	Endangered	Community known to occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Anous tenuirostris melanops Australian Lesser Noddy [26000]	Vulnerable	Species or species habitat may occur within area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat may 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 likely to occur within area
Calyptorhynchus banksii naso Forest Red-tailed Black-Cockatoo, Karrak [67034]	Vulnerable	Species or species habitat known to occur within area
Calyptorhynchus baudinii Baudin's Cockatoo, Long-billed Black-Cockatoo [769]	Vulnerable	Species or species habitat likely to occur within area
Calyptorhynchus latirostris Carnaby's Cockatoo, Short-billed Black-Cockatoo [59523]	Endangered	Species or species habitat known to occur within area
Diomedea amsterdamensis Amsterdam Albatross [64405]	Endangered	Species or species habitat may occur within area
Diomedea dabbenena Tristan Albatross [66471]	Endangered	Species or species habitat may occur within area

Name	Status	Type of Presence
Diomedea epomophora		
Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans		
Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi		
Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely 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 known to 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
Macronectes halli		
Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Numenius madagascariensis		
Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pachyptila turtur subantarctica		
Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat likely to occur within area
Phoebetria fusca		
Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area
Rostratula australis		
Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area
Sternula nereis nereis		
Australian Fairy Tern [82950]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Thalassarche cauta cauta		
Shy Albatross, Tasmanian Shy Albatross [82345]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche cauta steadi		
White-capped Albatross [82344]	Vulnerable	Foraging, feeding or related behaviour likely to 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		
Balaenoptera musculus		
Blue Whale [36]	Endangered	Species or species habitat likely to occur within area

Name	Status	Type of Presence
[Bettongia penicillata](#) Brush-tailed Bettong, Woylie [213]	Endangered	Species or species habitat known to occur within area
[Dasyurus geoffroii](#) Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat known to occur within area
[Eubalaena australis](#) Southern Right Whale [40]	Endangered	Breeding known to occur within area
[Megaptera novaeangliae](#) Humpback Whale [38]	Vulnerable	Congregation or aggregation known to occur within area
[Neophoca cinerea](#) Australian Sea-lion, Australian Sea Lion [22]	Vulnerable	Species or species habitat may occur within area
[Pseudocheirus occidentalis](#) Western Ringtail Possum, Ngwayir, Womp, Woder, Ngoor, Ngoolangit [25911]	Vulnerable	Species or species habitat likely to occur within area
Plants		
[Andersonia gracilis](#) Slender Andersonia [14470]	Endangered	Species or species habitat may occur within area
[Caladenia huegelii](#) King Spider-orchid, Grand Spider-orchid, Rusty Spider-orchid [7309]	Endangered	Species or species habitat likely to occur within area
[Diuris micrantha](#) Dwarf Bee-orchid [55082]	Vulnerable	Species or species habitat likely to occur within area
[Diuris purdiei](#) Purdie's Donkey-orchid [12950]	Endangered	Species or species habitat may occur within area
[Drakaea elastica](#) Glossy-leafed Hammer Orchid, Glossy-leaved Hammer Orchid, Warty Hammer Orchid [16753]	Endangered	Species or species habitat likely to occur within area
[Drakaea micrantha](#) Dwarf Hammer-orchid [56755]	Vulnerable	Species or species habitat likely to occur within area
[Lepidosperma rostratum](#) Beaked Lepidosperma [14152]	Endangered	Species or species habitat likely to occur within area
Reptiles		
[Caretta caretta](#) Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
[Chelonia mydas](#) Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
[Dermochelys coriacea](#) Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
[Natator depressus](#) Flatback Turtle [59257]	Vulnerable	Species or species habitat known to occur within area
Sharks		
[Carcharias taurus (west coast population)](#) Grey Nurse Shark (west coast population) [68752]	Vulnerable	Species or species habitat known to occur

Name	Status	Type of Presence
		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 habitat may occur within area
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardenna carneipes		
Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Species or species habitat likely to occur within area
Diomedea amsterdamensis		
Amsterdam Albatross [64405]	Endangered	Species or species habitat may occur within area
Diomedea epomophora		
Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans		
Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Hydroprogne caspia		
Caspian Tern [808]		Foraging, feeding or related behaviour known to occur within area
Macronectes giganteus		
Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli		
Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Onychoprion anaethetus		
Bridled Tern [82845]		Foraging, feeding or related behaviour likely to occur within area
Phoebetria fusca		
Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area
Sterna dougallii		
Roseate Tern [817]		Foraging, feeding or related behaviour likely to occur within area
Thalassarche cauta		
Tasmanian Shy Albatross [89224]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Thalassarche melanophris		
Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Migratory Marine Species		

Name	Threatened	Type of Presence
Balaena glacialis australis Southern Right Whale [75529]	Endangered*	Breeding known to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Caperea marginata Pygmy Right Whale [39]		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	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known 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 Ray [84994]		Species or species habitat may occur 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	Species or species habitat 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		
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat likely to occur within area

Name	Threatened	Type of Presence
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 likely to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat likely to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat likely to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name
Commonwealth Land -

Listed Marine Species [Resource Information]

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

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Anous stolidus Common Noddy [825]		Species or species habitat may occur within area
Anous tenuirostris melanops Australian Lesser Noddy [26000]	Vulnerable	Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species

Name	Threatened	Type of Presence
		habitat likely 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 likely to occur within area
[Calidris melanotos](#) Pectoral Sandpiper [858]		Species or species habitat likely to occur within area
[Diomedea amsterdamensis](#) Amsterdam Albatross [64405]	Endangered	Species or species habitat may occur within area
[Diomedea dabbenena](#) Tristan Albatross [66471]	Endangered	Species or species habitat may occur within area
[Diomedea epomophora](#) Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
[Diomedea exulans](#) Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
[Diomedea sanfordi](#) Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
[Haliaeetus leucogaster](#) White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
[Limosa lapponica](#) Bar-tailed Godwit [844]		Species or species habitat known to occur within area
[Macronectes giganteus](#) Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
[Macronectes halli](#) Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
[Merops ornatus](#) Rainbow Bee-eater [670]		Species or species habitat may occur within area
[Motacilla cinerea](#) Grey Wagtail [642]		Species or species habitat may occur within area
[Numenius madagascariensis](#) Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
[Pachyptila turtur](#) Fairy Prion [1066]		Species or species habitat likely to occur within area
[Pandion haliaetus](#) Osprey [952]		Species or species habitat likely to occur within area
[Phoebetria fusca](#) Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within

Name	Threatened	Type of Presence
		area
[Puffinus assimilis](#) Little Shearwater [59363]		Foraging, feeding or related behaviour known to occur within area
[Puffinus carneipes](#) Flesh-footed Shearwater, Fleshy-footed Shearwater [1043]		Species or species habitat likely to occur within area
[Rostratula benghalensis (sensu lato)](#) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area
[Sterna anaethetus](#) Bridled Tern [814]		Foraging, feeding or related behaviour likely to occur within area
[Sterna caspia](#) Caspian Tern [59467]		Foraging, feeding or related behaviour known to occur within area
[Sterna dougallii](#) Roseate Tern [817]		Foraging, feeding or related behaviour likely to occur within area
[Thalassarche cauta](#) Tasmanian Shy Albatross [89224]	Vulnerable*	Foraging, feeding or related behaviour likely to 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*	Foraging, feeding or related behaviour likely to occur within area
[Thinornis rubricollis](#) Hooded Plover [59510]		Species or species habitat likely to occur within area
[Tringa nebularia](#) Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area
Fish		
[Acentronura australe](#) Southern Pygmy Pipehorse [66185]		Species or species habitat may occur within area
[Campichthys galei](#) Gale's Pipefish [66191]		Species or species habitat may occur within area
[Heraldia nocturna](#) Upside-down Pipefish, Eastern Upside-down Pipefish, Eastern Upside-down Pipefish [66227]		Species or species habitat may occur within area
[Hippocampus angustus](#) Western Spiny Seahorse, Narrow-bellied Seahorse [66234]		Species or species habitat may occur within area
[Hippocampus breviceps](#) Short-head Seahorse, Short-snouted Seahorse [66235]		Species or species habitat may occur within area
[Hippocampus subelongatus](#) West Australian Seahorse [66722]		Species or species habitat may occur within

Name	Threatened	Type of Presence
		area
Histiogamphelus cristatus Rhino Pipefish, Macleay's Crested Pipefish, Ring-back Pipefish [66243]		Species or species habitat may occur within area
Lissocampus caudalis Australian Smooth Pipefish, Smooth Pipefish [66249]		Species or species habitat may occur within area
Lissocampus fatiloquus Prophet's Pipefish [66250]		Species or species habitat may occur within area
Lissocampus runa Javelin Pipefish [66251]		Species or species habitat may occur within area
Maroubra perserrata Sawtooth Pipefish [66252]		Species or species habitat may occur within area
Mitotichthys meraculus Western Crested Pipefish [66259]		Species or species habitat may occur within area
Nannocampus subosseus Bonyhead Pipefish, Bony-headed Pipefish [66264]		Species or species habitat may occur within area
Phycodurus eques Leafy Seadragon [66267]		Species or species habitat may occur within area
Phyllopteryx taeniolatus Common Seadragon, Weedy Seadragon [66268]		Species or species habitat may occur within area
Pugnaso curtirostris Pugnose Pipefish, Pug-nosed Pipefish [66269]		Species or species habitat may occur within area
Solegnathus lettiensis Gunther's Pipehorse, Indonesian Pipefish [66273]		Species or species habitat may occur within area
Stigmatopora argus Spotted Pipefish, Gulf Pipefish, Peacock Pipefish [66276]		Species or species habitat may occur within area
Stigmatopora nigra Widebody Pipefish, Wide-bodied Pipefish, Black Pipefish [66277]		Species or species habitat may occur within area
Stigmatopora olivacea a pipefish [74966]		Species or species habitat may occur within area
Urocampus carinirostris Hairy Pipefish [66282]		Species or species habitat may occur within area
Vanacampus margaritifer Mother-of-pearl Pipefish [66283]		Species or species habitat may occur within area
Vanacampus phillipi Port Phillip Pipefish [66284]		Species or species habitat may occur within area
Vanacampus poecilolaemus Longsnout Pipefish, Australian Long-snout Pipefish, Long-snouted Pipefish [66285]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Mammals		
Arctocephalus forsteri Long-nosed Fur-seal, New Zealand Fur-seal [20]		Species or species habitat may occur within area
Neophoca cinerea Australian Sea-lion, Australian Sea Lion [22]	Vulnerable	Species or species habitat may occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Disteira kingii Spectacled Seasnake [1123]		Species or species habitat may occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Species or species habitat known to occur within area

Whales and other Cetaceans		[Resource Information]
Name	Status	Type of Presence
Mammals		
Balaenoptera acutorostrata Minke Whale [33]		Species or species habitat may occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Caperea marginata Pygmy Right Whale [39]		Species or species habitat may occur within area
Delphinus delphis Common Dophin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Breeding known to occur within area
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

Name	Status	Type of Presence
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
Port Kennedy Scientific Park	WA

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Passer montanus Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Streptopelia senegalensis Laughing Turtle-dove, Laughing Dove [781]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Turdus merula Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur

Name	Status	Type of Presence within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Funambulus pennantii Northern Palm Squirrel, Five-striped Palm Squirrel [129]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus norvegicus Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Brachiaria mutica Para Grass [5879]		Species or species habitat may occur within area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat may occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Chrysanthemoides monilifera subsp. monilifera Boneseed [16905]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Olea europaea Olive, Common Olive [9160]		Species or species habitat may occur within area

Name	Status	Type of Presence
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Tamarix aphylla Athel Pine, Athel Tree, Tamarisk, Athel Tamarisk, Athel Tamarix, Desert Tamarisk, Flowering Cypress, Salt Cedar [16018]		Species or species habitat likely to occur within area
Reptiles		
Hemidactylus frenatus Asian House Gecko [1708]		Species or species habitat likely to occur within area

Nationally Important Wetlands	[Resource Information]
Name	State
Becher Point Wetlands	WA

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

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

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

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

- migratory and
- marine

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

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

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

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

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

Coordinates

-32.38753 115.77638

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

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

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

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

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APPENDIX B

NatureMap Search Report

NatureMap
Mapping Western Australia's biodiversity

NatureMap Species Report

Created By Guest user on 04/07/2017

Current Names Only Yes
Core Datasets Only Yes
Method 'By Circle'
Centre 115° 46' 36" E,32° 23' 15" S
Buffer 5km
Group By Kingdom

Kingdom	Species	Records
Animalia	167	1077
Fungi	3	3
Plantae	288	528
TOTAL	**458**	**1608**

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
Animalia					
1.	24260	*Acanthiza apicalis (Broad-tailed Thornbill, Inland Thornbill)*			
2.	24261	*Acanthiza chrysorrhoa (Yellow-rumped Thornbill)*			
3.	24262	*Acanthiza inornata (Western Thornbill)*			
4.	24560	*Acanthorhynchus superciliosus (Western Spinebill)*			
5.	25535	*Accipiter cirrocephalus (Collared Sparrowhawk)*			
6.	25536	*Accipiter fasciatus (Brown Goshawk)*			
7.	42368	*Acritoscincus trilineatus (Western Three-lined Skink)*			
8.	25755	*Acrocephalus australis (Australian Reed Warbler)*			
9.	41323	*Actitis hypoleucos (Common Sandpiper)*		IA	
10.		*Afurcagobius suppositus*			
11.		*Aname mainae*			
12.	24310	*Anas castanea (Chestnut Teal)*			
13.	24312	*Anas gracilis (Grey Teal)*			
14.	24313	*Anas platyrhynchos (Mallard)*			
15.	24315	*Anas rhynchotis (Australasian Shoveler)*			
16.	24316	*Anas superciliosa (Pacific Black Duck)*			
17.	47414	*Anhinga novaehollandiae (Australasian Darter)*			
18.	24561	*Anthochaera carunculata (Red Wattlebird)*			
19.	24562	*Anthochaera lunulata (Western Little Wattlebird)*			
20.	25670	*Anthus australis (Australian Pipit)*			
21.	24991	*Aprasia repens (Sand-plain Worm-lizard)*			
22.	41324	*Ardea modesta (Eastern Great Egret)*		IA	
23.	24340	*Ardea novaehollandiae (White-faced Heron)*			
24.	24341	*Ardea pacifica (White-necked Heron)*			
25.	25566	*Artamus cinereus (Black-faced Woodswallow)*			
26.	24353	*Artamus cyanopterus (Dusky Woodswallow)*			
27.	24318	*Aythya australis (Hardhead)*			
28.		*Barnardius zonarius*			
29.	24162	*Bettongia penicillata subsp. ogilbyi (Woylie, Brush-tailed Bettong)*		T	
30.	24319	*Biziura lobata (Musk Duck)*			
31.	25715	*Cacatua roseicapilla (Galah)*			
32.	25716	*Cacatua sanguinea (Little Corella)*			
33.	25598	*Cacomantis flabelliformis (Fan-tailed Cuckoo)*			
34.	24780	*Calidris alba (Sanderling)*		IA	
35.	24788	*Calidris ruficollis (Red-necked Stint)*		IA	
36.	25717	*Calyptorhynchus banksii (Red-tailed Black-Cockatoo)*			
37.	24731	*Calyptorhynchus banksii subsp. naso (Forest Red-tailed Black-Cockatoo)*		T	
38.	24734	*Calyptorhynchus latirostris (Carnaby's Cockatoo (short-billed black-cockatoo), Carnaby's Cockatoo)*		T	
39.	25454	*Canis lupus (Dog, Dingo)*	Y		
40.	30883	*Canis lupus subsp. familiaris (Dog)*	Y		
41.	25335	*Caretta caretta (Loggerhead Turtle)*		T	
42.	24186	*Chalinolobus gouldii (Gould's Wattled Bat)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
43.	24377	*Charadrius ruficapillus (Red-capped Plover)*			
44.	24321	*Chenonetta jubata (Australian Wood Duck, Wood Duck)*			
45.		*Chroicocephalus novaehollandiae*			
46.	24288	*Circus approximans (Swamp Harrier)*			
47.	24289	*Circus assimilis (Spotted Harrier)*			
48.	24774	*Cladorhynchus leucocephalus (Banded Stilt)*			
49.	25675	*Colluricincla harmonica (Grey Shrike-thrush)*			
50.	24399	*Columba livia (Domestic Pigeon)*	Y		
51.	25568	*Coracina novaehollandiae (Black-faced Cuckoo-shrike)*			
52.	25592	*Corvus coronoides (Australian Raven)*			
53.	25595	*Cracticus tibicen (Australian Magpie)*			
54.	25596	*Cracticus torquatus (Grey Butcherbird)*			
55.	25400	*Crinia insignifera (Squelching Froglet)*			
56.	30893	*Cryptoblepharus buchananii*			
57.	30899	*Ctenophorus adelaidensis (Southern Heath Dragon, Western Heath Dragon)*			
58.	25027	*Ctenotus australis*			
59.	25039	*Ctenotus fallens*			
60.	24322	*Cygnus atratus (Black Swan)*			
61.	30901	*Dacelo novaeguineae (Laughing Kookaburra)*	Y		
62.	25673	*Daphoenositta chrysoptera (Varied Sittella)*			
63.	25468	*Demansia psammophis (Yellow-faced Whipsnake)*			
64.		*Egretta novaehollandiae*			
65.		*Elanus axillaris*			
66.	25540	*Elanus caeruleus (Black-shouldered Kite)*			
67.		*Eolophus roseicapillus*			
68.	25621	*Falco berigora (Brown Falcon)*			
69.	25622	*Falco cenchroides (Australian Kestrel, Nankeen Kestrel)*			
70.	25623	*Falco longipennis (Australian Hobby)*			
71.	24041	*Felis catus (Cat)*	Y		
72.	25727	*Fulica atra (Eurasian Coot)*			
73.	24761	*Fulica atra subsp. australis (Eurasian Coot)*			
74.	25729	*Gallinula tenebrosa (Dusky Moorhen)*			
75.	24763	*Gallinula tenebrosa subsp. tenebrosa (Dusky Moorhen)*			
76.	25530	*Gerygone fusca (Western Gerygone)*			
77.	24443	*Grallina cyanoleuca (Magpie-lark)*			
78.	24487	*Haematopus longirostris (Pied Oystercatcher)*			
79.	24295	*Haliastur sphenurus (Whistling Kite)*			
80.	25410	*Heleioporus eyrei (Moaning Frog)*			
81.	25412	*Heleioporus psammophilus (Sand Frog)*			
82.	25232	*Hemidactylus frenatus (Asian House Gecko)*	Y		
83.	25119	*Hemiergis quadrilineata*			
84.	25734	*Himantopus himantopus (Black-winged Stilt)*			
85.	24491	*Hirundo neoxena (Welcome Swallow)*			
86.		*Hydroprogne caspia*			
87.		*Idiommata blackwalli*			
88.	25478	*Isoodon obesulus (Southern Brown Bandicoot)*		P4	
89.	24153	*Isoodon obesulus subsp. fusciventer (Quenda, Southern Brown Bandicoot)*		P4	
90.		*Jalmenus inous inous*			Y
91.	25637	*Larus novaehollandiae (Silver Gull)*			
92.	25133	*Lerista elegans*			
93.	25147	*Lerista lineata (Perth Slider, Lined Skink)*		P3	
94.	25005	*Lialis burtonis*			
95.	25661	*Lichmera indistincta (Brown Honeyeater)*			
96.	24582	*Lichmera indistincta subsp. indistincta (Brown Honeyeater)*			
97.	25415	*Limnodynastes dorsalis (Western Banjo Frog)*			
98.	30932	*Limosa lapponica (Bar-tailed Godwit)*		IA	
99.	24132	*Macropus fuliginosus (Western Grey Kangaroo)*			
100.	24326	*Malacorhynchus membranaceus (Pink-eared Duck)*			
101.	25654	*Malurus splendens (Splendid Fairy-wren)*			
102.	24552	*Malurus splendens subsp. splendens (Splendid Fairy-wren)*			
103.	25758	*Megalurus gramineus (Little Grassbird)*			
104.	25184	*Menetia greyii*			
105.	24598	*Merops ornatus (Rainbow Bee-eater)*		IA	
106.		*Microcarbo melanoleucos*			
107.	25240	*Morelia spilota subsp. imbricata (Carpet Python)*			
108.	24223	*Mus musculus (House Mouse)*	Y		
109.	24738	*Neophema elegans (Elegant Parrot)*			
110.		*Nicodamus mainae*			
111.	25252	*Notechis scutatus (Tiger Snake)*			
112.	25564	*Nycticorax caledonicus (Rufous Night Heron)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
113.	24407	*Ocyphaps lophotes (Crested Pigeon)*			
114.	24085	*Oryctolagus cuniculus (Rabbit)*	Y		
115.	25680	*Pachycephala rufiventris (Rufous Whistler)*			
116.	25681	*Pardalotus punctatus (Spotted Pardalote)*			
117.	25682	*Pardalotus striatus (Striated Pardalote)*			
118.	24648	*Pelecanus conspicillatus (Australian Pelican)*			
119.	48061	*Petrochelidon nigricans (Tree Martin)*			
120.	48066	*Petroica boodang (Scarlet Robin)*			
121.	25697	*Phalacrocorax carbo (Great Cormorant)*			
122.	25698	*Phalacrocorax melanoleucos (Little Pied Cormorant)*			
123.	24667	*Phalacrocorax sulcirostris (Little Black Cormorant)*			
124.	25699	*Phalacrocorax varius (Pied Cormorant)*			
125.	24409	*Phaps chalcoptera (Common Bronzewing)*			
126.	48071	*Phylidonyris niger (White-cheeked Honeyeater)*			
127.	24596	*Phylidonyris novaehollandiae (New Holland Honeyeater)*			
128.	24841	*Platalea flavipes (Yellow-billed Spoonbill)*			
129.	25720	*Platycercus icterotis (Western Rosella)*			
130.	24747	*Platycercus spurius (Red-capped Parrot)*			
131.	25721	*Platycercus zonarius (Australian Ringneck, Ring-necked Parrot)*			
132.	24750	*Platycercus zonarius subsp. semitorquatus (Twenty-eight Parrot)*			
133.	24383	*Pluvialis squatarola (Grey Plover)*		IA	
134.	25704	*Podiceps cristatus (Great Crested Grebe)*			
135.	25510	*Pogona minor (Dwarf Bearded Dragon)*			
136.	24907	*Pogona minor subsp. minor (Dwarf Bearded Dragon)*			
137.	24681	*Poliocephalus poliocephalus (Hoary-headed Grebe)*			
138.	25722	*Polytelis anthopeplus (Regent Parrot)*			
139.	25731	*Porphyrio porphyrio (Purple Swamphen)*			
140.	24767	*Porphyrio porphyrio subsp. bellus (Purple Swamphen)*			
141.	25511	*Pseudonaja affinis (Dugite)*			
142.	25259	*Pseudonaja affinis subsp. affinis (Dugite)*			
143.		*Purpureicephalus spurius*			
144.	24245	*Rattus rattus (Black Rat)*	Y		
145.		*Raveniella peckorum*			
146.	24776	*Recurvirostra novaehollandiae (Red-necked Avocet)*			
147.	48096	*Rhipidura albiscapa (Grey Fantail)*			
148.	25614	*Rhipidura leucophrys (Willie Wagtail)*			
149.	24454	*Rhipidura leucophrys subsp. leucophrys (Willie Wagtail)*			
150.	25534	*Sericornis frontalis (White-browed Scrubwren)*			
151.	25266	*Simoselaps bertholdi (Jan's Banded Snake)*			
152.	30948	*Smicrornis brevirostris (Weebill)*			
153.	24522	*Sterna bergii (Crested Tern)*			
154.	25590	*Streptopelia senegalensis (Laughing Turtle-Dove)*	Y		
155.	25518	*Strophurus spinigerus*			
156.	33992	*Synemon gratiosa (Graceful Sunmoth)*		P4	
157.	25705	*Tachybaptus novaehollandiae (Australasian Grebe, Black-throated Grebe)*			
158.	24682	*Tachybaptus novaehollandiae subsp. novaehollandiae (Australasian Grebe, Black-throated Grebe)*			
159.	24331	*Tadorna tadornoides (Australian Shelduck, Mountain Duck)*			
160.		*Thalasseus bergii*			
161.	24845	*Threskiornis spinicollis (Straw-necked Ibis)*			
162.	25203	*Tiliqua occipitalis (Western Bluetongue)*			
163.	25519	*Tiliqua rugosa*			
164.	25207	*Tiliqua rugosa subsp. rugosa*			
165.	24386	*Vanellus tricolor (Banded Lapwing)*			
166.	24040	*Vulpes vulpes (Red Fox)*	Y		
167.	25765	*Zosterops lateralis (Grey-breasted White-eye, Silvereye)*			
Fungi					
168.		*Candelariella sp.*			
169.		*Gymnopilus allantopus*			
170.	38832	*Resupinatus cinerascens*			
Plantae					
171.	15466	*Acacia applanata*			
172.	3237	*Acacia benthamii*		P2	
173.	3262	*Acacia cochlearis (Rigid Wattle)*			
174.	3409	*Acacia lasiocarpa (Panjang)*			
175.	11611	*Acacia lasiocarpa var. lasiocarpa*			
176.	3525	*Acacia rostellifera (Summer-scented Wattle)*			
177.	3527	*Acacia saligna (Orange Wattle, Kudjong)*			
178.	30033	*Acacia saligna subsp. lindleyi*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
179.	30032	*Acacia saligna subsp. saligna*			
180.	3557	*Acacia stenoptera (Narrow Winged Wattle)*			
181.	3602	*Acacia willdenowiana (Grass Wattle)*			
182.	1208	*Acanthocarpus preissii*			
183.	4582	*Adriana quadripartita (Bitter Bush)*			
184.	6565	*Alyxia buxifolia (Dysentery Bush)*			
185.	1409	*Anigozanthos humilis (Catspaw)*			
186.	6949	*Anthocercis littorea (Yellow Tailflower)*			
187.	202	*Anthoxanthum odoratum (Sweet Vernal Grass)*	Y		
188.	3688	*Aotus gracillima*			
189.	1117	*Aphelia cyperoides*			
190.	6210	*Apium annuum*			
191.	6211	*Apium prostratum (Sea Celery)*			
192.	8779	*Asparagus asparagoides (Bridal Creeper)*	Y		
193.	1364	*Asphodelus fistulosus (Onion Weed)*	Y		
194.	20283	*Astartea scoparia (Common Astartea)*			
195.	6323	*Astroloma ciliatum (Candle Cranberry)*			
196.	2471	*Atriplex prostrata (Hastate Orache)*	Y		
197.	2480	*Atriplex suberecta*			
198.	17234	*Austrostipa compressa*			
199.	17240	*Austrostipa flavescens*			
200.	233	*Avena barbata (Bearded Oat)*	Y		
201.	15037	*Bartsia trixago*	Y		
202.	741	*Baumea articulata (Jointed Rush)*			
203.	743	*Baumea juncea (Bare Twigrush)*			
204.	744	*Baumea laxa*			
205.	4594	*Beyeria cinerea*			
206.	34236	*Beyeria cinerea subsp. cinerea*		P3	
207.	749	*Bolboschoenus caldwellii (Marsh Club-rush)*			
208.	30142	*Brachyloma preissii subsp. obtusifolium*			
209.	30136	*Brachyloma preissii subsp. preissii*			
210.	247	*Bromus arenarius (Sand Brome)*			
211.	249	*Bromus diandrus (Great Brome)*	Y		
212.	1383	*Burchardia bairdiae*			
213.	1276	*Caesia micrantha (Pale Grass Lily)*			
214.	3002	*Cakile maritima (Sea Rocket)*	Y		
215.	15330	*Caladenia arenicola*			
216.	1599	*Caladenia latifolia (Pink Fairy Orchid)*			
217.	15361	*Caladenia longicauda subsp. calcigena*			
218.	2848	*Calandrinia corrigioloides (Strap Purslane)*			
219.	2856	*Calandrinia liniflora (Parakeelya)*			
220.	44226	*Calandrinia oraria*		P3	
221.	40827	*Calandrinia tholiformis*			
222.	5439	*Calytrix angulata (Yellow Starflower)*			
223.	43241	*Carex thecata*			
224.	2798	*Carpobrotus virescens (Coastal Pigface, Kolboko, Bain)*			
225.	1162	*Cartonema philydroides*			
226.	2951	*Cassytha flava (Dodder Laurel)*			
227.	2957	*Cassytha racemosa (Dodder Laurel)*			
228.	11799	*Cassytha racemosa forma racemosa*			
229.	259	*Cenchrus echinatus (Burrgrass)*	Y		
230.	6542	*Centaurium tenuiflorum*	Y		
231.	6214	*Centella asiatica*			
232.	1121	*Centrolepis aristata (Pointed Centrolepis)*			
233.	2889	*Cerastium glomeratum (Mouse Ear Chickweed)*	Y		
234.	2490	*Chenopodium glaucum (Glaucous Goosefoot)*	Y		
235.	763	*Chorizandra enodis (Black Bristlerush)*			
236.	10804	*Clematis linearifolia*			
237.	4552	*Comesperma confertum*			
238.	4564	*Comesperma virgatum (Milkwort)*			
239.	1885	*Conospermum triplinervium (Tree Smokebush)*			
240.	6349	*Conostephium preissii*			
241.	1418	*Conostylis aculeata (Prickly Conostylis)*			
242.	11826	*Conostylis aculeata subsp. aculeata*			
243.	1427	*Conostylis candicans (Grey Cottonhead)*			
244.	12027	*Conostylis candicans subsp. calcicola*			
245.	1443	*Conostylis pauciflora (Dawesville Conostylis)*			
246.	7945	*Cotula coronopifolia (Waterbuttons)*	Y		
247.	3137	*Crassula colorata (Dense Stonecrop)*			
248.	11563	*Crassula colorata var. colorata*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
249.	3140	*Crassula glomerata*	Y		
250.	15706	*Crassula natans var. minus*	Y		
251.	4802	*Cryptandra mutila*			
252.	768	*Cyathochaeta avenacea*			
253.	285	*Cynosurus echinatus (Rough Dogstail)*	Y		
254.	783	*Cyperus congestus (Dense Flat-sedge)*	Y		
255.	7484	*Dampiera trigona (Angled-stem Dampiera)*			
256.	6218	*Daucus glochidiatus (Australian Carrot)*			
257.	3845	*Daviesia triflora*			
258.	17663	*Desmocladus asper*			
259.	17691	*Desmocladus fasciculatus*			
260.	16595	*Desmocladus flexuosus*			
261.	299	*Deyeuxia quadriseta (Reed Bentgrass)*			
262.	3863	*Dillwynia dillwynioides*		P3	
263.	4454	*Diplolaena dampieri (Southern Diplolaena)*			
264.	18541	*Diplopeltis huegelii subsp. huegelii*			
265.	7054	*Dischisma arenarium*	Y		
266.	7055	*Dischisma capitatum (Woolly-headed Dischisma)*	Y		
267.	3106	*Drosera macrantha (Bridal Rainbow)*			
268.	3114	*Drosera nitidula (Shining Sundew)*			
269.	3131	*Drosera stolonifera (Leafy Sundew)*			
270.	347	*Ehrharta calycina (Perennial Veldt Grass)*	Y		
271.	6131	*Epilobium billardiereanum (Glabrous Willow Herb)*			
272.	17175	*Eremophila glabra subsp. albicans*			
273.	4333	*Erodium cicutarium (Common Storksbill)*	Y		
274.	15446	*Eryngium pinnatifidum subsp. pinnatifidum*			
275.	5649	*Eucalyptus foecunda (Narrow-leaved Red Mallee)*			
276.	20808	*Eucalyptus petiolaris*	Y		
277.	4648	*Euphorbia terracina (Geraldton Carnation Weed)*	Y		
278.	3880	*Eutaxia virgata*			
279.	10765	*Exocarpos sparteus (Broom Ballart, Djuk)*			
280.	20216	*Ficinia nodosa (Knotted Club Rush)*			
281.	20473	*Gastrolobium ebracteolatum*			
282.	20482	*Gastrolobium nervosum*			
283.	4339	*Geranium molle (Dove's Foot Cranesbill)*	Y		
284.	4340	*Geranium retrorsum*			
285.	4341	*Geranium solanderi (Native Geranium)*			
286.	10909	*Gompholobium confertum*			
287.	3957	*Gompholobium tomentosum (Hairy Yellow Pea)*			
288.	7538	*Goodenia pulchella*			
289.	1982	*Grevillea crithmifolia*			
290.	15839	*Grevillea preissii subsp. preissii*			
291.	1472	*Haemodorum simplex*			
292.	2197	*Hakea prostrata (Harsh Hakea)*			
293.	3961	*Hardenbergia comptoniana (Native Wisteria)*			
294.	3016	*Heliophila pusilla*	Y		
295.	6839	*Hemiandra pungens (Snakebush)*			
296.	5117	*Hibbertia cuneiformis (Cutleaf Hibbertia)*			
297.	5172	*Hibbertia stellaris (Orange Stars)*			
298.	13758	*Histiopteris incisa*			
299.	6222	*Homalosciadium homalocarpum*			
300.	6229	*Hydrocotyle diantha*			
301.	6241	*Hydrocotyle tetragonocarpa*			
302.	8086	*Hypochaeris glabra (Smooth Catsear)*	Y		
303.	17841	*Hypolaena pubescens*			
304.	910	*Isolepis cernua (Nodding Club-rush)*			
305.	20200	*Isolepis cernua var. setiformis*			
306.	917	*Isolepis marginata (Coarse Club-rush)*			
307.	921	*Isolepis producta*			
308.	3992	*Isotropis cuneifolia (Granny Bonnets)*			
309.	8092	*Ixiolaena viscosa (Sticky Ixiolaena)*			
310.	4012	*Jacksonia furcellata (Grey Stinkwood)*			
311.	4027	*Jacksonia sericea (Waldjumi)*		P4	
312.	20454	*Juncus acutus subsp. acutus*	Y		
313.	1185	*Juncus kraussii (Sea Rush)*			
314.	11922	*Juncus kraussii subsp. australiensis*			
315.	1188	*Juncus pallidus (Pale Rush)*			
316.	4044	*Kennedia prostrata (Scarlet Runner)*			
317.	13562	*Lachenalia aloides*	Y		
318.	467	*Lagurus ovatus (Hare's Tail Grass)*	Y		

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
319.	1309	*Laxmannia squarrosa*			
320.	44490	*Leontodon rhagadioloides*	Y		
321.	925	*Lepidosperma angustatum*			
322.	42742	*Lepidosperma calcicola*			
323.	932	*Lepidosperma effusum (Spreading Sword-sedge)*			
324.	933	*Lepidosperma gladiatum (Coast Sword-sedge, Kerbin)*			
325.	940	*Lepidosperma pubisquameum*			
326.		*Lepidosperma sp.*			
327.	945	*Lepidosperma squamatum*			
328.	1078	*Leptocarpus coangustatus*			
329.	1080	*Leptocarpus scariosus*			
330.	17852	*Leptorhynchos scaber (Lanky Buttons)*			
331.	1085	*Lepyrodia glauca*			
332.	6360	*Leucopogon australis (Spiked Beard-heath)*			
333.	6427	*Leucopogon parviflorus (Coast Beard-heath)*			
334.	7677	*Levenhookia stipitata (Common Stylewort)*			
335.	36160	*Liparophyllum capitatum*			
336.	36179	*Liparophyllum violifolium*			
337.	9289	*Lobelia anceps (Angled Lobelia)*			
338.	7408	*Lobelia tenuior (Slender Lobelia)*			
339.	6515	*Logania vaginalis (White Spray)*			
340.	476	*Lolium perenne (Perennial Ryegrass)*	Y		
341.	478	*Lolium rigidum (Wimmera Ryegrass)*	Y		
342.	11073	*Lolium x hybridum*	Y		
343.	1231	*Lomandra maritima*			
344.	1232	*Lomandra micrantha (Small-flower Mat-rush)*			
345.	14542	*Lomandra micrantha subsp. micrantha*			
346.	8564	*Lotus subbiflorus*	Y		
347.	36375	*Lysimachia arvensis (Pimpernel)*	Y		
348.	4961	*Malva parviflora (Marshmallow)*	Y		
349.	34676	*Meionectes brownii (Swamp Raspwort)*			
350.	13273	*Melaleuca incana subsp. incana*			
351.	5926	*Melaleuca lateritia (Robin Redbreast Bush)*			
352.	5952	*Melaleuca preissiana (Moonah)*			
353.	18598	*Melaleuca systena*			
354.	4085	*Melilotus indicus*	Y		
355.	6886	*Mentha x piperita*	Y		Y
356.	955	*Mesomelaena pseudostygia*			
357.	15419	*Microtis media subsp. media*			
358.	1660	*Microtis orbicularis (Dark Mignonette Orchid)*			
359.	16693	*Minuartia mediterranea*	Y		
360.	37440	*Monopsis debilis var. depressa*	Y		
361.	2412	*Muehlenbeckia adpressa (Climbing Lignum)*			
362.	7289	*Myoporum caprarioides (Slender Myoporum)*			
363.	8127	*Olearia axillaris (Coastal Daisybush)*			
364.	7348	*Opercularia hispidula (Hispid Stinkweed)*			
365.	18255	*Opercularia vaginata (Dog Weed)*			
366.	4113	*Ornithopus compressus (Yellow Serradella)*	Y		
367.	7089	*Parentucellia latifolia (Common Bartsia)*	Y		
368.	7090	*Parentucellia viscosa (Sticky Bartsia)*	Y		
369.	4343	*Pelargonium capitatum (Rose Pelargonium)*	Y		
370.	4346	*Pelargonium littorale*			
371.	6006	*Pericalymma ellipticum (Swamp Teatree)*			
372.	19825	*Petrorhagia dubia*	Y		
373.	18529	*Philotheca spicata (Pepper and Salt)*			
374.	1478	*Phlebocarya ciliata*			
375.	16177	*Phyllangium paradoxum*			
376.	4675	*Phyllanthus calycinus (False Boronia)*			
377.	5252	*Pimelea lanata*			
378.	18117	*Pimelea rosea subsp. rosea*			
379.	573	*Poa drummondiana (Knotted Poa)*			
380.	577	*Poa poiformis (Coastal Poa)*			
381.	578	*Poa porphyroclados*			
382.	8175	*Podolepis gracilis (Slender Podolepis)*			
383.	8182	*Podotheca angustifolia (Sticky Longheads)*			
384.		*Podotheca sp.*			
385.	582	*Polypogon monspeliensis (Annual Beardgrass)*	Y		
386.	1670	*Prasophyllum drummondii (Swamp Leek Orchid)*			
387.	1672	*Prasophyllum fimbria (Fringed Leek Orchid)*			
388.	1686	*Pterostylis barbata (Bird Orchid)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
389.	17267	*Pterostylis brevisepala*			
390.	12217	*Pterostylis sanguinea*			
391.	2718	*Ptilotus drummondii (Narrowleaf Mulla Mulla)*			
392.	2938	*Ranunculus trilobus (Buttercup)*	Y		
393.	19183	*Retama raetam*	Y		
394.	11341	*Rhagodia baccata subsp. baccata*			
395.	11930	*Rhagodia baccata subsp. dioica (Sea Berry Saltbush)*			
396.	13300	*Rhodanthe citrina*			
397.	1556	*Romulea rosea (Guildford Grass)*	Y		
398.	2433	*Rumex crispus (Curled Dock)*	Y		
399.	40426	*Rytidosperma occidentale*			
400.	6483	*Samolus junceus*			
401.	2593	*Sarcocornia quinqueflora (Beaded Samphire)*			
402.	7595	*Scaevola anchusifolia*			
403.	7603	*Scaevola canescens (Grey Scaevola)*			
404.	980	*Schoenus capillifolius*		P3	
405.	986	*Schoenus efoliatus*			
406.	992	*Schoenus grandiflorus (Large Flowered Bogrush)*			
407.	1004	*Schoenus nitens (Shiny Bog-rush)*			
408.	1018	*Schoenus subfascicularis*			
409.	6033	*Scholtzia involucrata (Spiked Scholtzia)*			
410.	6	*Selaginella gracillima (Tiny Clubmoss)*			
411.	32433	*Sematophyllum homomallum*			
412.	25878	*Senecio condylus*			
413.	20161	*Senecio pinnatifolius*			
414.	8224	*Siloxerus filifolius*			
415.	8230	*Sonchus asper (Rough Sowthistle)*	Y		
416.	9367	*Sonchus hydrophilus (Native Sowthistle)*			
417.	8231	*Sonchus oleraceus (Common Sowthistle)*	Y		
418.	20348	*Sphaerolobium calcicola*		P3	
419.	624	*Spinifex hirsutus (Hairy Spinifex)*			
420.	8710	*Sporobolus africanus (Parramatta Grass)*	Y		
421.	635	*Sporobolus virginicus (Marine Couch)*			
422.	4828	*Spyridium globulosum (Basket Bush)*			
423.	9069	*Stackhousia huegelii*			
424.	4733	*Stackhousia monogyna*			
425.	7712	*Stylidium despectum (Dwarf Triggerplant)*			
426.	7717	*Stylidium divaricatum (Daddy-long-legs)*			
427.	7756	*Stylidium longitubum (Jumping Jacks)*		P4	
428.	7774	*Stylidium piliferum (Common Butterfly Triggerplant)*			
429.	2329	*Synaphea spinulosa*			
430.	20135	*Taxandria linearifolia*			
431.	4256	*Templetonia retusa (Cockies Tongues)*			
432.	2820	*Tetragonia decumbens (Sea Spinach)*	Y		
433.	1036	*Tetraria octandra*			
434.	1708	*Thelymitra fuscolutea (Chestnut Sun Orchid)*			
435.	20730	*Thelymitra paludosa*			
436.		*Thelymitra sp.*			
437.	1318	*Thysanotus arbuscula*			
438.	1319	*Thysanotus arenarius*			
439.	1339	*Thysanotus multiflorus (Many-flowered Fringe Lily)*			
440.	1357	*Thysanotus thyrsoideus*			
441.	32445	*Tortula muralis*			
442.	1368	*Trachyandra divaricata*	Y		
443.	19041	*Trachymene coerulea subsp. coerulea*			
444.	6280	*Trachymene pilosa (Native Parsnip)*			
445.	4292	*Trifolium campestre (Hop Clover)*	Y		
446.	4295	*Trifolium dubium (Suckling Clover)*	Y		
447.	4297	*Trifolium glomeratum (Cluster Clover)*	Y		
448.	151	*Triglochin striata*			
449.	152	*Triglochin trichophora*			
450.	11665	*Trymalium ledifolium var. ledifolium*			
451.	7107	*Verbascum virgatum (Twiggy Mullein)*	Y		
452.	11137	*Vulpia fasciculata*	Y		
453.	33101	*Vulpia myuros forma myuros*	Y		
454.	7389	*Wahlenbergia preissii*			
455.	1398	*Wurmbea monantha*			
456.	1256	*Xanthorrhoea preissii (Grass tree, Palga)*			
457.	6289	*Xanthosia huegelii*			
458.	36218	*Zygodon menziesii*			

NatureMap
Mapping Western Australia's biodiversity

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

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

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

APPENDIX C

Flora, Vegetation and Black Cockatoo Report

360 environmental

Lot 11, Mandurah Road, Karnup

Flora, Vegetation and Black Cockatoo Report

Prepared for:
Rockingham Montessori School

February 2015

people • planet • professional

Document Reference	Revision	Prepared by	Reviewed by	Submitted to Client	
				Copies	Date
808 AB	A INTERNAL DRAFT	SF/LS	RF	1 Electronic (email)	18/12/14
	B SUBMITTED TO CLIENT	NW	TS	1 Electronic (email)	28/01/15
	C FINAL	NW	TS	1 Electronic (email)	23/02/15

Executive Summary

360 Environmental Pty Ltd (360 Environmental) was commissioned by Rockingham Montessori School to undertake a Level 2 Flora and Vegetation Assessment and a Black Cockatoo Assessment for Lots 11 and 700 Mandurah Road, Karnup (Survey Area). The Survey Area is approximately 10.43 ha in size, surrounded by large residential lots with remnant vegetation. The Survey Area is located approximately 55 km south of Perth, Western Australia (WA).

Database searches showed 19 flora species of conservation significance have been recorded as potentially occurring within the vicinity of the Survey Area. These include eight Threatened species pursuant to the *Environment Protection and Biodiversity Conservation Act 1999* and/or gazetted as Declared Rare Flora pursuant to the *Wildlife Conservation Act 1950,* and 11 Priority species as listed by the Department of Parks and Wildlife (DPaW).

No Threatened or Priority species were recorded during the survey.

A total of 59 flora taxa (including species, subspecies, varieties and forms) from 49 genera and 31 families were recorded in the Survey Area. The commonly occurring families were; Poaceae (7 taxa, 6 of which were weed species), Fabaceae (9 taxa), Proteaceae (5 taxa) and Asteraceae (5 taxa).

A total of 16 introduced flora species were recorded during the field survey. None of these are listed as Declared under the Biosecurity and Agriculture Management Act or listed as a Weed of National Significance (WONS).

Three natural vegetation associations were described in the Survey Area.

- BaBm – *Banksia attenuata*, *Banksia menziesii* woodland
- EgBa – *Eucalyptus gomphocephala*, *Banksia* woodland
- AsOa – *Acacia saligna*, *Olearia axilaris* shrubland

No Threatened Ecological Communities (TEC) occurred within the Survey Area.

One Priority 3 vegetation community was found to occur within the Survey Area;

- Central *Banksia attenuata – Eucalyptus marginata* woodlands (type 21a)

Two Priority 3 vegetation communities that have been inferred were also thought to occur on site;

- Northern Spearwood shrublands and woodlands (type 24)
- Southern Swan Coastal Plain *E. gomphocephala – A. flexuosa* woodlands (type 25)

There is no written policy on how to respond to the presence of Priority Ecological Communities or Threatened Ecological Communities within proposed development sites and the presence of these communities is dealt with by DPaW on a case by case basis.

Vegetation condition ranged from Excellent to Completely Degraded with majority large portion of the Survey Area considered in Completely Degraded condition (52.2%).

A Black Cockatoo Assessment was undertaken in the Survey Area. A total of seven potential Black Cockatoo breeding trees were recorded. All of the trees were Tuarts (*Eucalyptus gomphocephela)* and were located in the north east corner of the site (Figure 9). The trees (including one dead tree) had DBH measurements ranging from 570 mm to 830 mm. There were no hollows observed and there was no evidence of foraging. Three natural vegetation associations which potentially provide foraging habitat for Black Cockatoos were identified in the Survey Area:

- BaBm – 4.48 ha of the Survey Area consisted of *B. attenuata* and *B. menziesii* woodland.
- EgBa – 0.96 ha of the Survey Area consisted of *E. gomphocephala* over *Banksia* woodland.
- AsOa – 0.41 ha of the Survey Area consisted of *A. saligna*, and *Olearia axilaris* shrubland.

Permits

This flora survey was conducted under the following licences issued by DPaW; Licence to take flora for scientific or other prescribed purposes SL011217 issued to Sophie Fox.

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1 Introduction

1.1 The Project

360 Environmental Pty Ltd (360 Environmental) was commissioned by Rockingham Montessori School in November 2014 to undertake a Level 2 Flora and Vegetation Assessment and a Black Cockatoo Assessment for Lot 11 Mandurah Road, Karnup, (Survey Area) (Figure 1). 360 Environmental was later commissioned in February 2015 to survey Lot 700 Mandurah Road, Karnup. The Survey Area is approximately 10.43 ha and is located about 50 km south of Perth, on the Swan Coastal Plain (SCP) Biogeographic Region of Western Australia (WA).

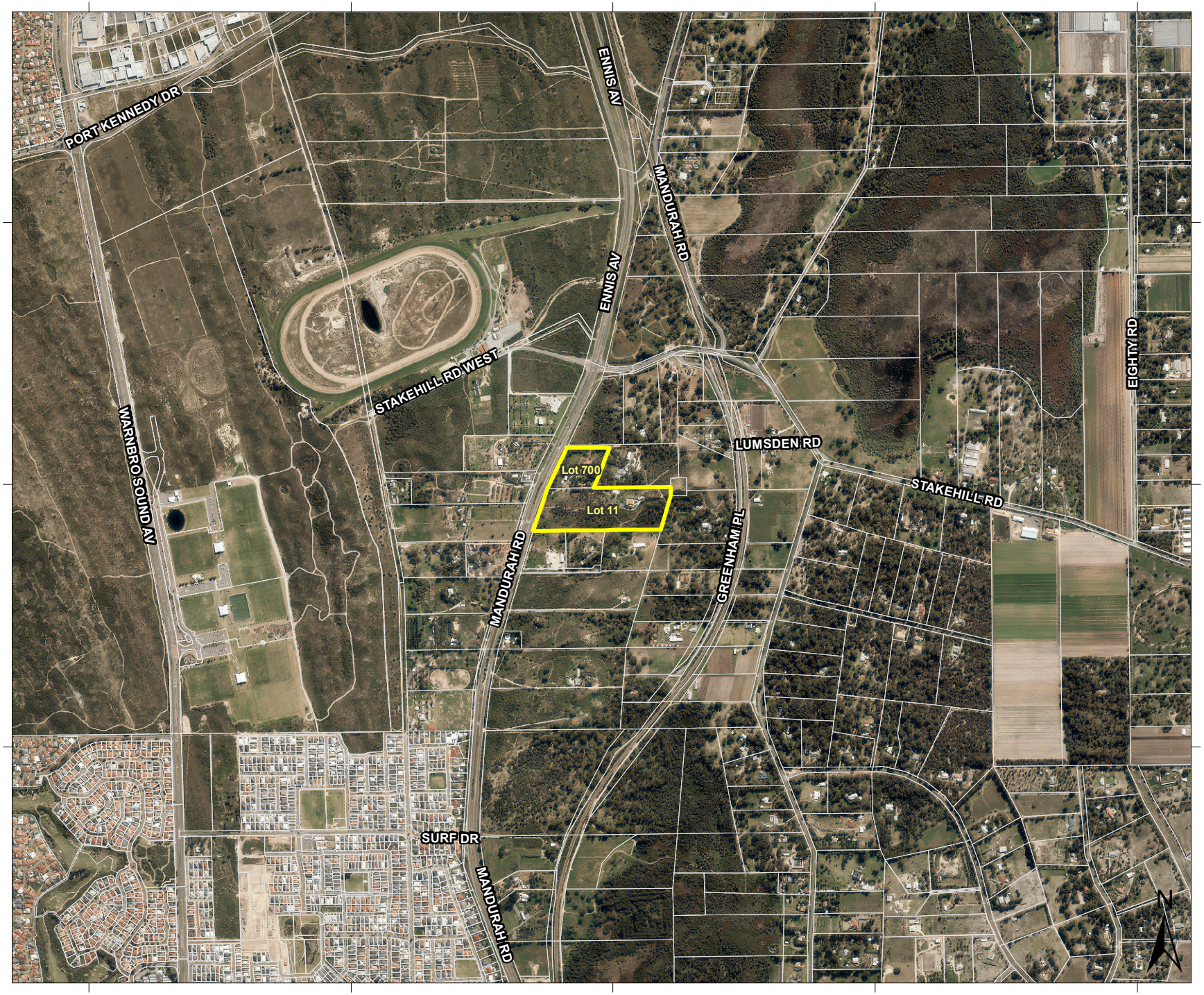
1.1.1 Objectives

The objectives of the flora and vegetation assessment were to:

- Conduct a desktop assessment of relevant literature, databases and spatial datasets to determine the environmental values and any potential issues, such as Threatened/Rare and significant species, Threatened Ecological Communities (TECs) and Priority Ecological Communities (PECs), that may be present in the site and the surrounding areas;
- Produce a list of plant species (including weed species);
- Document and map the location of any Declared Rare Flora (DRF), Priority flora and any other flora of local or taxonomic significance;
- Identify, map and discuss the significance of any TECs, PECs and any other areas of ecological importance (e.g. National Parks, wetlands and Environmentally Sensitive Areas [ESAs] etc.);
- Assess, map and photograph vegetation condition; and
- Document, describe and map the vegetation associations present.

The objective of the Black Cockatoo Survey was to:

- Identify and determine the type and extent of habitat (breeding and foraging) suitable for Black Cockatoos in the Survey Area with reference to the Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) (now Department of the Environment [DoE]) *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) referral guidelines for three threatened black cockatoo species (DESEWPaC 2012).



Legend

- Survey Area (10.43 ha)
- Cadastral Boundaries

- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS
- LOCALITY MAP SOURCED FROM LANDGATE 2006
- CADASTRE SOURCED FROM LANDGATE 7 NOV 2014
- AERIAL PHOTOGRAPHY SOURCED FROM LANDGATE 2014
(© Western Australian Land Information Authority 2014)

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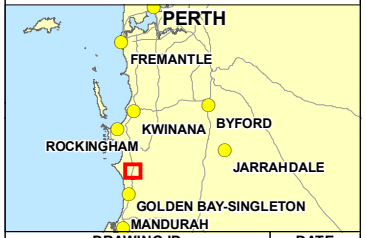
Meters
1:20,000 @ A4

LOCALITY MAP



DRAWING ID	DATE
808_f1_sitelocation v2.mxd	10-Feb-2015

HORIZONTAL DATUM AND PROJECTION
GDA 1994 MGA Zone 50

CREATED	CHECKED	APPROVED	REVISION
CS	LS/NW	RF	0

Rockingham Montessori School
Lots 11 Mandurah Road, Karnup

Flora, Vegetation and Black Cockatoo Report

Figure 1 - Site Location

1.2 Background to the Protection of Flora, Vegetation and Fauna

WA flora and fauna is protected formally and informally by various legislative and non-legislative measures, which are as follows:

Legislative measures:

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

Non-legislative measures:

- WA Department of Parks and Wildlife (DPaW) Priority lists for flora, ecological communities and fauna;
- Weeds of National Significance; and
- Recognition of locally significant populations by the DPaW.

A short description of each is given below. Other definitions, including species conservation categories, are provided in Appendix A. Conservation categories for ecological communities are provided in Appendix B.

1.2.1 EPBC Act

The EPBC Act aims to protect matters of national environmental significance (MNES). Under the EPBC Act, the Commonwealth Department of the Environment (DotE) lists threatened species and communities in categories determined by criteria set out in the Act (Appendix A and B).

Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*) is listed as Endangered under the EPBC Act. The Forest Red-tailed Black Cockatoo (FRTBC) (*Calyptorhynchus banksii naso*) and Baudin's Black Cockatoo (*Calyptorhynchus baudinii*) are classified as Vulnerable.

Projects likely to cause a significant impact to MNES should be referred to the DotE for assessment under the EPBC Act.

1.2.2 WC Act

The WA DPaW lists flora and fauna under the provisions of the WC Act as protected according to their need for protection (Appendix A).

Flora is given Declared Rare status when populations are geographically restricted or are threatened by local processes. In addition, under the WC Act, by Notice in the WA Government Gazette of 9 October 1987, all native flora (spermatophytes, pteridophytes,

bryophytes and thallophytes) is protected throughout the State. Fauna are classified as Schedule 1 to Schedule 4 according to their need for protection.

Under the WC Act both Carnaby's Black Cockatoo and Baudin's Black Cockatoo are listed as Endangered and the FRTBC is listed as Vulnerable.

1.2.3 EP Act

Declared Rare Flora (DRF) and TECs are given special consideration in environmental impact assessments, and have special status as Environmentally Sensitive Areas (ESAs) under the EP Act and the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*. Exemptions for a clearing permit do not apply in an ESA. In addition, habitat necessary for the maintenance of indigenous fauna is considered in the clearing principles and assessed during consideration of applications for a clearing permit.

1.2.4 BAM Act

Plants may be 'Declared' by the minister for Agriculture under the BAM Act 2007 (WA). The Western Australian Organism List (WAOL) contains information on the area(s) in which a plant is declared and the control and keeping categories to which it has been assigned in Western Australia. Details of the definitions of these categories are provided in Appendix C. A declaration may apply to the whole State, to districts, individual properties or even to single paddocks. If a plant is 'Declared', landholders are obliged to control that plant on their properties (Department of Agriculture and Food Western Australia [DAFWA] 2014).

DPaW Weed Prioritisation Process

The DPaW Weed Prioritisation Process (WPP) was developed to progress the Environmental Weed Strategy of WA (CALM 1999). The Weed Prioritisation Process for DPaW (DPaW 2013) prioritises weeds in each of the DPaW Regions, with the aim being to establish both a species-led and an asset-protection-based approach to weed management

The species-led process assesses weed species for their invasiveness, ecological impacts, potential and current distribution and feasibility of control. The resulting priorities focus on infestations of species which are considered to be high impact, rapidly invasive and still at a population size which is feasible to eradicate or contain to a manageable size. Weed species which are already widespread do not rank as a high priority through this part of the process.

The next stage of the process investigates the use of an asset-protection-based approach to guide the management of widespread weeds. This approach focuses on identifying high value biodiversity assets, the weeds that pose a threat to these assets and the sites where control will have the greatest biodiversity benefit and cost

effectiveness. Social, cultural and economic assets as well as good neighbour issues are considered at a later stage of the process.

1.2.5 Weeds of National Significance

The Australian Government along with the State and Territory governments has endorsed 32 Weeds of National Significance (WONS). Four major criteria were used in determining WONS:

- The invasiveness of a weed species;
- A weed's impacts;
- The potential for spread of a weed; and
- Socio-economic and environmental values.

Each WONS has a national strategy and a national coordinator, responsible for implementing the strategy. WONS are regarded as the worst weeds in Australia because of their invasiveness, potential for spread, and economic and environmental impacts (Commonwealth of Australia 2014).

1.2.6 DPaW Priority Lists

The DPaW lists 'Priority' flora and fauna that have not been assigned statutory protection as Declared Rare or 'Scheduled' under the WC Act, but which are under consideration for declaration as DRF or 'Scheduled' fauna. Flora and fauna assessed as Priority 1-3 are considered to be in urgent need of further survey. Priority 4 flora and fauna require monitoring every 5-10 years and Priority 5 flora and fauna are subject to a specific conservation programme (Appendix A).

The DPaW maintains a list of PECs which identifies ecologically valuable communities that need further investigation before possible nomination for TEC status. Once listed, a community is a PEC, and when endorsed by the WA Minister of Environment becomes a TEC, and protected as an ESA under *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* (Appendix B).

1.2.7 Informal Recognition of Flora and Fauna

Certain populations or communities of flora may be of local significance or interest because of their patterns of distribution and abundance. For example, specific locations of flora may be locally significant because they are range extensions to the previously known distribution, or are newly discovered taxa (and have the potential to be of more than local significance). In addition, many species are in decline as a result of threatening processes (land clearing, grazing, changed fire regimes), and relict populations of such species assume local importance for the DPaW. It is not uncommon for the DPaW to make comment on these species of interest.

2 Biophysical Environment

2.1 Climate

The closest long term official Bureau of Meteorology (BoM) weather station currently operating near to the Survey Area is the Medina Research Centre (Station number 009194), approximately 16 km north west of the Survey Area. The climate is described as Mediterranean (Mitchell *et al*. 2002), with mean minima of 12.3 °C, and a maxima of 24.4 °C and an average of 761.5 mm of rainfall per annum (BoM 2014).

Medina Research Centre recorded 560.4 mm of rain in 2014 prior to the survey (January 2014 – October 2014). This is 150.4 mm below the long term average rainfall of 710.8 mm for the same period (BoM 2014). The three months prior to survey (August 2014 – Oct 2014), Medina Research Centre recorded 175.3 mm of rainfall, 24.3% below the 231.5 mm long term average rainfall for the same period (BoM 2014).

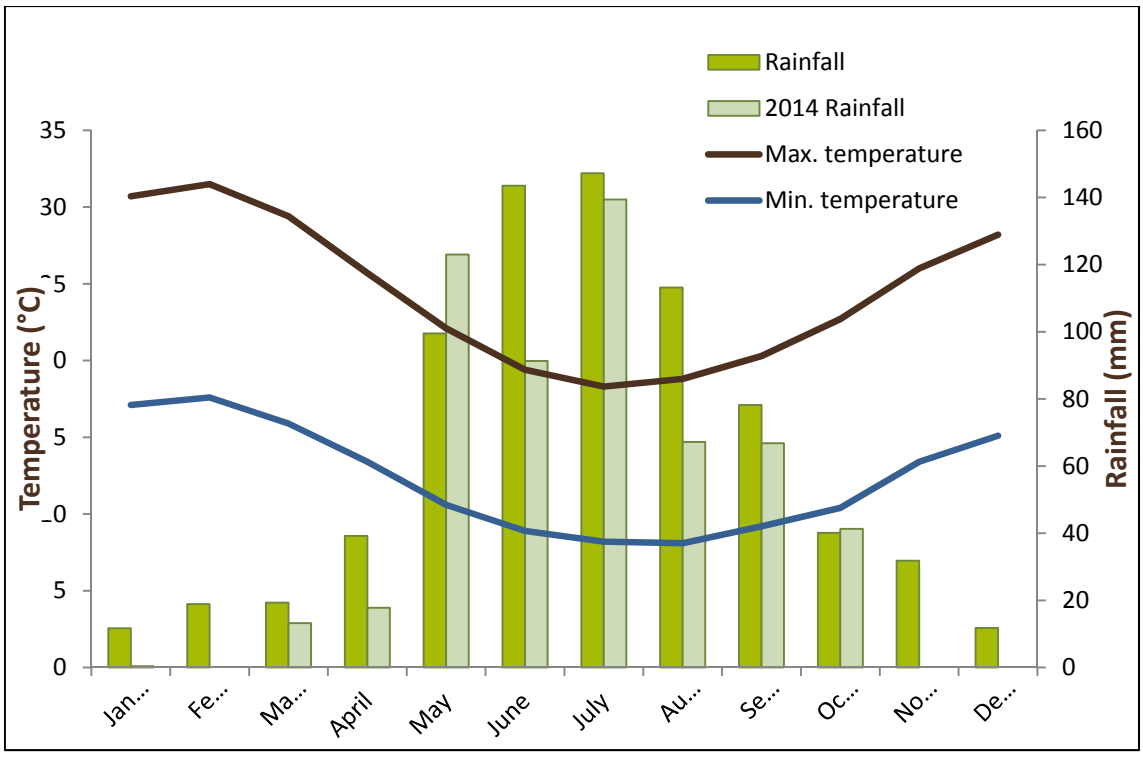


Figure 2: Mean rainfall (from 1983 to 2014) and temperature data (from 1983 to 2014) for Medina Research Centre (009194) (BoM 2014).

2.2 Geology and Soils

Soil-landscape mapping of south WA has been captured at scales ranging from 1:20 000 to 1:250 000. Soil-landscape mapping describes broad soil and landscape characteristics

from regional to local scales. Regional soil mapping indicates that the Survey Area occurs within the following four broad soil systems (DAFWA 2004) (Figure 3):

- 211Qu__Qf2, Quindalup South Qf2 Phase-Calcareous deep sands (landform: relict foredunes and gently undulating beach ridge plain);
- 211Qu__Qp2, Quindalup South Qp2 Phase-Uniform calcareous sands showing variable depths of surface darkening (Landform: long walled discrete parabolic dunes with moderate to steep slopes);
- 211Sp__S1d, Spearwood S1d Phase-Moderately deep to very deep brown siliceous yellow-brown sands (landform: dune ridges with rare limestone outcrop and slopes 3-20% occurring on the eastern slipface); and
- 211Sp__S1b, Spearwood S1b Phase-Deep siliceous yellow-brown sands or pale sands with yellow-brown subsoil (dune ridges with slopes up to 15%).

2.3 Hydrology

A review of available surface water feature mapping did not identify any known water bodies occurring within the Survey Area. Several geomorphic wetlands were located in the vicinity of the Survey Area, the closest of which is a Multiple Use Wetland located approximately 190 m east of the Survey Area. The closest wetland of conservation significance is a Conservation Category Wetland located approximately 570 m north-east of the Survey Area (The Department of Water [DoW] 2014).

2.4 Bush Forever

Bush Forever is a State Government Policy and programme that identifies 51,200 ha of regionally significant vegetation for protection, covering 26 vegetation complexes. This amounts to approximately 18% of the original vegetation on the SCP portion of the Perth metropolitan area.

Regionally significant vegetation has been identified based on criteria relating to its conservation value. Important criteria in the identification process include the achievement, where possible, of a comprehensive representation of all the ecological communities originally occurring in the region. This is principally achieved through protecting a target of at least 10% of each vegetation complex in the Bush Forever project boundary (Government of WA 2000).

There are no Bush Forever Sites in the Survey Area, however, there are five Bush Forever sites within 2km of the Survey Area (Table 1 and Figure 4).

Table 1: Bush Forever Sites near the Survey Area.

Bush Forever ID	Distance from Survey Area (km)
356	0.36
377	1.50
278	0.75
379	0.65
75	2.0

2.5 Ecological Linkages

The purpose of the Regional Ecological Linkages identified by the Perth Biodiversity Project was to link protected natural areas with other areas of mapped native vegetation. Priority was given to identifying linkages through those areas having the greatest assumed protection and to those areas that maximised opportunities to form continuous corridors of native vegetation. The Survey Area does not form part of the Perth Biodiversity Project's Draft Regional Ecological linkage network, however, there are Ecological Linkages near the Survey Area (Table 2 and Figure 4).

Table 2: Ecological Linkages near the Survey Area

Ecological Linkage Number	Distance from Survey Area (km)
81	0.60
76	0.98
80	1.0

2.6 Biogeographic Regionalisation for Australia

The Biogeographic Regionalisation of Australia (IBRA7) divides Australia into 89 bioregions based on major biological and geographical/geological attributes. These bioregions are subdivided into 419 subregions, as part of a refinement of the IBRA framework (DotE 2014a).

The Survey Area lies within the Swan Coastal Plain Bioregion and Perth subregion (SWA2) of the IBRA. The Perth subregion is a low lying coastal plain composed of

colluvial and aeolian sands, alluvial river flats and coastal limestone rising to duricrusted Mesozoic sediments in the east. Outwash plains are extensive only in the south, while a complex series of seasonal wetlands and swamps extends from north to south. Vegetation comprises heath and/or Tuart (*Eucalyptus gomphocephala*) woodlands on limestone, *Banksia* and Jarrah (*Eucalyptus marginata*) -*Banksia* woodlands on Quaternary marine dunes of various ages, Marri (*Corymbia calophylla*) on colluvial and alluvial soils, Swamp She-oak *(Casuarina obesa)* on out-wash plains, and Paperbark (*Melaleuca* sp.) in wetland areas (Mitchell *et al*. 2002).

2.7 Broad Vegetation Types

Mapping of the vegetation of the Perth region of WA was completed on a broad scale (1:250,000) by Beard (1975). These vegetation units were re-assessed by Shepherd *et al.* (2001) to account for clearing in the intensive land use zone, dividing some larger vegetation units into smaller units.

There are two Beard / Shepherd vegetation units in the Survey Area. The Shepherd *et al.* (2001) vegetation type (along with the corresponding Beard [1975] type in brackets) is described below, and its representation within the Survey Area, subregion, region and state is shown in Table 3.

- 998: Medium Woodland; Tuart
- 3048: Shrublands; Scrub-heath on the SCP

Table 3: Broad Vegetation Type within the Survey Area and its State and Regional Representation (Government of WA 2013)

	Pre-European area (ha)	Current extent (ha) 1	Remaining (%)	Current extent % in IUCN Class I-IV Reserves1
Vegetation Types (Beard 1979/ Shepherd *et al*. 2001) in the state				
998	51,015.33	19,373.13	37.98	11.98
3048	12,100.68	3,329.31	27.51	6.95
Vegetation Types (Beard 1979/ Shepherd *et al*. 2001) in the Swan Coastal Bioregion				
998	50,867.50	19,372.82	38.08	12.02
3048	10,417.98	3,316.97	31.84	8.00
Vegetation Types (Beard 1979/ Shepherd *et al*. 2001) in the Perth Subregion				
998	50,867.50	19,372.82	38.08	12.02
3048	10,417.98	3,316.97	31.84	8.00

Mapping by Heddle *et al.* (1980) is based on the relation of landform-soil units determined by Churchward and McArthur (1980). Heddle *et al.* identified one vegetation complex occurring in the Survey Area which is summarised in Table 4. The delineation of vegetation complexes is based on the concept of a series of plant communities forming regularly repeating complexes associated with a particular soil unit. The Heddle *et al.* (1980) vegetation complex that occurs across the site is described below:

- Cottesloe Complex Central and South

Table 4: Vegetation Complex within the Survey Area and its State and Regional Representation

	Pre-European area (ha)	Current extent (ha)	Remaining (%)	Current extent % Secure Tenure Reserves
Vegetation Complexes (Heddle *et al.*, 1980) in the System 6/part System 1 area (EPA 2006)				
Cottesloe Complex Central and South	44,995	18,474	41.1	8.8
Vegetation (Heddle *et al.*, 1980) in the Swan Coastal Bioregion (PBP 2013)				
Cottesloe Complex Central and South	44,899.92	15,815.73	35.22	12.75

2.8 Background to Black Cockatoos

Carnaby's Cockatoo

Carnaby's Cockatoo is listed as Endangered under the EPBC Act. Carnaby's Cockatoo is endemic to south-west WA, and is distributed from the Murchison River to Esperance and inland to Coorow, Kellerberrin and Lake Cronin (Cale 2003). The species was once common, but the population has declined significantly in the last half century, and is now locally extinct in some areas (Johnstone and Storr 1998, Shah 2006). In the last 45 years the species has suffered a 50% reduction in its abundance (Cale 2003). This reduction is due to the clearing of core breeding habitat in the wheatbelt, the deterioration of nesting hollows, and clearing of food resources on the Swan Coastal Plain (Cale 2003). The total population of Carnaby's Cockatoo is currently estimated at 40,000 (Johnstone and Johnstone 2008).

Carnaby's Cockatoos feed on seeds, nuts and flowers of a variety of native and exotic plants. Food plants include Banksia (including those previously included in the genus Dryandra), Pine trees (Pinus sp.), Marri, Jarrah, Grevillea, Allocasuarina, and Hakea species (Shah 2006). Marri nuts that are damaged extensively, especially on the main body of the nut, are likely to have been chewed by Carnaby's Cockatoo or FRTBC. The severed new growth, developing flower heads and chewed seed pods of Banksia species

are also a good indicator of Black Cockatoo feeding. Recent damage to bark is regarded as Black Cockatoo feeding activity along with the stripping of pine needles and cones (Cale 2003).

Carnaby's Cockatoo are less efficient at extracting Marri seeds than (the long-billed) Baudin's Cockatoo (Cooper *et al.* 2002). The seeds from seed pods of Banksia and the cones of Pine trees provide the highest energetic yield (Cooper *et al.* 2002).

Breeding has been recorded from early July to mid-December, and primarily occurs in the wheatbelt in the semi-arid and subhumid interior (Johnstone and Storr 1998). However judging from breeding records in the Storr-Johnstone Bird Data Bank, this species is currently expanding its breeding range westward and south into the Jarrah-Marri forests of the Darling Scarp (e.g. Wungong Dam Catchment) and into the Tuart forests of the Swan Coastal Plain including Yanchep, Baldivis, Lake Clifton and near Bunbury.

Carnaby's Cockatoo display strong pair bonds and mate for life. They nest in hollows of smooth-barked eucalypts especially Salmon Gum (E. *salmonophloia*) and Wandoo but nests have also been found in other eucalypts including York Gum (E. *loxophleba)*, Flooded Gum (*E. rudis*) and Tuart, and the rough-barked Marri. On the Swan Coastal Plain most nests are in Tuart. Eggs are laid on a mat of wood chips at the bottom of a large hollow (mostly top entry hollows) ranging from a few centimetres to 5 m deep. Clutch size is 1–2 (mostly two but only one young is reared). Incubation lasts for 29 days and only the female incubates and broods. The nestling is brooded by the female during which time both rely on the male for food. The female then leaves the nest each day at dawn, sometimes returning mid-morning (with the male) to feed the chick. After approximately three weeks she ceases to brood and the chick is fed by one or both parents in the morning and at late evening.

Baudin's Cockatoo

Baudin's Cockatoo is listed as Vulnerable under the EPBC Act. The species is distributed through the south-western humid and subhumid zones, from the northern Darling Range and adjacent far east of the Swan Coastal Plain (south of the Swan River), south to Bunbury and across to Albany. Baudin's Cockatoo rarely occurs near the coast north of Mandurah, and rarely occurs north of the Swan River (Johnstone & Kirkby 2008, Johnstone & Storr 1998). Baudin's Cockatoo usually occur in small flocks of up to 30, or occasionally up to 50 and rarely in aggregations of up to 1200 (Johnstone & Kirkby 2008). Baudin's Cockatoo is distinguished from Carnaby's Cockatoo by its longer bill and slightly different call.

This species forages primarily in eucalypt forest, where it feeds on Marri seeds, flowers, nectar and buds. They also feed on a wide range of seeds of Eucalyptus, Banksia, Hakea and Pines (*Pinus* sp.) as well as fruiting apples and pears and beetle larvae from under the bark of trees (Johnstone & Kirkby 2008, Johnstone & Storr 1998). Baudin's

Cockatoo forages at all levels of the forest from the canopy to the ground, often feeding in the understorey on proteaceous trees and shrubs, especially Banksia, and in orchards both in trees and on dropped or fallen fruit on the ground.

There is very little breeding information and the breeding biology of this species is poorly known. Recorded breeding in deep south-west, north to the Whicher Range and Lowden and also isolated records at Wungong Catchment, Serpentine (hills area) and east to Kojonup and near Albany. They nest in large, mostly vertical, hollows of Karri, Marri, Wandoo, and Bullich. Baudin's Cockatoos display strong pair bonds are monogamous, and probably mate for life. The pair remain together all year round except when the female is incubating and brooding. Both adults play a part in selecting the nest hollow, but only the female is responsible for renovation and preparing the hollow for breeding. Preparation of the hollow consists of chewing around the entrance of the hollow and down one part of the interior wall. Pairs have also been recorded prospecting for hollows in most months and also outside the breeding range (Johnstone & Kirkby 2011).

Forest Red-tailed Black Cockatoo

The FRTBC is listed as Vulnerable under the EPBC Act. The FRTBC is distributed through the humid and subhumid south-west of WA from Gingin through the Darling Ranges to the south-west from Bunbury to Albany. It occasionally occurs in the southern SCP, and rarely in the Perth metropolitan area. The FRTBC occurs in pairs or small flocks, or occasionally large flocks of up to 200 birds (Johnstone & Storr 1998). The FRTBC inhabits dense Jarrah (*E. marginata*), Karri (*E. diversicolor*) and Marri (*Corymbia calophylla*), forests that receive more than 600 mm average annual rainfall (DSEWPaC 2012).

The FRTBC feeds primarily on Marri and Jarrah fruit (Johnstone *et al*. 2013a). Also Tuart (Johnstone & Kirkby 2011) and to a lesser extent on Blackbutt (*E. patens*), Albany Blackbutt (*E. staeri*), Karri, Sheoak (*Allocasuarina fraseriana*) and Snottygobble (*Persoonia longifolia*). FRTBC can obtain energy faster when feeding on Marri and Jarrah than other food sources (Cooper *et al.* 2002) and these two plant species make up 90% of their diet (DSEWPaC 2012).

FRTBC are monogamous and pair nest in tree hollows from 6.5 – 33 m above ground. Most nests are in large and old mature Marri, and these trees are the most important nesting tree throughout the FRTBC range (Johnstone *et al.* 2013a). Nest trees of the FRTBC have a mean circumference at breast height of 2.79 m, a mean estimated age of 222 years and a mean overall height of 20.24 m. Marri nest trees have a mean circumference at breast height of 2.76 m, a mean estimated age of 220 years (95% confidence limit 209–231 years) and an average height of 20.04 m (Johnstone *et al.* 2013b).

Breeding has been recorded from February to December (with a peak between October and December, also a peak in some years in April–May). The FRTBC nests in large

hollows of Tuart, Marri, Jarrah, Wandoo (*E. wandoo*), Bullich (*E. megacarpa*), and Karri. FRTBC have a clutch size of one, rarely two and only the female incubates and broods. The incubation period is 29–31 days and nestling period 75–85 days (Johnstone and Storr 1998). Most pairs appear to breed every second year (Johnstone & Kirkby 2011).

3 Methods

3.1 Background

The flora survey was consistent with a single season Level 2 survey as per the EPA requirements for environmental surveying and reporting for flora and vegetation in WA where practical and relevant, as set out in the following documents:

- EPA Guidance for the Assessment of Environmental Factors: Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in WA No. 51 (EPA 2004a); and
- EPA Guidance for the Level of Assessment for Proposals affecting Natural Areas within the System 6 Region and Swan Coastal Plain Portion of the System 1 region. Guidance Statement No. 10 (EPA 2006).

The Black Cockatoo Survey was compliant with the EPBC Act referral guidelines for three threatened black cockatoo species (DSEWPaC 2012).

Three species of Black Cockatoo occur in the south-west of WA and all are protected under the following State and Federal legislation:

- The WA Wildlife Conservation Act 1950 (WC Act); and
- *The Commonwealth Environment Protection and Biodiversity Conservation Act* (EPBC Act).

3.2 Flora and Vegetation Survey Methods

3.2.1 Flora and Vegetation Database Review

The desktop study provided background information on the flora and vegetation of the Survey Area. This involved a search of the following sources:

- DPaW Threatened and Priority Flora database (DPaW 2014a);
- DPaW Threatened and Priority Ecological Communities database (DPaW 2014b); and
- DSEWPaC Protected Matters Search Tool (PMST) (DotE 2014).

A request for a database search was submitted to the DPaW (5 km buffer search around the Survey Area) to obtain a list of Declared Rare Flora/Threatened or Priority flora, and TECs and PECs in and near the Survey Area (Figure 5). These sources were used to compile a list of expected DRF or Priority species and TECs and PECs that may occur based on the landforms in the Survey Area.

3.2.2 Flora and Vegetation Field Survey

The field survey was conducted for Lot 11 on the 13th November 2014 with Lot 700 being surveyed on 3 February 2015.

The survey included the assessment of 2 quadrats, 6 relevés and mapping notes (Figure 6). Quadrats are vegetation survey plots which are accurately measured out as 10 x 10 m (or an area equivalent to 100 m^2) and marked at the NW corner using a handheld Garmin GPS unit.

The information recorded at each quadrat included landscape features, surface soil colour and texture, bare ground, litter cover, disturbance, fire age, aspect and vegetation condition (Government of WA 2000). Each species of plant at each quadrat was recorded, including information on height and percentage cover.

3.2.3 Systematic Searches

In addition to the information collected from the quadrats, traverses throughout the Survey Area were undertaken for significant flora. For each population of suspected significant flora identified during the field survey, the following was recorded:

- Co-ordinate locations (using handheld GPS units);
- Description of vegetation association present; and
- Estimation of population size.

3.2.4 Taxonomy and Nomenclature

Where field identification of plant taxa was not possible, specimens were collected systematically for later identification utilising resources of the Western Australian Herbarium (WAH).

The species list was checked against FloraBase (WAH 2014) to determine the species conservation status. Threatened and Priority Flora were verified against the EPBC Act listing of threatened species to determine the Commonwealth listing.

Introduced species were checked against the DPaW Weed Prioritisation Process (WPP) (DPaW 2013), to determine their ranking in terms of environmental impact. The BAM Act Declared Plants list was consulted to determine if any are Declared Plants, and the Weeds of National Significance list was examined to determine if any were WONS (Commonwealth of Australia 2014).

3.2.5 Vegetation Mapping

The vegetation mapping units were described based on their structure and species composition, as defined by quadrat data and field observations. Vegetation was mapped in the field using handheld GPS (Garmin) units and high-resolution aerial photographs (1:3,402 scale), which in the office were digitised using GIS software (ArcGIS 9.3.1).

Vegetation condition was mapped in the field using handheld GPS (Garmin) units and high-resolution aerial photographs (1:10,000 scale), which in the office were digitised using GIS software (ArcGIS 9.3.1). Vegetation condition was assessed based on Bush Forever (Government of WA 2000) (Appendix D).

3.3 Black Cockatoo Survey Methods

The field survey was undertaken on 13th November 2014 according to the methods (where practical and possible) outlined in the EPBC Act referral guidelines for the three threatened Black Cockatoo species (DSEWPaC 2012).

The Black Cockatoo Assessment involved traversing the Survey Area by foot. Any trees meeting the following criteria for potential breeding were recorded, marked and electronically logged using a hand held Global Positioning System (GPS) unit:

- Native trees (e.g. Jarrah, Tuart, Marri etc.);
- Diameter at breast height (DBH) ≥ 500 mm (300 mm for Wandoo and Salmon Gum); and
- Hollows > 120 mm diameter.

The Black Cockatoo assessment also involved assessing the habitat for tree and shrub species known to be important dietary items e.g. Marri and Banksia *sp.* It also included looking for:

- Evidence of feeding (chewed cones, seed and nut material); and
- Opportunistic observations of Black Cockatoos in the Survey Area.

4 Results

4.1 Flora, Vegetation and Fauna Survey Limitations and Constraints

Survey constraints are often difficult to predict, as is the extent to which they influence survey effort. Survey limitations and constraints of the flora, vegetation and fauna survey are detailed in Table 5.

Table 5: Limitations and constraints associated with the Survey Area.

VARIABLE	IMPACT ON SURVEY OUTCOMES
Access	The whole site was accessed and traversed. Particular focus was given to areas expected to be impacted and or that may have species of conservation significance.
Experience	The personnel who executed these surveys were practitioners suitably qualified in their respective fields: • Field Staff: Botanist: Sophie Fox (November survey) Principal Botanist: Narelle Whittington (February survey). • Field Staff: Zoologist: Laura Stevens. • Data Interpretation and Reporting: Narelle Whittington, Laura Stevens and Sophie Fox. • Report Review: Dr Ron Firth.
Timing, weather, season	The survey was conducted during spring after three months of below average rainfall (refer to section 2.1). Some of the Threatened or Priority species which have potential to occur within the Survey Area have flowering periods outside of the survey timing. Some species, therefore, may not have been located during the survey. Flora composition changes with time, particularly seasonally as a result of seasonal conditions. Therefore, botanical surveys completed at different times of the year will have varying results.
Scope: Life forms sampled	The scope of this project included the surveying of flora and vegetation and searching for conservation significant species or communities, and the surveying of potential Black Cockatoo breeding and foraging habitat.

Sources of information	Relevant DPaW searches were undertaken for the Survey Area, see section 3.2.
Completeness	The entire Survey Area was accessible; the time spent conducting the survey was considered adequate for the size and complexity of the site. All vegetation associations were sufficiently surveyed; with two quadrats, six relevés and additional vegetation mapping notes recorded.
Disturbances	Lot 11 is highly disturbed and has been subject to vegetation clearing, building of a property, planting of garden species and non-endemic revegetation. Lot 700 has no native vegetation except for a couple of *Banksia attenuata* scattered through the garden along the southern fence line. The property is a function centre with established tropical and landscaped gardens.

4.2 Flora Results

4.2.1 Overview of Flora

A total of 59 taxa (including species, subspecies, varieties and forms) from 49 genera and 31 families were recorded in the Survey Area. The commonly occurring families were; Fabaceae (9 taxa), Poaceae (7 taxa), Proteaceae (5 taxa) and Asteraceae (5 taxa).

The flora inventory is provided in Appendix E and the site data sheets in Appendix F.

4.2.2 Flora of Conservation Significance

No Threatened species listed under the EPBC Act and/or gazetted as Declared Rare Flora (Threatened) pursuant to the WC Act were recorded during the survey. No Priority species, as listed by DPaW, were recorded during the survey.

The review of the database searches identified 19 conservation significant flora potentially occurring in the vicinity of the Survey Area. The likelihood of these 19 conservation significant taxa occurring in the Survey Area is shown in Table 6. The description of the conservation status is listed in Appendix A.

Table 6: Assessment of the likelihood of occurrence of Significant Flora in the Survey Area

[1]Closest record to Survey Area based on DPaW 2014. Likely = Suitable habitat present and records less than 15 km from the Survey Area, Possible = Suitable habitat present and records between 15 km and 40 km from the Survey Area, and Unlikely = No suitable habitat present and/or records greater than 40 km from the Survey Area.

Conservation Status	Species	Habitat Information (WAH 2014)	Suitable Habitat	Closest Record[1]	Likelihood
T	*Andersonia gracilis*	White/grey sand, sandy clay, gravelly loam. Winter-wet areas, near swamps.	Yes	Information unavailable	Unknown
T	*Caladenia huegelii*	Grey or brown sand, clay loam. *Banksia* woodland.	Yes	11km	Likely
T	*Darwinia foetida*	Information not available.	Information unavailable	Information unavailable	Unknown
T	*Diuris micrantha*	Brown loamy clay. Winter-wet swamps, in shallow water.	No	Information unavailable	Unknown
T	*Diuris purdiei*	Grey-black sand, moist. Winter-wet swamps.	No	Information unavailable	Unknown
T	*Drakaea elastica*	White or grey sand. Low-lying situations adjoining winter-wet swamps.	No	Information unavailable	Unknown
T	*Drakaea micrantha*	White-grey sand.	Yes	26km	Possible
T	*Lepidosperma rostratum*	Peaty sand, clay.	No	Information unavailable	Unknown

Conservation Status	Species	Habitat Information (WAH 2014)	Suitable Habitat	Closest Record[1]	Likelihood
P2	*Acacia benthamii*	Typically on limestone breakaways.	No	0.65km	Unlikely
P3	*Beyeria cinerea* subsp. *cinerea*	Information not available.	Information unavailable	1.4km	Unknown
P3	*Calandrinia oraria*	Information not available.	Information unavailable	4km	Unknown
P3	*Dillwynia dillwynioides*	Sandy soils. Winter-wet depressions.	Yes	4.2km	Likely
P3	*Schoenus capillifolius*	Brown mud. Claypans.	No	4.3km	Unlikely
P3	*Sphaerolobium calcicola*	White-grey-brown sand, sandy clay over limestone, black peaty sandy clay. Tall dunes, winter-wet flats, interdunal swamps, low-lying areas.	Yes	1.1km	Likely
P3	*Stylidium longitubum*	Sandy clay, clay. Seasonal wetlands.	No	Information unavailable	Unknown
P3	*Thelymitra variegata*	Sandy clay, sand, laterite.	Yes	Information unavailable	Unknown
P4	*Centrolepis caespitose*	White sand, clay. Salt flats, wet areas.	No	Information unavailable	Unknown
P4	*Dodonaea hackettiana*	Outcroping limestone.	No	Information unavailable	Unknown

Conservation Status	Species	Habitat Information (WAH 2014)	Suitable Habitat	Closest Record[1]	Likelihood
P4	*Jacksonia sericea*	Calcareous and sandy soils.	Yes	2.2km	Likely

4.2.3 Introduced Flora

A total of 16 introduced species were recorded during the survey (Table 7). None of these species are listed as Declared under the BAM Act or as WONS.

Table 7: Introduced Flora Recorded in the Survey Area and their ranking under the DPaW Weed Prioritisation Process (DPaW 2013)

TAXON	(COMMON NAME)	DPAW WPP RANKING
Arctotheca calendula	Cape Weed	Low
Avena barbata	Wild Oats	Low
Briza maxima	Blowfly Grass	Low
Briza minor	Shivery Grass	Low
Bromus diandrus	Great Brome	Low
Carpobrotus edulis	Hottentot Fig	Moderate
Ehrharta calycina	Perennial Veldt Grass	Low
Euphorbia peplus	Petty Spurge	Negligible
Fumaria capreolata	Whiteflower Fumitory	Low
Lagurus ovatus	Hare's Tail Grass	Low
Melia azedarach	White Cedar	Negligible
Olea europaea	Olive	High
Pelargonium capitatum	Rose Pelargonium	Low
Pinus pinaster	Maritime pine	Negligible
Schinus molle	Pepper Tree	Low
Ursinia anthemoides	Ursinia	Negligible

4.2.4 Vegetation Associations

Three natural vegetation associations were described for the Survey Area, a description of this vegetation association is provided in Table 8 and Figure 7.

Table 8: Vegetation Association Descriptions and Extent in the Survey Area

Vegetation Association Code	Name	Description	Extent (%)	Extent (ha)
BaBm	*B. attenuata, B. menziesii* woodland	Low Open Woodland of *B. attenuata* over Tall Shrubland of *Acacia rostellifera* over Low Open Shrubland of *Kunzea glabrescens*, *Hemiandra pungens* and *Conostylis aculeata* over Grassland of **Ehrharta calycina*	42.9	4.48
EgBa	*E. gomphocephala - Banksia* woodland	Woodland of *E. gomphocephala* over Tall Shrubland of *B. attenuata* and *B. menziesii* over Open Shrubland of *Hibbertia hypericoides* and *Kunzea glabrescens*, over Very Open Sedgeland of *Lepidosperma gladiatum*, over Grassland of **Ehrharta calycina*.	6.6	0.69
AsOa	*A. saligna, Olearia axilaris* shrubland	Tall Shrubland of *A. saligna* over Open Shrubland of *O. axilaris*, over Shrubland of *K. glabrescens*, *Scaevola thesioides* and *H. hypericoides* over Very Open Grassland of **E. calycina*	3.9	0.41
Ne	Non-endemic species	Non-endemic species and/or garden species and/or weedy tracks and/or revegetation	28.7	3.0

4.2.5 Vegetation Condition

Vegetation condition ranged from Excellent to Completely Degraded with majority large portion of the Survey Area considered to be in Completely Degraded condition (52.2%) (Figure 8). Vegetation condition mapping is presented in Figure 8 and the extent is described in Table 9. Lot 11 is highly disturbed and has been subject to vegetation clearing associated with the building of a house, tracks and sheds as well as

establishment of gardens and non-endemic revegetation. Lot 700 has no native vegetation except for a couple of *Banksia attenuata*, *Conostylis aculeata* and *Acacia pulchella* that are interspersed with garden plants along the southern fence line. The property is a function centre with established tropical and landscaped gardens.

The average fire age of the vegetation was considered very old (>12 years since last fire).

Table 9: Vegetation Condition and Extent in the Survey Area

CONDITION	EXTENT (%)	EXTENT (HA)
Excellent	0.86	0.09
Good	21.95	2.29
Degraded	24.9	2.60
Completely Degraded	52.25	5.45

4.2.6 Floristic Community Types

The FCT represented by the vegetation in the Survey Area was determined by statistical analysis (multivariate analysis) and further data interpretation of the two quadrats established, as shown in Table 10 below. The following FCT was found to occur in the Survey Area:

- FCT21a; Central *B. attenuata – E. marginata* woodlands (this FCT is listed as a Priority 3 by Department of Parks and Wildlife (DPaW)

Table 10: Floristic Community Type Analysis for Quadrats

VEGETATION ASSOCIATION	FLORISTIC COMMUNITY TYPES1	SIMILARITY	COMMENTS	INFERRED FLORISTIC COMMUNITY TYPE
BaBm (Q1,Q2,R4,R5)	**FCT 30c** Other mallees or scrubs	15%	Documented occurrences are in the Perth region on the Quindalup-Spearwood landform unit, and not known to occur in the area, or that far south.	**FCT 21a** Central *B. attenuata – E. marginata* woodlands Based on species present, and surrounding occurrences of this FCT
	FCT 24 Northern Spearwood shrublands	13.19%	The dominance of vegetation in BaBm does not match the characteristics of	

Vegetation Association	Floristic Community Types1	Similarity	Comments	Inferred Floristic Community Type
	and woodlands		FCT 24	
	FCT 20c Eastern shrublands and woodlands	13.7%	Not known to occur in the area, occurs in the Ridgehill / Pinjarra landform unit.	

1. Gibson *et al.* 1994

Due to the altered state of the Survey Area and the highly disturbed nature of the vegetation, FCTs were not able to be determined through statistical analysis (multivariate analysis) for all sites. Two Quadrats were established within the Survey Area, however, due to low diversity of native species and the relatively small size of the site, relevés were established ; therefore FCTs have been inferred based on factors that are diagnostic, this includes the presence of indicator species, soil types and landform position (Table 11). The following FCTs are inferred to occur in the Survey Area:

- FCT25; Southern *E. gomphocephala – Agonis flexuosa* woodlands
- FCT24; Northern Spearwood shrublands and woodlands

Table 11. Floristic Community Type Analysis for Relevés

Vegetation Association	Comments	Inferred Floristic Community Type
EgBa (R2)	Based on species present and surrounding occurrences of this FCT	**FCT25** Southern *E. gomphocephala – A. flexuosa* woodlands
AsOa (R3, R6)	Based on species present and surrounding occurrences of this FCT	**FCT24** Northern Spearwood shrublands and woodlands

4.2.7 Threatened and Priority Ecological Communities

A search of the EPBC PMST and DPaWs database for TECs and PECs identified the following as occurring within 5 km of the Survey Area (Figure 5);

- Sedgelands in Holocene dune swales of the southern Swan Coastal Plain Threatened Ecological Community (SCP19a) (Categorised as Critically Endangered under the WC and EPBC Acts)
- Woodlands over sedgelands in Holocene dune swales of the southern Swan Coastal Plain Threatened Ecological Community (SCP19b) (Categorised as Critically Endangered under the WC and EPBC Acts)

Both SCP19a and SCP19b represent the TEC 'sedgelands in Holocene dune swales', however, they are split into two sub-communities, 'a' and 'b', due to differences in overstorey vegetation. The typically common vegetation associated with both SCP19a and SCP19b includes *A. rostellifera*, *A. saligna*, *Xanthorrhoea preissii* over sedges including *Baumea juncea*, *Ficinia nodosa* and *L. gladiatum*, over native grass *Poa porphyroclado*, SCP19b typically contains an overstorey of *E. gomphocephala*, *Melaleuca rhaphiophylla* and *Banksia littoralis* (DoEC 2011).

- Microbial community of a coastal saline lake (Lake Walyungup) (Walyungup Microbial) (Priority 1)
- Northern Spearwood shrublands and woodlands (SCP24) (Priority 3)
- Southern Eucalyptus gomphocephala-Agonis flexuosa woodlands (SCP25) (Priority 3)
- Coastal shrublands on shallow sand (SCP29a) (Priority 3)
- Acacia shrublands on taller dunes (SCP29b) (Priority 3)

No TECs were found to occur within the Survey Area.

4.2.8 Regional Representation

Vegetation mapping units described in the Survey Area were correlated with the Beard (1975) and Shepherd *et al*. (2001) broad vegetation types as much as possible by examining similarities in vegetation descriptions (Table 12). Differences exist with the terminology used in the descriptions as they are based on different methods of categorising and characterising vegetation types, and the different spatial scale of the analysis (i.e. region vs. local scale).

Table 12: Representation of broad vegetation types and corresponding vegetation associations

Vegetation Type and Description (Shepherd *et al.* 2001/Beard 1975)	Corresponding Vegetation Association (Current Survey)	Vegetation Association Extent in Survey Area (ha)
998: Medium Woodland; Tuart	EgBa	0.69
3048: Shrublands; Scrub-heath on the Swan Coastal Plain	AsOa	0.41

4.3 Black Cockatoo Results

During the Black Cockatoo Assessment, no Black Cockatoos were observed utilising the Survey Area and no foraging evidence (for example in the form of chewed nuts) was recorded.

4.3.1 Foraging Habitat

Three natural vegetation associations were described in the Survey Area:

- BaBm – 4.48 ha of the Survey Area consisted of *B. attenuata* and *B. menziesii* woodland.
- EgBa – 0.96 ha of the Survey Area consisted of *E. gomphocephala* over *Banksia* woodland.
- AsOa – 0.41 ha of the Survey Area consisted of *A. saligna*, and *Olearia axilaris* shrubland.

Black Cockatoos have been recorded foraging on a variety of Banksia and Acacia species, as well as *E. gomphocephala* (Johnstone & Kirkby 2011) and will be discussed in section 5.6.

4.3.2 Potential Breeding Habitat

The Survey Area contained a total of seven potential breeding trees with a DBH of 500 mm or greater. All of the seven trees recorded were Tuart (E. *gomphocephala).*

None of these potential breeding trees contained any visible hollows which would be considered suitable for nesting. The dimensions and the locations of the potential breeding trees are displayed in Table 13 and Figure 9 respectively.

Table 13: Potential breeding tree species recorded during the survey, dimensions and location (Coordinates are in GDA 94)
Brackets denotes dead tree

No.	Taxa	Height (m)	DBH (mm)	No of Hollow	Hollow Size	Easting	Northing
1	*E. gomphocephala*	20	700	0	-	0385194	6415936
2	*E. gomphocephala*	20	800	0	-	0385193	6415914
3	*E. gomphocephala*	18	580	0	-	0385180	6415923
4	*E. gomphocephala*	20	570	0	-	0385166	6415921
5	*E. gomphocephala*	19	630	0	-	0385140	6415929
6	*E. gomphocephala*	20	630	0	-	0385134	6415905
7	*(E. gomphocephala)*	18	830	0	-	0385115	6415904

5 Discussion

A total of 59 flora taxa (including species, subspecies, varieties and forms) from 49 genera and 31 families were recorded in the Survey Area.

5.1 Flora of Conservation Significance

No threatened species pursuant to the EPBC Act or to the WC Act were recorded in the Survey Area during the field survey. Nineteen species listed as Threatened by the EPBC Act, and also listed under the WC Act, were identified as potentially occurring in the Survey Area.

Four of these - (*Caladenia huegelii*, *Dillwynia dillwynioides, Sphaerolobium calcicola and Jacksonia sericea)* - are considered likely to occur within the Survey Area due to the presence of suitable habitat and the close proximity to the site of previous records.

One of these (*Drakaea micrantha*) is considered as possibly occurring in the site due to the presence of suitable habitat and the proximity of previous records to the Survey Area.

Two of these (*Acacia benthamii* and *Schoenus capillifolius*) are considered unlikely to occur due to lack of suitable habitat.

A further 12 priority flora taxa were identified as potentially occurring in the Survey Area based on database searches, however, the likelihood of occurrence is not known due to a lack of information on their preferred habitat or known closest record to the site.

Caladenia huegelii is a tuberous, perennial orchid that grows to 0.6 m high that is easily recognizable during its flowering period from September to October (WAH 2014). Outside of this period *C. huegelii* remains as an underground tuber and is difficult to detect in the field. The vegetation in the Survey Area does contain tree species that *Caladenia huegelii* is associated with, however the understorey lacks the majority of typical species. The understory in the Survey Area is regarded as being open whereas *Caladenia huegelii* tends to favour areas of thick undergrowth. Soil preferable for the species is usually deep grey-white sand associated with the Bassendean sand-dune system. However, specimens have been known to extend into the Spearwood system in some areas. From the information above, it can be concluded, that even though the survey was undertaken outside the optimum time for the flowering of this species and it is possible for the species to occur on the soil present on site, there is limited preferable habitat present, it has an open structure and considered to be dominantly in Good to Degraded condition; consequently its likely occurrence is questionable.

Drakaea micrantha is a tuberous, terrestrial herb which has a diminutive flower and a heart shaped leaf which is silvery grey with prominent green veins. The species flowers from September to October. The vegetation in the Survey Area does contain tree species that *Drakaea micrantha* is associated with and there is *Kunzea glabrescens* present which is typically associated with the species. The occurrence of Kunzea on site however, is sporadic and lacking the community structure often associated with the presence of *Drakaea micrantha*. The sands occurring at the site belong to the Spearwood and Quindalup system and therefore are generally calcareous yellow to brown sands. DPaW records suggest that this species is generally confined to areas further inland upon the grey sands of the Bassendean system. Even though the survey was undertaken outside the optimum time for the flowering of this species, the above information implies its possible occurrence in the Survey Area is unlikely.

5.2 Vegetation of Conservation Significance

A search of the EPBC PMST and DPaW TEC and PEC database identified two TECs and five PECs occurring within five km of the Survey Area (DPaW 2014b).

No TEC's were found to occur within the Survey Area.

One Priority 3 vegetation community was found to occur in the Survey Area;

- Central Banksia attenuata – Eucalyptus marginata woodlands (type 21a)
- The vegetation association, BaBm, has been inferred as FCT SCP21a Central Banksia attenuata – Eucalyptus marginata woodlands. Even though FCT SCP21a is not formally listed as a PEC, in 2012 a nomination was put forward under the EPBC Act to list all *Banksia* dominated woodlands as TECs. The nomination is currently being assessed by DoE with the decision to be completed in July 2015. The main feature of these *Banksia* woodlands is the presence of *Banksia attenuata* and/or B. *menziesii* occurring on deeps sands. This community is listed as Priority 3.
- Two additional inferred Priority 3 vegetation communities were found to occur in the Survey Area;Northern Spearwood shrublands and woodlands (type 24) (this FCT is listed as a Priority 3 by DPaW)
- Southern Swan Coastal Plain *E. gomphocephala – A. flexuosa* woodlands (type 25) (this FCT is listed as a Priority 3 by DPaW)

PECs are known as ecologically valuable communities that need further investigation before possible nomination for TEC status. Priority communities listed by DPaW have no formal protection. There is no written policy on how to respond to the presence of PECs within proposed development sites and the presence of these communities is dealt with by DPaW on a case by case basis.

5.3 Vegetation Condition and Introduced Flora

Vegetation condition ranged from Excellent to Completely Degraded, with majority large portion of the Survey Area considered in Completely Degraded condition (52.2%). Tracks and invasive weed species were the most common form of disturbance in the Survey Area. The low percentage of vegetation considered in Excellent or Good condition can be attributed to the location and surrounding land uses of the Survey Area. The surrounding urban development and roads are a source of weeds, rubbish and there are tracks. Lot 700 land-use as a function centre with established tropical gardens and landscaping has left the property devoid of native species except for a very small area along the southern boundary.

A total of 16 introduced species were recorded during the field survey. None of these taxa are listed as Declared under the BAM act or WONS. All of the weed species recorded are common bushland and agricultural weeds (Hussey *et al.* 2007). One of the weeds (**Olea europaea*) has a High rating under the DPaW Weed Prioritization Process, One is rated Moderate, Ten are rated Low and four are rated as Negligible under the DPaW Weed Prioritization Process (Table 7).

5.4 Regional Representation

The Cottesloe Complex is estimated to have 41.1% native vegetation remaining based on the pre-European extent, with 8.8% in secure tenure (EPA 2006). More recently the (PBP) has mapped native vegetation extent by vegetation complex on the SCP. It is estimated that 35.22% of Cottesloe Complex remains compared to its pre-European extent (PBP 2013).

The EPA recognises vegetation complexes that are not well represented as being significant. Vegetation complexes which have 10%-30% remaining may be considered regionally significant. Proposals that would affect a vegetation complex with 10% or less remaining are likely to be formally assessed by the EPA (EPA 2006).

5.5 Ecological Linkages

The purpose of the Regional Ecological Linkages identified by the PBP was to link protected natural areas with other areas of mapped native vegetation. Priority was given to identifying linkages through those areas having the greatest assumed protection and to those areas that maximised opportunities to form continuous corridors of native vegetation. The Survey Area does not form part of the PBP's Draft Regional Ecological linkage network, however, there are Ecological Linkages surrounding the Survey Area (Table 2 and Figure 4).

5.6 Black Cockatoo Assessment

During the Black Cockatoo Assessment potential foraging and breeding habitat was identified in the Survey Area. Foraging habitat consisted of Tuart, Banksia and Acacia, all known dietary item of Black Cockatoos and potential breeding habitat consisted of Tuart (Johnstone & Kirkby 2011).

5.6.1 Foraging Habitat

Carnaby's Cockatoo have been observed feeding on a wide range of foods including the seeds of *B. attenuata, B. baxteri, B. coccinea, B. menziesii, B. grandis, B. prionotes, B. speciosa, B. ilicifolia, B. longifolia, B. ericifolia, B. quercifolia, B. hookeriana*, as well as flower buds, flowers and nectar of *B. attenuata, B. ericifolia, B. grandis, B. ilicifolia, B. menziesii, E. gomphocephala.* They have been recorded foraging on insect larvae and insects (including weevils) from under bark, from wood of live and dead trees and shrubs, from galls and from flowers and flower stems, of *Acacia* spp. including *A. saligna, Banksia* spp., *and Eucalyptus* spp. (Johnstone & Kirkby 2011).

Baudin's Cockatoo is mainly found in eucalypt forests, especially *E. marginata – C. calophylla* forest, *E. diversicolor* forest, and less frequently in woodlands of *E. wandoo, E. patens and E. rudis*. This cockatoo forages at all levels of the forest from the canopy to the ground, often feeding in the understorey on proteaceous trees and shrubs, especially Banksia (Johnstone & Kirkby 2011).

FRTBC feeds mainly on the seeds of *C. calophylla and E. marginata* (Johnstone & Kirkby 2011). Immature FRTBC have been recorded taking up to three times as long as their parents to open Jarrah or Marri nuts and eat the seeds (Johnstone *et. al.* 2013).

In more recent years there has been an interesting change in foraging behaviour of FRTBC in the northern Darling Range (adjacent to the Perth metropolitan area) with the FRTBC discovering and using a new food source, the introduced Cape Lilac (*Melia azedarach*), This species is of growing importance as food in the Perth region (Johnstone *et. al.* 2013).

5.6.2 Potential Breeding Habitat

Black cockatoos breed in large hollow-bearing trees, generally in woodlands or forests (Johnstone *et al.* 2013). The size of the tree can be a useful indication of the hollow-bearing potential of the tree. Trees of suitable DBH are potentially important for maintaining breeding in the long-term, through maintaining the integrity of the habitat and allowing trees to provide future nest hollows. Maintaining the long-term supply of trees of a size to provide suitable nest hollows is particularly important in woodland stands that are known to support Black Cockatoo breeding (DSEWPaC 2012).

The Black Cockatoo Assessment revealed that the Survey Area contains Tuart trees which have reached a size that are considered to be potential future hollow bearing

trees, therefore potential breeding trees (≥500 mm DBH) according to the EPBC Act Black Cockatoo referral guidelines.

In total, seven trees were recorded which met the criteria to be classed as a potential breeding tree (Figure 9). This suggests that these trees may develop hollows and have the potential to be used for Black Cockatoo breeding in the future. In order to be suitable for Black Cockatoos, the holes need to be greater than 120 mm diameter (Johnstone *et al.* 2013). No hollows were observed in any of the trees.

In summary, 49.1% of the Survey Area consists of species, such as Banksia, Acacia and Tuart, which are known to provide potential foraging, roosting and breeding habitat. Therefore the Survey Area contains habitat which is important to all three Black Cockatoo species. During the survey no Black Cockatoos were observed directly utilising the Survey Area and none were observed flying over the site. No direct or indirect foraging evidence was recorded during the survey. This may suggest that the site is not extensively utilised by Black Cockatoos.

6 Conclusions

The flora and vegetation survey was undertaken during Spring, however was outside of the optimum flowering period of several species. The Survey Area was surveyed sufficiently and to a high standard, and as such the following conclusions can be drawn:

- No Threatened species are likely to be present on site;
- No Priority species are likely to be present on site;
- No TECs are present in the Survey Area;
- One Priority 3 PEC, as listed by DPaW, occur within the Survey Area:
    - Central Banksia attenuata – Eucalyptus marginata woodlands (type 21a).
- Two Priority 3 vegetation Communities that were inferred have been identified as occurring on site:
    - Northern Spearwood shrublands and woodlands (type 24); and
    - Southern Swan Coastal Plain *E. gomphocephala – A. flexuosa* woodlands (type 25).

During the Black Cockatoo Assessment, the Survey Area was sufficiently surveyed and as such the following conclusions can be made:

- No Black Cockatoos were observed during the assessment;
- The Survey Area contained potential foraging and breeding habitat;
- Seven potential breeding trees were recorded;
- No breeding hollows were observed; and
- No foraging evidence was recorded in the Survey Area.

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8 Limitations

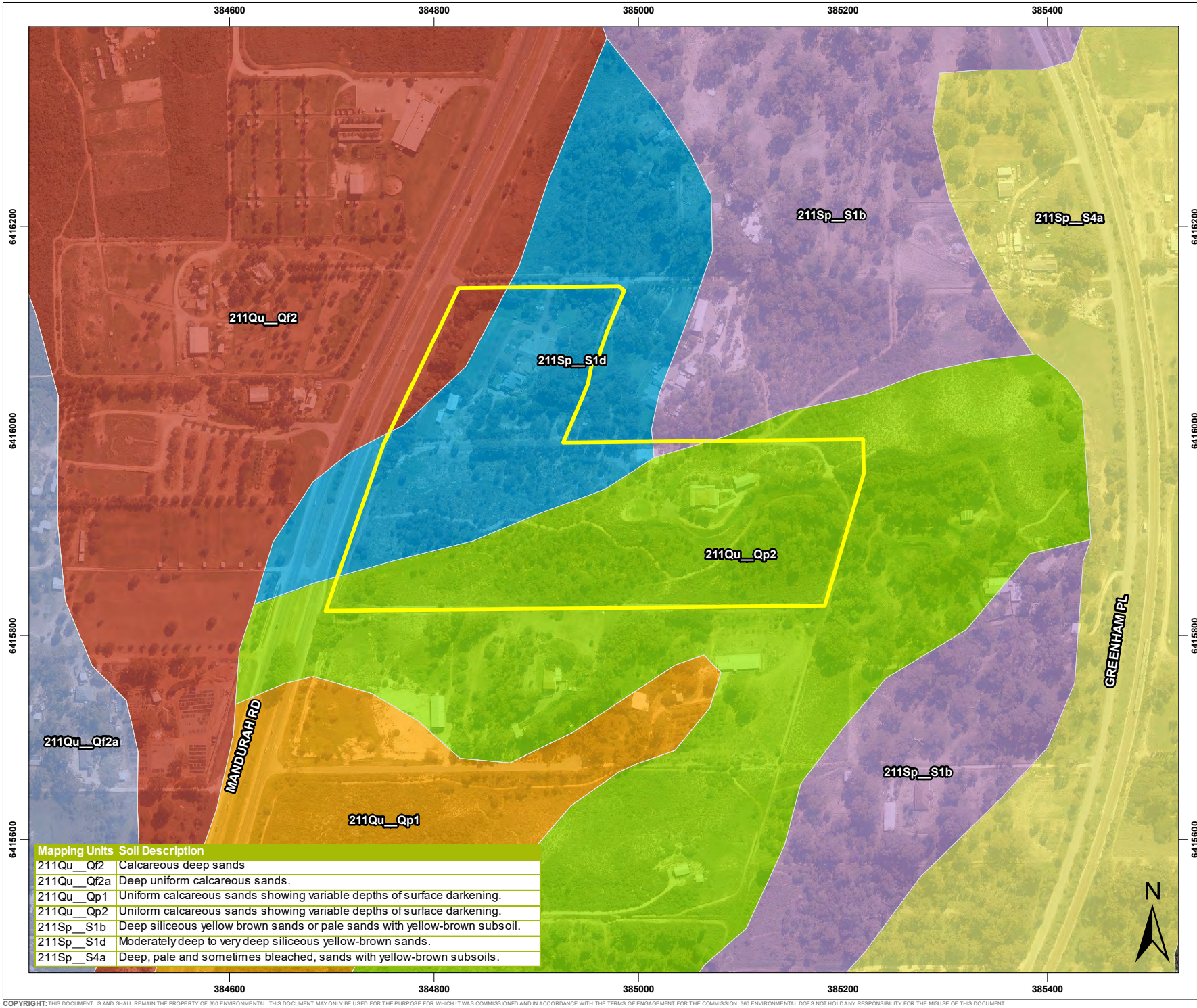
This report is produced strictly in accordance with the scope of services set out in the contract or otherwise agreed in accordance with the contract. 360 Environmental makes no representations or warranties in relation to the nature and quality of soil and water other than the visual observation and analytical data in this report.

In the preparation of this report, 360 Environmental has relied upon documents, information, data and analyses ("client's information") provided by the client and other individuals and entities. In most cases where client's information has been relied upon, such reliance has been indicated in this report. Unless expressly set out in this report, 360 Environmental has not verified that the client's information is accurate, exhaustive or current and the validity and accuracy of any aspect of the report including, or based upon, any part of the client's information is contingent upon the accuracy, exhaustiveness and currency of the client's information. 360 Environmental shall not be liable to the client or any other person in connection with any invalid or inaccurate aspect of this report where that invalidity or inaccuracy arose because the client's information was not accurate, exhaustive and current or arose because of any information or condition that was concealed, withheld, misrepresented, or otherwise not fully disclosed or available to 360 Environmental.

Aspects of this report, including the opinions, conclusions and recommendations it contains, are based on the results of the investigation, sampling and testing set out in the contract and otherwise in accordance with normal practices and standards. The investigation, sampling and testing are designed to produce results that represent a reasonable interpretation of the general conditions of the site that is the subject of this report. However, due to the characteristics of the site, including natural variations in site conditions, the results of the investigation, sampling and testing may not accurately represent the actual state of the whole site at all points.

It is important to recognise that site conditions, including the extent and concentration of contaminants, can change with time. This is particularly relevant if this report, including the data, opinions, conclusions and recommendations it contains, are to be used a considerable time after it was prepared. In these circumstances, further investigation of the site may be necessary.

FIGURES



Mapping Units	Soil Description
211Qu__Qf2	Calcareous deep sands
211Qu__Qf2a	Deep uniform calcareous sands.
211Qu__Qp1	Uniform calcareous sands showing variable depths of surface darkening.
211Qu__Qp2	Uniform calcareous sands showing variable depths of surface darkening.
211Sp__S1b	Deep siliceous yellow brown sands or pale sands with yellow-brown subsoil.
211Sp__S1d	Moderately deep to very deep siliceous yellow-brown sands.
211Sp__S4a	Deep, pale and sometimes bleached, sands with yellow-brown subsoils.

Legend

Survey Area

Soil Subsystems

- **211Qu__Qf2,** Quindalup South Qf2 Phase
- **211Qu__Qf2a**, Quindalup South Qf2a Phase
- **211Qu__Qp1**, Quindalup South Qp1 Phase
- **211Qu__Qp2**, Quindalup South Qp2 Phase
- **211Sp__S1b**, Spearwood S1b Phase
- **211Sp__S1d**, Spearwood S1d Phase
- **211Sp__S4a**, Spearwood S4a Phase

- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS
- LOCALITY MAP SOURCED FROM LANDGATE 2006
- SOILS SOURCED FROM DAFWA 2004
- AERIAL PHOTOGRAPHY SOURCED FROM LANDGATE 2014 (© Western Australian Land Information Authority 2014)

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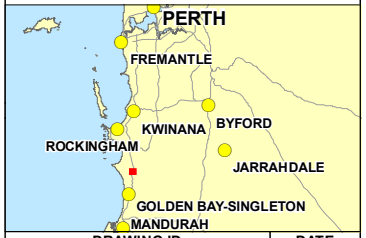
LOCALITY MAP



DRAWING ID	DATE
808_f3_soils.mxd	10-Feb-2015

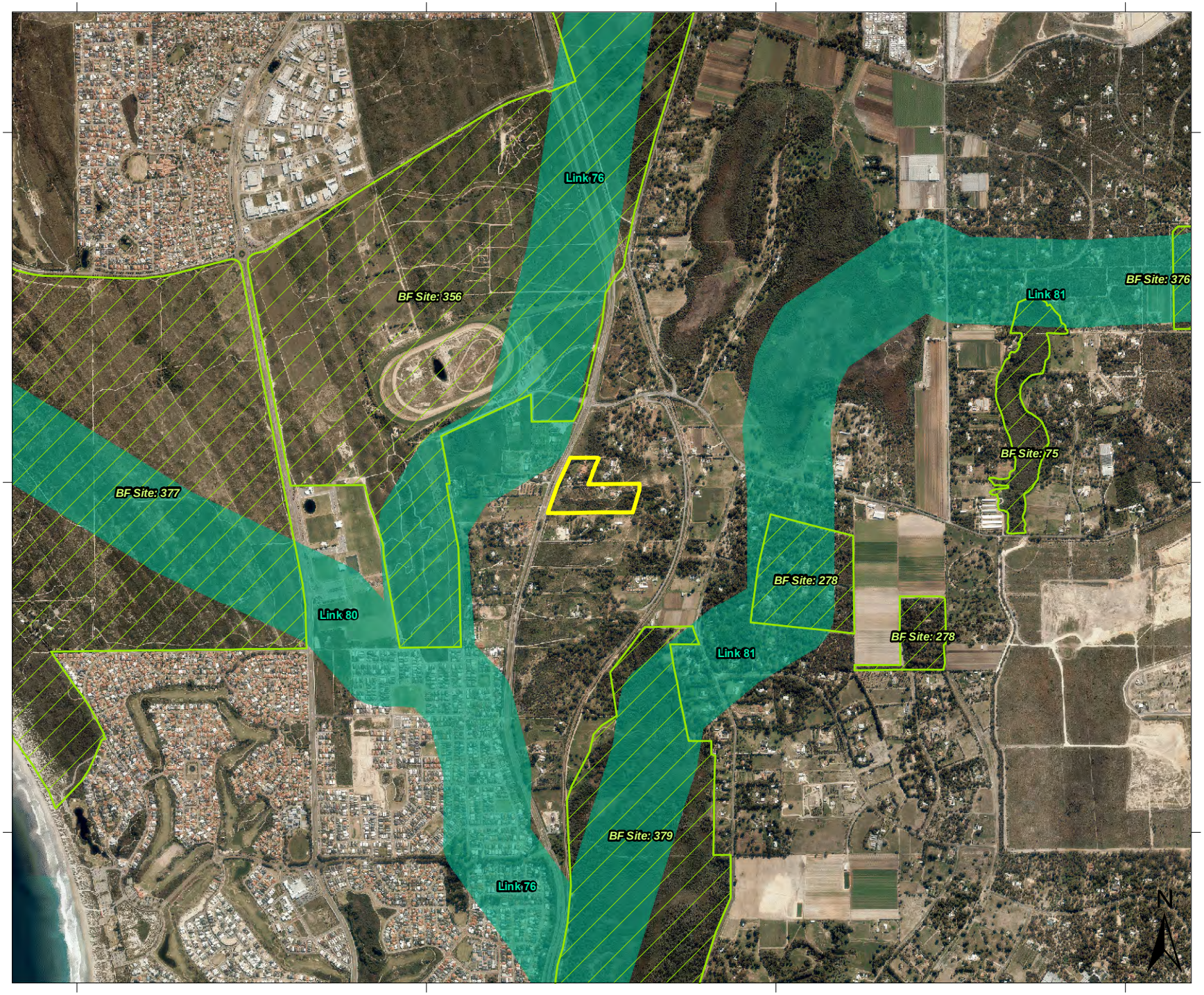
HORIZONTAL DATUM AND PROJECTION
GDA 1994 MGA Zone 50

CREATED	CHECKED	APPROVED	REVISION
CS	LS/SF	RF	0

Rockingham Montessori School
Lot 11 Mandurah Road, Karnup

Flora, Vegetation and Black Cockatoo Report

Figure 3 - Soils



Legend

- Survey Area
- Bush Forever Sites
- Perth Regional Ecological Linkages

- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS
- LOCALITY MAP SOURCED FROM LANDGATE 2006
- BUSH FOREVER SITES SOURCED FROM DOP 2012
- ECOLOGICAL LINKAGES SOURCED FROM PBP (WALGA) 2008
- AERIAL PHOTOGRAPHY SOURCED FROM LANDGATE AUG 2014 (© Western Australian Land Information Authority 2014)

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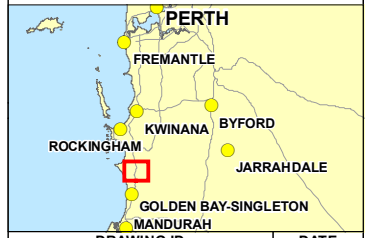
LOCALITY MAP



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HORIZONTAL DATUM AND PROJECTION
GDA 1994 MGA Zone 50

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CS	LS/SF	TS	0

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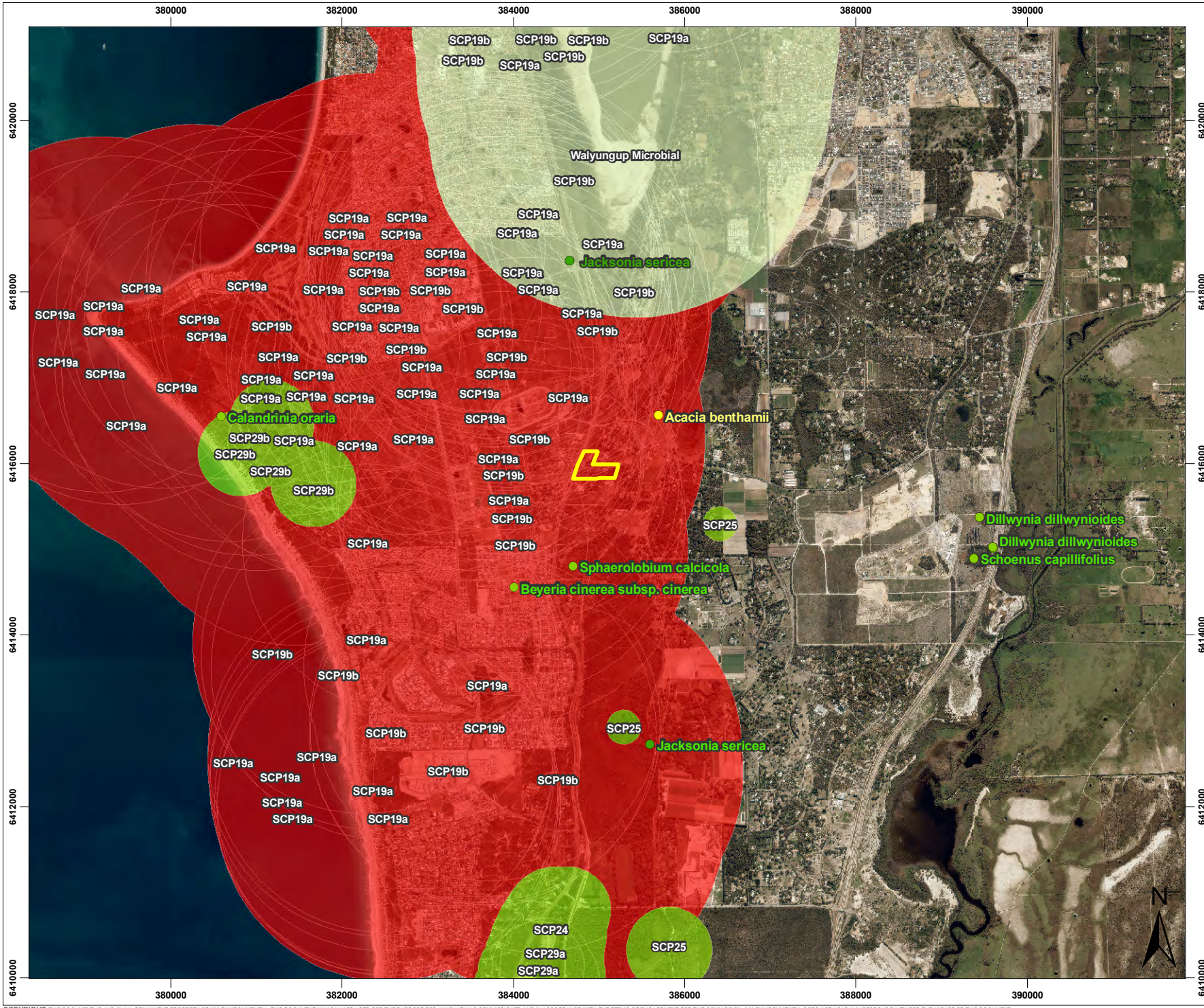
Flora, Vegetation and Black Cockatoo Report

Figure 4 - Conservation Area



Legend

- Survey Area

TECs/PECs

- Priority 4
- Priority 3
- Priority 2
- Priority 1
- Vulnerable
- Endangered
- Critically Endangered

Priority and Rare Flora

- Priority 4
- Priority 3
- Priority 2
- Priority 1
- Declared Rare

- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS
- LOCALITY MAP SOURCED FROM LANDGATE 2006
- TEC PEC AND DRF SOURCED DPAW 2014
- AERIAL PHOTOGRAPHY SOURCED FROM LANDGATE 2014
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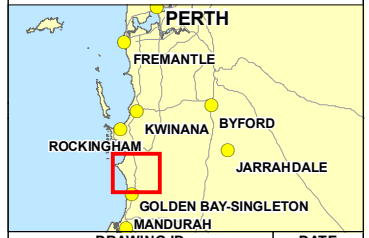
LOCALITY MAP



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HORIZONTAL DATUM AND PROJECTION
GDA 1994 MGA Zone 50

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CS	LS/SF	RF	0

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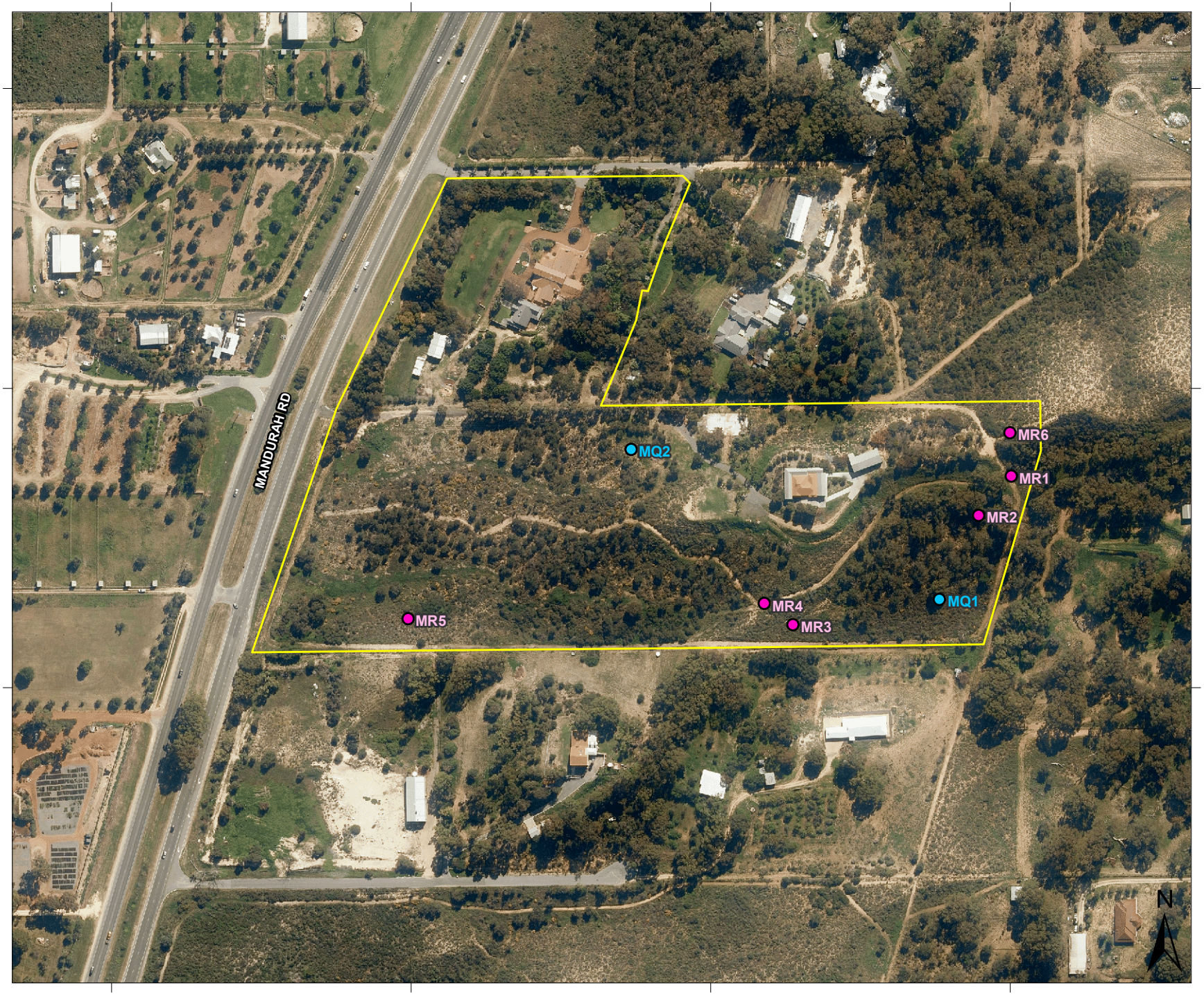
Flora, Vegetation and Black Cockatoo Report

Figure 5 -
TECs, PECs and Flora



Legend

- Survey Area
- Quadrat
- Releve

- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS
- LOCALITY MAP SOURCED FROM LANDGATE 2006
- AERIAL PHOTOGRAPHY SOURCED FROM LANDGATE AUG 2014
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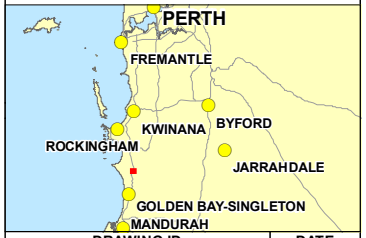
LOCALITY MAP



DRAWING ID	DATE
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HORIZONTAL DATUM AND PROJECTION
GDA 1994 MGA Zone 50

CREATED	CHECKED	APPROVED	REVISION
CS	LS/SF	RF	0

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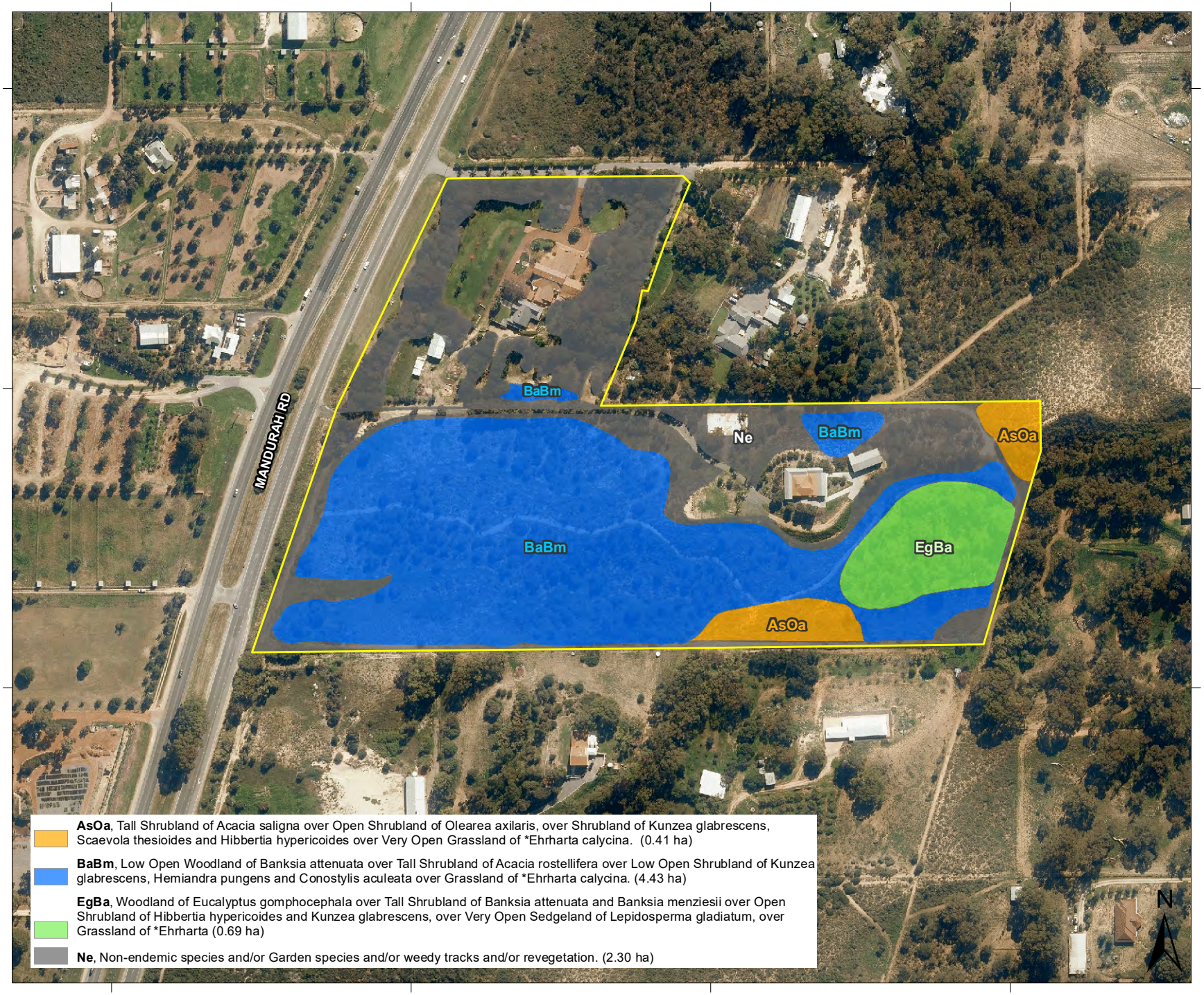
Flora, Vegetation and Black Cockatoo Report

Figure 6 -
Quadrat and Releve Locations



AsOa, Tall Shrubland of Acacia saligna over Open Shrubland of Olearea axilaris, over Shrubland of Kunzea glabrescens, Scaevola thesioides and Hibbertia hypericoides over Very Open Grassland of *Ehrharta calycina. (0.41 ha)

BaBm, Low Open Woodland of Banksia attenuata over Tall Shrubland of Acacia rostellifera over Low Open Shrubland of Kunzea glabrescens, Hemiandra pungens and Conostylis aculeata over Grassland of *Ehrharta calycina. (4.43 ha)

EgBa, Woodland of Eucalyptus gomphocephala over Tall Shrubland of Banksia attenuata and Banksia menziesii over Open Shrubland of Hibbertia hypericoides and Kunzea glabrescens, over Very Open Sedgeland of Lepidosperma gladiatum, over Grassland of *Ehrharta (0.69 ha)

Ne, Non-endemic species and/or Garden species and/or weedy tracks and/or revegetation. (2.30 ha)

Legend

Survey Area

- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS
- LOCALITY MAP SOURCED FROM LANDGATE 2006
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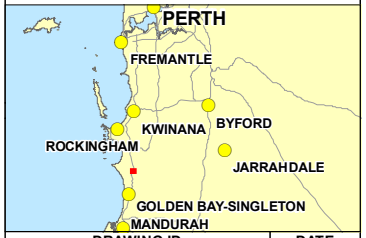
LOCALITY MAP



DRAWING ID	DATE
808_f7_vegetation_ass.mxd	10-Feb-2015

HORIZONTAL DATUM AND PROJECTION
GDA 1994 MGA Zone 50

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CS	LS/SF	RF	0

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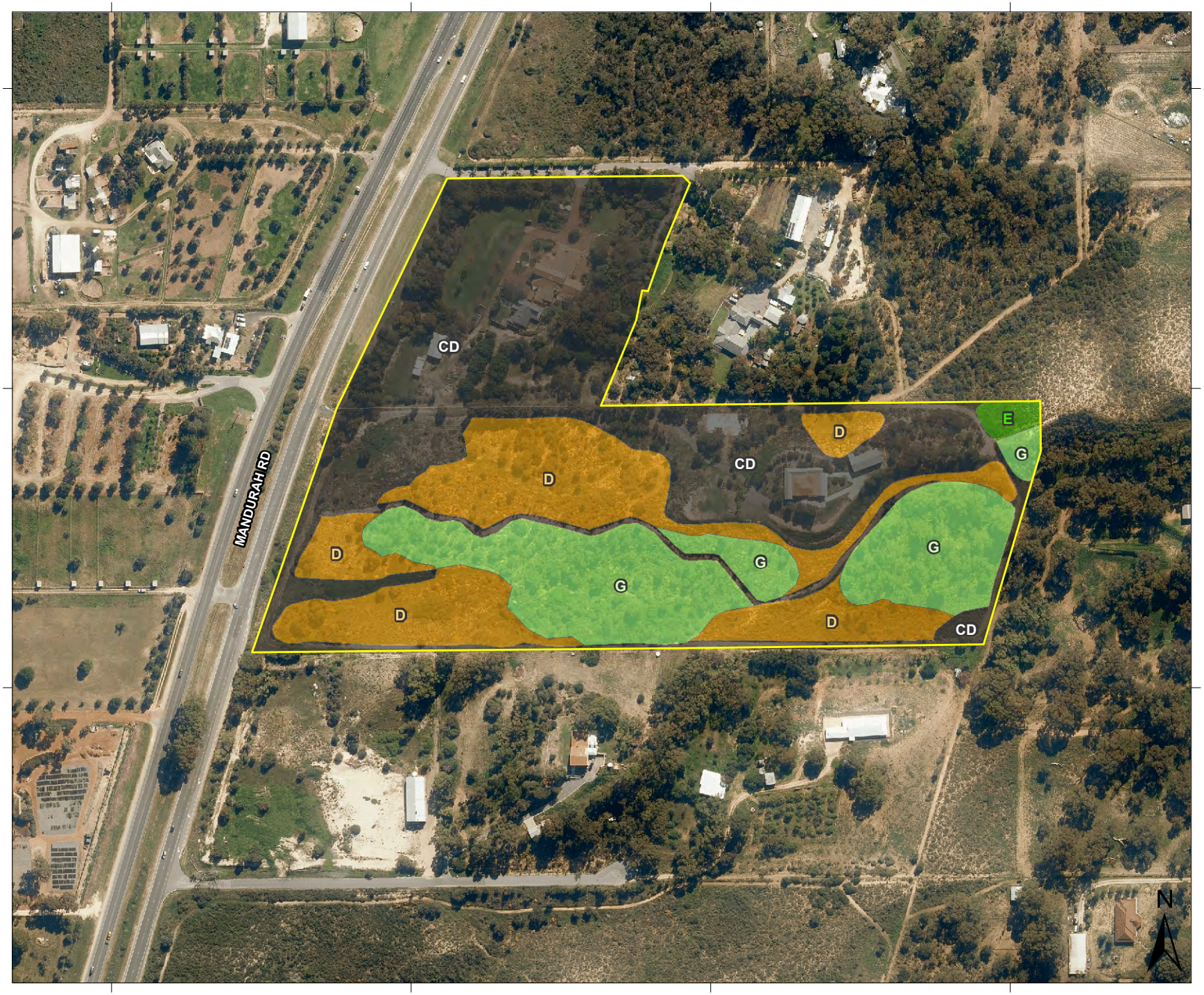
Flora, Vegetation and Black Cockatoo Report

Figure 7 -
Vegetation Association



Legend

Survey Area

Vegetation Condition

- Excellent (0.09 ha)
- Good (2.29 ha)
- Degraded (2.61 ha)
- Completely Degraded (5.44 ha)

- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS
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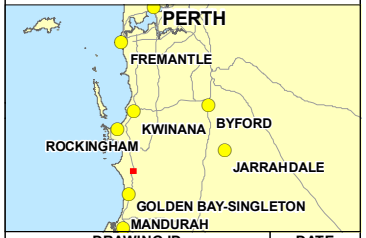
LOCALITY MAP



DRAWING ID	DATE
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HORIZONTAL DATUM AND PROJECTION
GDA 1994 MGA Zone 50

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CS	LS/SF	RF	0

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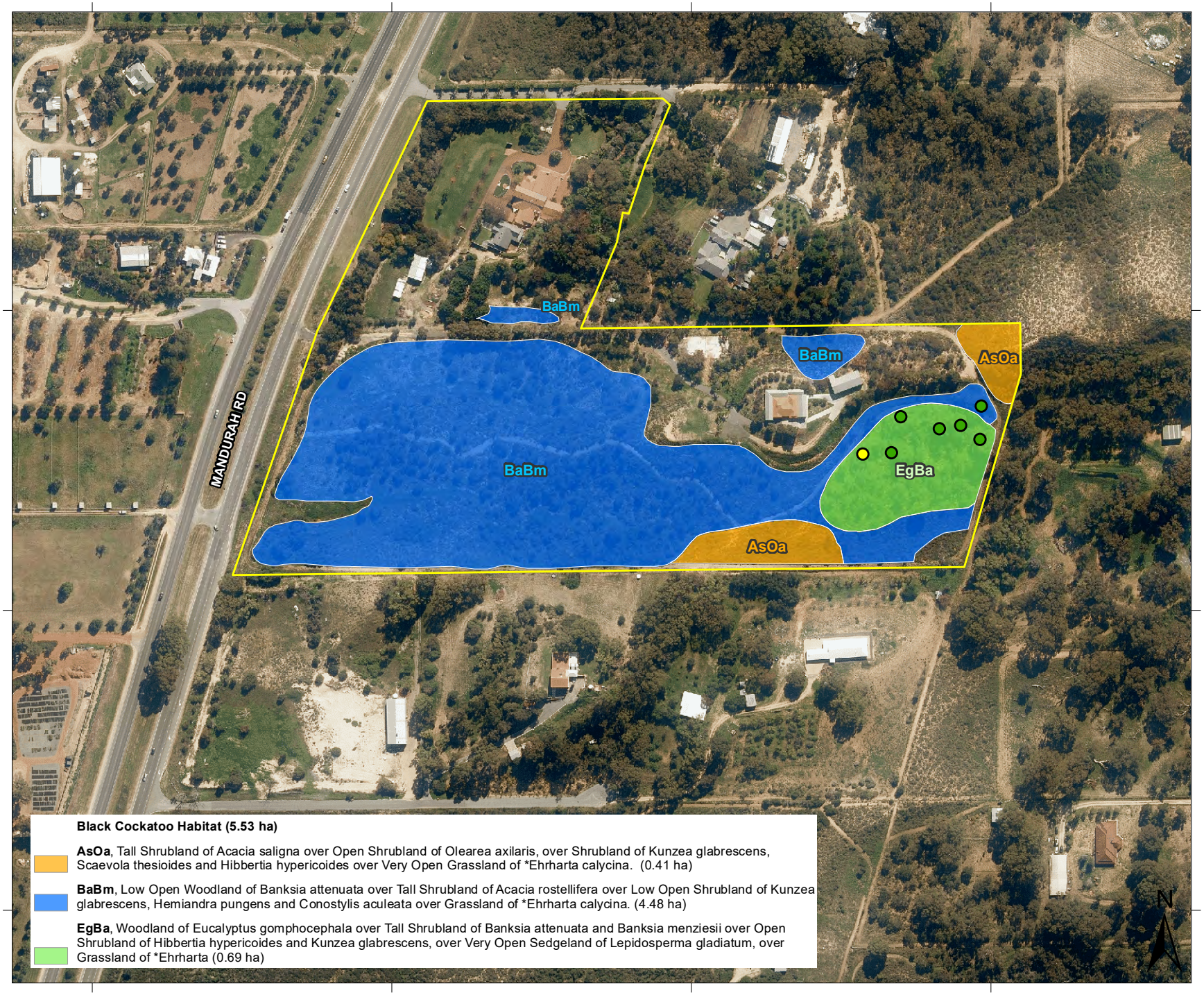
Flora, Vegetation and Black Cockatoo Report

Figure 8 -
Vegetation Condition



Black Cockatoo Habitat (5.53 ha)

AsOa, Tall Shrubland of Acacia saligna over Open Shrubland of Olearea axilaris, over Shrubland of Kunzea glabrescens, Scaevola thesioides and Hibbertia hypericoides over Very Open Grassland of *Ehrharta calycina. (0.41 ha)

BaBm, Low Open Woodland of Banksia attenuata over Tall Shrubland of Acacia rostellifera over Low Open Shrubland of Kunzea glabrescens, Hemiandra pungens and Conostylis aculeata over Grassland of *Ehrharta calycina. (4.48 ha)

EgBa, Woodland of Eucalyptus gomphocephala over Tall Shrubland of Banksia attenuata and Banksia menziesii over Open Shrubland of Hibbertia hypericoides and Kunzea glabrescens, over Very Open Sedgeland of Lepidosperma gladiatum, over Grassland of *Ehrharta (0.69 ha)

Legend

- Survey Area
- *Eucalyptus gomphocephela*
- *Eucalyptus gomphocephela* (dead)

- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS
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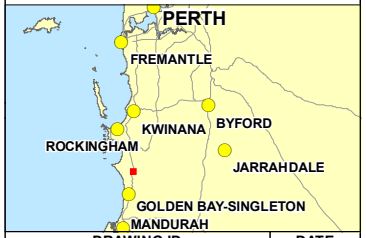
LOCALITY MAP



DRAWING ID	DATE
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Figure 9 - Black Cockatoo Habitat