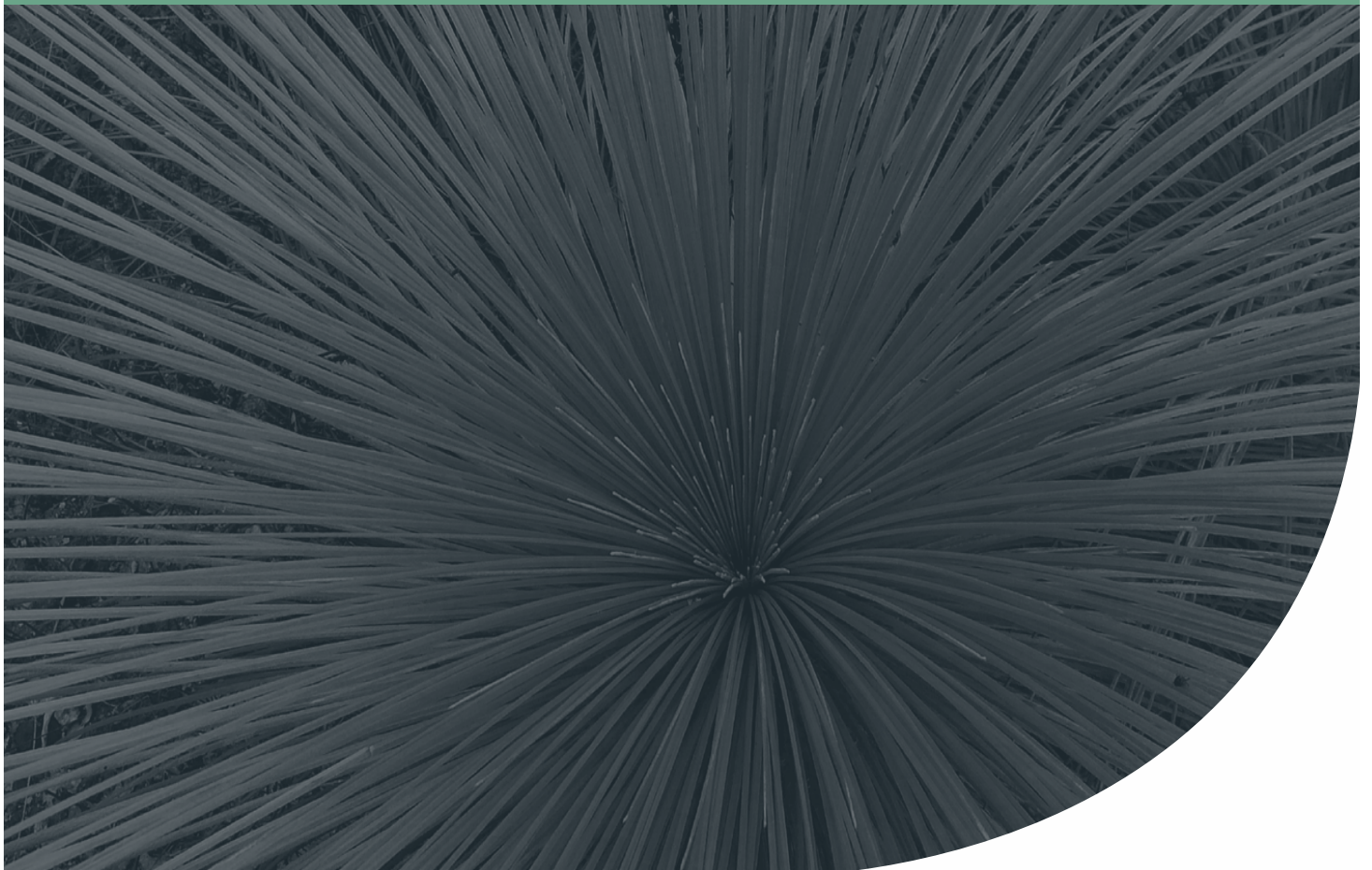


Reconnaissance Flora, Vegetation and Tree Assessment

Part Mandurah Road Reserve between Dixon
Road and Office Road

Project No: EP22-039(01)

**Prepared for City of Rockingham
July 2022**



Reconnaissance Flora, Vegetation and Tree Assessment

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Executive Summary

The City of Rockingham engaged Emerge Associates to conduct a reconnaissance flora and vegetation and tree assessment within a section of Mandurah Road between Dixon Road and Office Road in East Rockingham (referred to herein as the 'site').

As part of the assessment a desktop review of relevant background information was completed and a field survey was undertaken on 15 June 2022. During the field survey an assessment was made on the type, condition and values of vegetation across the site.

Outcomes of the survey include the following:

- Native vegetation is present across 1.02 ha of the site in varying levels of condition.
- Non-native vegetation and sealed areas occur across the majority of the site (6.2 ha).
- A total of 10 native and 20 non-native (weed) species were recorded in the site.
- No threatened or priority flora species were recorded within the site and none are considered likely to occur given the lack of suitable habitat or because they were not recorded during the field survey.
- The vegetation within the site was classified into the following five plant communities that are present in 'degraded' and 'completely degraded' condition:
 - Plant community **EgAr** comprises a canopy of *Eucalyptus gomphocephala* trees over *Acacia rostellifera* shrubs over occasional scattered native shrubs and forbs and non-native pasture grasses and weeds.
 - Plant community **Eg** comprises a canopy of *Eucalyptus gomphocephala* trees over occasional scattered native shrubs and/or non-native pasture grasses and weeds.
 - Plant community **Ar** comprises a shrubland of *Acacia rostellifera* over occasional scattered native species and non-native pasture grasses and weeds.
 - **Non-native** vegetation and **road** occur over the remainder of the site, comprising weed dominated road reserves, gardens and sealed areas.
- The **EgAr** and **Eg** plant communities contain tuart trees and extend over a total of 0.98 ha. Tuart trees can indicate that vegetation represents the *tuart (Eucalyptus gomphocephala) woodlands and forests of the Swan Coastal Plain* threatened and priority ecological community (TEC/PEC). Further survey within and adjacent to the site would be required to confirm if this TEC/PEC occurs within the site and to identify its full extent. If present, the actual extent of TEC/PEC would likely be larger than the **EgAr** and **Eg** plant communities.
- Fifty trees were recorded in the site, comprising 30 habitat trees and 20 other trees. The 30 habitat trees consisted of two with potentially suitable hollow(s) and 28 with no suitable hollow(s). The habitat trees with potentially suitable hollow(s) may provide breeding habitat for black cockatoos but an internal hollow inspection would be required to confirm whether the hollows are in fact suitable and whether they are being used by black cockatoos for breeding.

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Appendix A

Additional Information

Appendix B

Conservation Significant Flora Species and likelihood of Occurrence Assessment

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Conservation Significant Communities and Likelihood of Occurrence Assessment

Appendix E

Tree data

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Abbreviation Tables

Table A1: Abbreviations – Organisations

Organisations	
EPA	Environmental Protection Authority
DBCA	Department of Biodiversity, Conservation and Attractions
DWER	Department of Water and Environmental Regulation
WALGA	Western Australia Local Government Association

Table A2: Abbreviations – General terms

General terms	
FCT	Floristic community type
IBRA	Interim Biogeographic Regionalisation of Australia
NVIS	National Vegetation Inventory System (ESCAVI 2003)
P1	Priority 1
P2	Priority 2
P3	Priority 3
P4	Priority 4
P5	Priority 5
PEC	Priority ecological community
T	Threatened
TEC	Threatened ecological communities
UFI	Unique feature identifier

Table A3: Abbreviations – Legislation

Legislation	
BAM Act	<i>Biosecurity and Agriculture Management Act 2007</i>
EP Act	<i>Environmental Protection Act 1986</i>
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
BC Act	<i>Biodiversity Conservation Act 2016</i>

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Table A4: Abbreviations – Units of measurement

Units of measurement	
cm	Centimetre
ha	Hectare
m AHD	m in relation to the Australian height datum
mm	Millimetre

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1 Introduction

1.1 Project background

Emerge Associates (Emerge) were engaged by the City of Rockingham to characterise the flora and vegetation values within part of the road reserve along Mandurah Road between Dixon Road and Office Road in East Rockingham (referred to herein as the 'site'). The site is located approximately 34 kilometres (km) south-west of the Perth Central Business District within the City of Rockingham.

The site is approximately 7.22 hectares (ha) in size and is bounded predominantly by bushland to the west, bushland and mixed industrial land to the east and the continuation of Mandurah Road to the north and south. The location and extent of the site is shown in **Figure 1**.

1.2 Purpose and scope of work

The scope of work was specifically to undertake a flora and vegetation assessment within the site to the standard required of a reconnaissance survey with reference to the Environmental Protection Authority's (EPA's) technical guidance (EPA 2016), as well as an assessment of trees potentially impacted as part of proposed development within the site.

As part of this scope of work, the following tasks were undertaken:

- Desktop review of relevant background information pertaining to the site and surrounds, including database searches for threatened flora species and ecological communities.
- A field survey to record a comprehensive list of flora species, assess vegetation type and condition and tree locations.
- Mapping of plant communities, vegetation condition, conservation significant flora and vegetation and trees.
- Identification of potential habitat for conservation significant flora and vegetation and an assessment of likelihood of occurrence.
- Documentation of the desktop assessment, methodology, field survey and results into a report.

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2 Environmental Context

2.1 Climate

Climate influences the types of vegetation that grow in a region and the life cycles of the flora present. Therefore, it is critical for a flora and vegetation survey to respond appropriately to climatic conditions to ensure that surveys are conducted during times when flora species are easiest to detect and identify.

The south-west of Western Australia experiences a Mediterranean climate of hot dry summers and cool wet winters. In Mediterranean type climates some flora species will typically spend part of their lifecycle as either underground storage organs or as seed. This is an adaptation to unfavourable environmental conditions such as excessive heat and drought that occur over the summer period. These species, known as 'geophytes' or 'annuals', tend to re-emerge during winter when favourable conditions return and are most visible during spring, which is the flowering period for a majority of plant species. Therefore, spring is the optimal time to complete flora and vegetation surveys in the south-west of WA.

An average of 610.4 millimetres (mm) of rainfall is recorded annually from the Garden Island HSF weather station (no. 009256), which is the closest weather station, located approximately 9 km north-east of the site. The majority of this rainfall is received between the months of May and September. Mean maximum temperatures at the Garden Island HSF weather station range from 17.9°C in July to 28.3°C in February, while mean minimum temperatures range from 11.2°C in August to 19.4°C in February (BoM 2022).

A total of 162.8 mm of rain was recorded during April and May 2022 prior to the survey which is higher than the combined long-term average of 113.2 mm for the same months (BoM 2022). Since the survey was undertaken outside of the main flowering period (spring), the amount of rainfall was not considered to affect the survey outcomes.

2.2 Geomorphology and soils

Landform and soils influence vegetation types at regional and local scales. The site occurs on the Swan Coastal Plain, which is the geomorphic unit that characterises much of the Perth metropolitan area. The Swan Coastal Plain is approximately 500 km long and 20 to 30 km wide and is roughly bound by the Indian Ocean to the west and the Darling Scarp to the east. Broadly the Swan Coastal Plain consists of two sedimentary belts of different origin. Its eastern side comprises the Pinjarra Plain which formed from the deposition of alluvial material washed down from the Darling Scarp, while its western side comprises three dune systems that run roughly parallel to the Indian Ocean coastline (Seddon 2004). These dune systems, referred to as Quindalup, Spearwood and Bassendean associations, represent a succession of coastal deposition that has occurred since the late Quaternary period (approximately two million years ago) (Kendrick *et al.* 1991) and, as a result, they contain soils at different stages of leaching and formation.

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Examination of broad scale soil mapping places the site within the Quindalup Dune physiographic region (Gozzard 2011). The Quindalup Dunes comprise sand plains with low dunes and occasional swamps, iron or humus podzols and areas of complex steep dunes.

Fine scale soil landscape mapping by DPIRD (2018) shows the site as occurring on the border of two soil units. The western portion of the site is mapped as comprising the 'Quindalup South Qf3' phase which is described as 'relict foredunes forming a plain which is typically lower than Qf2 with prominent ridges and swales. Swamps frequently occupy the swales. Deep calcareous sands with variable organic matter'. The eastern portion of the site is mapped as comprising the 'Quindalup South Qf2' phase which is described as comprising 'relict foredunes and gently undulating beach ridge plain with deep uniform calcareous sands' (DPIRD 2018). The soil types mapped within the site are shown in **Figure 2**.

The site is not known to contain any restricted landforms or unique geological features.

2.3 Topography

The elevation of the site ranges from four m in relation to the Australian height datum (mAHD) in the southern portion of the site, six mAHD in the central portion and five mAHD in the northern portion of the site (DoW 2008) (**Figure 2**).

2.4 Hydrology and wetlands

Wetlands are areas of seasonally, intermittently or permanently waterlogged land such as poorly drained soils, ponds, billabongs, lakes, swamps, tidal flats, estuaries, rivers and their tributaries (Wetlands Advisory Committee 1977). Wetlands can be recognised by the presence of vegetation associated with waterlogging or the presence of hydric soils such as peat, peaty sand or carbonate mud (Hill *et al.* 1996).

Wetlands of national or international significance may be afforded special protection under Commonwealth or international agreements. The following lists of important wetlands were checked as part of this assessment:

- *Ramsar List of Wetlands of International Importance* (DBCA 2017)
- *A Directory of Important Wetlands in Australia* (DBCA 2018)

No Ramsar or listed 'important wetlands' are located within or near the site.

Examination of the Department of Water and Environmental Regulation (DWER) hydrography dataset (DWER 2018) shows no wetland or water related features occur within the site.

The Department of Biodiversity, Conservation and Attractions (DBCA) has developed the *Geomorphic Wetlands of the Swan Coastal Plain* dataset (DBCA 2021a). This dataset maps geomorphic wetland features and classifies them based on their landform shape and water permanence. Each feature is assigned to one of three management categories which guides land use and conservation.

A review of the *Geomorphic Wetlands, Swan Coastal Plain* dataset indicated that no wetland features occur within or adjacent to the site (DBCA 2021a).

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Multiple wetland features occur in the wider area of the site. The closest wetland feature to the site is a 'conservation' category wetland feature located approximately 490 m east of the site (UFI 6392). This feature is classified as a sumpland wetland. The locations of the geomorphic wetlands near the site are shown in **Figure 2**.

2.5 Regional vegetation

Native vegetation is described and mapped at different scales in order to illustrate patterns in its distribution. At a continental scale the *Interim Biogeographic Regionalisation of Australia* (IBRA) divides Australia into floristic subregions (Environment Australia 2000).

The site is contained within the Swan Coastal Plain IBRA region and within the 'SWA02' or Perth subregion. The Perth subregion is characterised by mainly banksia low woodland on leached sands with melaleuca swamps where ill-drained; and woodland of *Eucalyptus gomphocephala* (tuart), *E. marginata* (jarrah) and *Corymbia calophylla* (marri) on less leached soils (Beard 1990). This subregion is recognised as a biodiversity hotspot and contains a wide variety of endemic flora and vegetation types.

Variations in native vegetation can be further classified based on regional vegetation mapping. Heddle *et al.* (1980) mapping shows the site as comprising the 'Quindalup complex', which is described as a 'coastal dune complex which consists mainly of two alliances: the strand and fore dune alliance and the mobile and stable dune alliance. Local variations include the low closed forest of *Melaleuca lanceolata* and *Callitris preissii* and the closed scrub of *Acacia rostellifera*'.

The Quindalup complex was determined to have 60.49% of its pre-European extent remaining on the Swan Coastal Plain, of which 9.84% is protected for conservation purposes (Government of Western Australia 2019).

2.6 Historical land use

Review of historical images available from 1953 onwards shows that the majority of the site was cleared of native vegetation prior to 1953 as part of the Mandurah Road construction (WALIA 2022).

2.7 Conservation significant values

2.7.1 Threatened and priority flora

Certain flora taxa that are considered to be rare or under threat warrant special protection under Commonwealth and/or State legislation. At a Commonwealth level, flora taxa may be listed as 'threatened' under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Threatened flora species listed under the EPBC Act are assigned a conservation status according to attributes such as population size and geographic distribution. Any action likely to have a significant impact on a taxon listed under the EPBC Act requires Ministerial approval.

In Western Australia flora species may also be classed as 'threatened' under the *Biodiversity Conservation Act 2016* (BC Act). Similarly, it is an offence to 'take' or 'disturb' threatened flora listed under the BC Act without Ministerial approval.

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Flora species that do not currently meet the criteria for listing as threatened but are potentially rare or threatened may be added to the DBCA's *Priority Flora List*. These species are classified into 'priority' levels based on threat. Whilst priority species are not under direct statutory protection, they are considered during State approval processes.

Further information on threatened and priority species and their categories is provided in **Appendix A**. An assessment of the likelihood of occurrence of threatened and priority flora within the site was undertaken (refer to **Sections 3.1.1** and **4.2.1**).

2.7.2 Threatened and priority ecological communities

An ecological community is a naturally occurring group of native plants, animals and other organisms that are interacting in a unique habitat. An ecological community's structure, composition and distribution are influenced by environmental factors such as soil type, position in the landscape, altitude, climate and water availability (DAWE 2021a). 'Threatened ecological communities' (TECs) are ecological communities that are recognised as rare or under threat and therefore warrant special protection.

Selected TECs are afforded statutory protection at a Commonwealth level under the EPBC Act. Similar to flora species, TECs listed under the EPBC Act are assigned a conservation status. Any action likely to have a significant impact on a community listed under the EPBC Act requires Ministerial approval.

TECs are also listed within Western Australia under the BC Act and the BC Regulations. Their significance is also acknowledged through other state environmental approval processes such as 'environmental impact assessment' pursuant to Part IV of the *Environmental Protection Act 1986* (EP Act) and the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*.

An ecological community that is under consideration for listing as a TEC in Western Australia but does not yet meet survey criteria or has not been adequately defined may be listed as a 'priority ecological community' (PEC). Listing as a PEC is similarly considered during State approval processes.

Further information on categories of TECs and PECs is provided in **Appendix A**. An assessment of the likelihood of occurrence of threatened and priority flora within the site was undertaken (refer to **Sections 3.1.1** and **4.3.1**).

2.8 Weeds and pests

The term 'weed' can refer to any plant that requires some form of action to reduce its effect on the economy, the environment, human health and amenity. Many non-native flora species and some native species are considered to be weeds. The likelihood of weeds occurring is higher in areas disturbed areas, especially areas that have been agricultural or urban landuse.

A particularly invasive or detrimental weed species may be listed as a 'declared pest' pursuant to *Western Australia's Biosecurity and Agriculture Management Act 2007* (BAM Act), indicating that it warrants special management to limit its spread.

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The Commonwealth government has further compiled a list of 32 *Weeds of National Significance* (WoNS) (DAWE 2021b). Whilst the WoNS list is non-statutory, many WoNS are also listed under the BAM Act. Further information on weeds and declared pests is provided in **Appendix A**.

2.9 Bush Forever

The Government of Western Australia's *Bush Forever* policy is a strategic plan for conserving regionally significant bushland within the Swan Coastal Plain portion of the Perth Metropolitan Region. The objective of *Bush Forever* is to protect comprehensive representations of all original ecological communities by targeting a minimum of 10% of each vegetation complex for protection (Government of WA 2000). *Bush Forever* sites are representative of regional ecosystems and habitat and have a key role in the conservation of Perth's biodiversity. Flora considered to be 'significant', irrespective of Commonwealth and state conservation significance status, are listed in *Bush Forever* documentation.

No *Bush Forever* sites occur within the site. Bush Forever Site 349 (Leda and adjacent bushland, Leda) lies adjacent to the south-eastern and south-western portions of the site and extends to the north-east and south of the site. The significant flora species *Glischrocaryon aureum* is known to occur in this site. This species is listed as significant on the basis that it is 'uncommon in the Perth metropolitan area' (Government of WA 2000).

Bush Forever site 356 (Lake Cooloongup, Lake Walyungup and adjacent bushland, Hillman to Port Kennedy) lies adjacent to the south-western portion of the site and extends to the south of the site. Multiple significant flora species were recorded within this site: *Trachymene coerulea*, *Trachymene pilosa*, *Sonchus hydrophilus*, *Atriplex suberecta*, *Linum marginale*, *Acacia pulchella* var. *goadbyi*, *Eremophila glabra* subsp. *albicans*, *Jacksonia furcellata* (floriferous shrub form) and *Kennedia coccinea*. The reasons these species are considered significant include range extensions, unique forms, and rare or at-risk species (Government of WA 2000).

The location of the of *Bush Forever* sites near the site are shown in **Figure 3**.

2.10 DBCA managed or legislated land

DBCA has tenure of or interests in numerous areas of land across the state for a range of purposes. Tenure categories include national parks, nature reserves, conservation parks, marine parks, marine nature reserves, marine management areas, section 5(1)(g) reserves, state forest and timber reserves. These areas are mapped within the *Legislated Lands and Waters* (DBCA 2021c) and *Lands of Interest* (DBCA 2021b) datasets. The *Legislated Lands and Waters* (DBCA 2021c) dataset includes lands subject to the following legislation; the *Conservation and Land Management Act 1984* (CALM Act 1984), *Swan and Canning Rivers Management Act 2006* (SCRM Act) and lands identified under the *Land Administration Act 1997* (LA Act). The *Lands of Interest* (DBCA 2021b) dataset includes all other lands of which DBCA is recognised as the manager but is not vested under any act. These lands comprise of crown land and freehold land which DBCA has been acknowledged by the Department of Lands as the responsible agency.

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No DBCA legislated land or land of interest are mapped within or adjacent to the site. Multiple legislated lands and lands of interest occur to the east and south of the site as shown in **Figure 3** (DBCA 2021c, b).

2.11 Ecological linkages

Ecological linkages are linear landscape elements that allow the movement of fauna, flora and genetic material between areas of remnant habitat. This exchange of genetic material between vegetation remnants improves the viability of those remnants by allowing greater access to breeding partners and food sources, refuge from disturbances such as fire and maintenance of genetic diversity of plant communities and populations. Ecological linkages are ideally continuous or near-continuous as the more fractured a linkage is, the less ease flora and fauna have in moving within the corridor (Alan Tingay and Associates 1998).

The Perth Biodiversity Project, supported by the Western Australia Local Government Association (WALGA), have identified and mapped regional ecological linkages within the Perth Metropolitan Region (WALGA and PBP 2004).

There are no mapped ecological linkages within the site. Two ecological linkages (Nos. 76 and 77) occur near the southern portion of the site. These ecological linkages are associated with Bush Forever site 349 and connect to other areas of *Bush Forever* located in the wider local area. The locations of the portions of these ecological linkages near the site are shown in **Figure 3**.

Review of aerial imagery indicates that the vegetation within the site is separated from vegetation associated with the ecological linkages by a rail line and Dixon Road.

2.12 Previous surveys

No previous flora and vegetation surveys are known to have been undertaken over the site.

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3 Methods

3.1 Flora and vegetation

3.1.1 Database searches

A search was conducted for threatened and priority flora that may occur or have been recorded within a 10 km radius of the site using the *Protected Matters Search Tool* (DAWE 2022), *NatureMap* (DBCA 2022) and DBCA's threatened and priority flora database (reference no. 12-0522FL).

A search was also conducted for TECs and PECs that may occur or have been recorded within a 10 km radius of the site using the *Protected Matters Search Tool* (DAWE 2022), the *weed and native flora dataset* (Keighery *et al.* 2012) and DBCA's threatened and priority ecological communities' database (reference no. 10_0522EC).

Prior to undertaking the field survey, information on the habitat preferences of threatened and priority flora species and communities identified from database searches was reviewed. This was compared to existing environmental information available for the site, such as geomorphology, soils, regional vegetation and historic land use, to identify species and communities for which habitat may occur in the site.

3.1.2 Field survey

Two botanists from Emerge visited the site on 15 June 2022 to conduct the flora, vegetation and tree field survey¹.

The site was traversed on foot and the composition and condition of vegetation was recorded. Photographs were taken throughout the field visit to show particular site conditions. Flora species not native to Western Australia are denoted by an asterisk ("*") in text and raw data.

Plant specimens collected during the field survey were dried, pressed and named in accordance with requirements of the Western Australian Herbarium (2022). Identification of specimens occurred through comparison with named material and through the use of taxonomic keys.

3.1.2.1 Sampling

Detailed sampling of vegetation using quadrats and/or relevés was not undertaken due to level of survey and the disturbed condition of vegetation in the site. Plant taxa were systematically recorded as the ecologists traversed the site.

3.1.2.2 Targeted searches

The suitability of habitat within the site for conservation significant flora and communities identified in the desktop assessment was assessed (refer **Section 3.1.1**). Areas of suitable habitat were traversed along transects and searched for conservation significant species, as required.

¹ Appropriate traffic management was in place in accordance with City of Rockingham requirements.

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3.1.2.3 Vegetation condition

Vegetation condition was assigned at each sample and changes in vegetation condition were also noted and mapped across the site. The condition of the vegetation was assessed using the Keighery (1994) scale (**Table 1**).

Table 1: Vegetation condition scale applied during the field assessment

Condition category	Definition (Keighery 1994)
Pristine	Pristine or nearly so, no obvious signs of disturbance.
Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.
Very good	Vegetation structure altered obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.
Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. For example, disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing.
Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.
Completely degraded	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora comprising weed or crop species with isolated native trees or shrubs.

3.1.2.4 Trees

Transects were traversed across the site and 'habitat trees' and 'other trees' were recorded. Habitat trees were defined as native eucalypt that is typically known to support black cockatoo² breeding such as marri, jarrah, blackbutt, tuart or flooded gum with a DBH ≥ 50 centimetres (cm). Other trees were defined as non-habitat trees with a diameter at breast height of ≥ 15 cm.

Habitat trees and other trees were individually identified and the attributes outlined in **Table 2** were recorded.

Table 2: Attributes recorded for each habitat tree and other tree in the site

Attribute	Description
GPS location	The location was recorded using a handheld GPS unit
Tree species	Species and common name were identified
Diameter at breast height (DBH) (cm)	DBH was measured at breast height (1.3 m) using a diameter tape

² Refers to three species of black cockatoo listed under the EPBC Act and BC Act: *Zanda latirostris* (Carnaby's black cockatoo), *Zanda baudinii* (Baudin's black cockatoo) and *Calyptorhynchus banksii naso* (forest red-tailed black cockatoo).

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Table 2: Attributes recorded for each habitat tree and other tree in the site (continued)

Attribute	Description
Hollows potentially suitable for breeding by a black cockatoo	Number of hollows potentially suitable for breeding by a black cockatoo recorded (assessed from ground level only)

To be suitable for use as breeding habitat by black cockatoos it was considered a hollow must:

- have an entrance opening of at least 10 cm but preferably 20-30 cm (Saunders *et al.* 1982; Groom 2010; Johnstone *et al.* 2013)
- be located at least 3 m from the ground (Saunders 1979b; Johnstone and Storr 1998; Groom 2010; Saunders 2014)
- be located in a trunk or branch that is generally large enough to contain a hollow that has a floor diameter of at least 40 cm and depth of 50-200 cm such that it could house an adult black cockatoo and nestlings (Saunders 1979a; Johnstone and Storr 1998; Saunders 2014; DPaW 2015)
- have vertical or near vertical orientation (Johnstone and Kirkby 2008; Johnstone *et al.* 2013).

Each habitat tree was assigned to a category listed in **Table 3**. Note that suitability of hollows for black cockatoos was assessed from ground level only.

Table 3: Habitat tree categories

Category	Specifications
Nest	The tree contains a hollow used by black cockatoos for breeding as confirmed by records of black cockatoos, their eggs or fledglings or other evidence of recent nesting activity by black cockatoos.
Suitable hollow(s) with signs of use	The tree contains one or more hollows that are suitable for use by black cockatoos as breeding habitat as confirmed by internal hollow inspection [^] and potential evidence of use by black cockatoos such as feathers, chew marks or nest material has been recorded within a hollow.
Suitable hollow(s)	The tree contains one or more hollows that are suitable for use by black cockatoos as breeding habitat as confirmed by internal hollow inspection [^] .
Potentially suitable hollow(s)	The tree contains or is suspected to contain one or more hollows that have the potential to be suitable for use by black cockatoos when either viewed from the ground or following an internal hollow inspection that was inconclusive [^] .
No suitable hollow(s)	The tree does not contain hollow(s) that have the potential to be suitable for use by black cockatoos when viewed from the ground or contains hollows that were determined to be unsuitable for use by black cockatoos by internal inspection [^] .

[^]Hollow determined to be suitable for use as breeding habitat by black cockatoos as listed above in **Section 3.1.2.4**.

3.2 Mapping and analysis

3.2.1 Conservation significant flora and communities

Based on the database searches and information recorded during the field survey, an assessment of the likelihood of occurrence of threatened and priority flora species and communities within the site was undertaken using the categories outlined in **Table 4**.

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Table 4: Likelihood of occurrence assessment categories and definitions

Likelihood	Definition
Recorded	The species was recorded during the current field survey.
Likely	The site contains suitable habitat for the species and it is likely the species may occur based on presence of a recent historical record within or close to the site.
Possible	The site contains suitable habitat for the species but there is no other information to suggest that the species may occur within or close to the site.
Unlikely	The site does not contain suitable habitat for the species or the site contains suitable habitat for the species within which thorough targeted searches were completed and conclusion has been made that the species is unlikely to be present.

3.2.2 Plant community identification and description

The plant communities within the site were identified from the sample data collected during the field survey. The vegetation was described according to the dominant species present using the structural formation descriptions of the *National Vegetation Inventory System (NVIS)* (NVIS Technical Working Group 2017). The identified plant communities were mapped on aerial photography from notes taken in the field and boundaries were interpreted from aerial photography. Vegetation condition was mapped on aerial photography based on notes recorded during the field survey to define areas with differing condition.

3.2.3 Floristic community type assignment

No floristic community type (FCT) analysis was completed due to the high level of disturbance and because the vegetation was considered unlikely to currently represent an FCT.

3.2.4 Threatened and priority ecological communities

Areas of native vegetation potentially representing a TEC or PEC were assessed against key diagnostic characteristics and, if available, size and/or vegetation condition thresholds.

3.2.5 Trees

Habitat trees and other trees were mapped on aerial imagery using data recorded during the field survey. A complete summary of the recorded attributes of habitat trees and other trees was compiled in a tabular format.

3.3 Survey limitations

It is important to note the specific constraints imposed on surveys and the degree to which these may have limited survey outcomes. An evaluation of the survey methodology against standard constraints outlined in the EPA document *Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA 2016) is provided in **Table 5**.

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Table 5: Evaluation of survey methodology against standard constraints outlined in EPA (2016)

Constraint	Degree of limitation	Details
Availability of contextual information	No limitation	The broad scale contextual information described in Section 2 is adequate to place the site and vegetation in context.
Experience level of personnel	No limitation	This flora and vegetation assessment was undertaken by qualified botanists with two and four years of botanical experience in Western Australia. Technical review was undertaken by a senior environmental consultant/botanist with 11 years' botanical experience in Western Australia.
Suitability of timing	No limitation	The survey was conducted in June and thus outside of the main flowering season. The site has been subject to historical disturbance but there is still the possibility that annual and geophytic threatened and priority species may occur and would not have been detectable at the time of survey. The survey timing was acceptable for a reconnaissance level survey.
Temporal coverage	No limitation	Comprehensive flora and vegetation assessments can require multiple visits, at different times of year, and over a period of a number of years, to enable observation of all species present. The site was only surveyed once, and the survey was undertaken outside of the spring main flowering period. However, the site is disturbed and one visit was considered sufficient for a reconnaissance level survey.
Spatial coverage and access	No limitation	Site coverage was comprehensive (track logged).
	No limitation	All parts of the site could be accessed.
Sampling intensity	No limitation	The site was traversed comprehensively and a total of 30 species were recorded. No formal sampling was undertaken or considered necessary due to the disturbed condition of the site. Opportunistic records of flora, plant communities and vegetation condition were sufficient to accurately characterise the vegetation within the site.
	No limitation	Survey effort was limited to the vegetation within the site. However, in order to determine whether the 'Tuart (<i>Eucalyptus gomphocephala</i>) woodlands and forests of the Swan Coastal Plain' threatened ecological community occurs within the site and to determine its full extent, further survey of the vegetation within and adjacent to the site is required. The survey effort was acceptable for a reconnaissance level survey.
Influence of disturbance	Minor limitation	Time since fire is greater than 69 years as interpreted from aerial imagery and therefore short-lived species more common after fire may not have been visible.
	No limitation	Historical ground disturbance was evident in parts of the site and some native vegetation in the site is regrowth with minimal non-native species present. The disturbance history of the site was considered when undertaking field sampling.
Adequacy of resources	No limitation	All resources required to perform the survey were available.

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4 Results

4.1 General site conditions

The site comprises a gentle slope with the highest point being in the centre of the site. The majority of the site comprises sealed road surface with only a narrow band of unsealed area along the eastern and western boundaries within the road reserve. The unsealed area comprises a mixture of bare ground, native and non-native vegetation.

4.2 Flora

4.2.1 Desktop assessment

The database search results identified a total of 11 threatened and 33 priority flora species occurring or potentially occurring within a 10 km radius of the site. Information on these species including their habitat preferences and flowering period is provided in **Appendix B**.

Based on background information available for the site, suitable habitat was considered to potentially occur within the site for one threatened flora species and 11 priority flora species as shown in **Table 6**.

Table 6: Conservation significant flora species considered to have potential to occur in the site based on known habitat preferences

Species	Level of significance		Life strategy	Habitat	Flowering period
	State	EPBC Act			
<i>Caladenia huegelii</i>	CR	EN	PG	Grey or brown sand, clay loam.	Sept-Oct
<i>Acacia benthamii</i>	P2	-	P	Sand, typically on limestone breakaways	Aug-Sept
<i>Acacia</i> sp. Binningup (G. Cockerton et al. WB 37784)	P1	-	P	Woodland and shrubland on sand, often in degraded areas	Aug
<i>Austrostipa mundula</i>	P3	-	P	Grey sand over limestone.	Sept-Nov
<i>Beyeria cinerea</i> subsp. <i>cinerea</i>	P3	-	P	Sand, limestone.	May-Oct
<i>Boronia juncea</i> subsp. <i>juncea</i>	P1	-	P	Sand in low scrub.	Apr
<i>Calandrinia oraria</i>	P3	-	A/P	Coastal dunes, in low heath, sand over limestone.	Aug-Oct
<i>Dodonaea hackettiana</i>	P4	-	P	Sand, outcropping limestone.	Jul-Oct
<i>Jacksonia sericea</i>	P4	-	P	Calcareous and sandy soils on Swan Coastal Plain	Dec-Feb

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Table 6: Conservation significant flora species considered to have potential to occur in the site based on known habitat preferences (continued)

Species	Level of significance		Life strategy	Habitat	Flowering period
	State	EPBC Act			
<i>Lachnagrostis nesomytica</i> subsp. <i>paralia</i>	P1	-	A/P	Calcareous sands. Coastal dunes and swales.	Unknown
<i>Pimelea calcicola</i>	P3	-	P	Sand, limestone on coastal ridges.	Sep-Nov
<i>Sphaerolobium calcicola</i>	P3	-	P	White-grey-brown sand, sandy clay over limestone, black peaty sandy clay. Tall dunes, winter-wet flats, interdunal swamps, low-lying areas.	Jun or Sep-Nov

CR=critically endangered, EN=endangered, VU=vulnerable, P1-P4=Priority 1-Priority 4, P=perennial, PG=perennial geophyte.

4.2.2 Species inventory

A total of 10 native and 20 non-native (weed) species were recorded within the site during the field survey, representing 15 families and 29 genera. The dominant family containing the most taxa and the most native taxa was Fabaceae (five native taxa and one weed taxa). The most common genus was *Acacia* with two taxa.

A complete species list is provided in **Appendix C**.

4.2.3 Threatened and priority flora

No occurrences of threatened or priority flora species were recorded within the site and none are considered likely to occur given the lack of suitable habitat in the site or because they were not recorded during the field survey.

4.2.4 Locally and regionally significant flora

No locally or regionally significant flora species were recorded within the site.

4.2.5 Declared pests

Two species listed as a declared pests (C3) pursuant to the BAM Act, **Asparagus asparagoides* (bridal creeper) and **Zantedeschia aethiopica* (arum lily), was recorded within the site. Bridal creeper is also listed as a weed of national significance. Scattered individuals of both species were recorded in multiple locations in the site.

4.3 Vegetation

4.3.1 Desktop assessment

The database search results identified 16 TECs and 10 PECs occurring or potentially occurring within a 10 km radius of the site. Information on these communities is provided in **Appendix D**.

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Based geomorphology, soils and regional vegetation patterns, four TECs and three PECs were considered to have potential to occur in the site:

- ‘Sedgeland in Holocene dune swales of the southern Swan Coastal Plain’ TEC which is listed as endangered under the EPBC Act and critically endangered in WA
- ‘Woodlands over sedgeland in Holocene dune swales of the southern Swan Coastal Plain’ TEC which is listed as endangered under the EPBC Act and critically endangered in WA.
- ‘Tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain TEC/PEC’ which is listed as ‘critically endangered’ under the EPBC Act and P3 in WA.
- ‘Banksia woodlands of the Swan Coastal Plain’ TEC/PEC which is listed as ‘endangered’ under the EPBC Act and P3 in WA.
- ‘Northern Spearwood shrublands and woodlands’ which is listed as P3 in WA.

4.3.2 Plant communities

Five plant communities were identified within the site. Plant community **Ar** exists as two small patches of vegetation in the north-eastern and central-eastern portions of the site and extends over 0.04 ha. Plant community **Eg** comprises multiple scattered patches of trees in the northern portion of the site which extend over 0.13 ha. Plant community **EgAr** occurs as small patches of vegetation scattered throughout the site, extending over 0.85 ha. The remainder of the site comprises **non-native** vegetation (2.49 ha) or **road** (3.71 ha).

A description and the area of each plant community is provided in **Table 7** and representative photographs of each are provided in **Plate 1** to **Plate 3**. The location of each plant community is shown in **Figure 4**.

Table 7: Description and extent of plant communities identified within the site

Plant community	Description	Area (ha)
Ar	Shrubland to closed shrubland <i>Acacia rostellifera</i> over non-native grassland and forbland and occasional native species (Plate 1).	0.04
Eg	Isolated trees to isolated clumps of trees <i>Eucalyptus gomphocephala</i> over non-native grassland and forbland and occasional native species.	0.13
EgAr	Open forest to woodland <i>Eucalyptus gomphocephala</i> over shrubland <i>Acacia rostellifera</i> over occasional <i>Xanthorrhoea preissii</i> over non-native grassland and forbland and occasional native species (Plate 2).	0.85
Non-native	Heavily disturbed areas comprising predominantly non-native grassland and forbland with occasional native shrubs and forbs and planted vegetation (Plate 3).	2.49
Road	Sealed area associated with Mandurah Road, other roads and driveways (Plate 3).	3.71

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Plate 1: Plant community Ar in 'degraded' condition (foreground)



Plate 2: Plant community EgAr in 'degraded' condition

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Plate 3: Plant community *non-native* in 'completely degraded' condition (left side) and road (right side)

4.3.3 Vegetation condition

The site has been subject to a high level of historic disturbance. Plant communities **Ar**, **Eg** and **EgAr** were mapped as being in 'degraded' condition as the vegetation structure has been severely impacted, with low native species cover and diversity and high cover of non-native species.

Non-native vegetation was mapped as being in 'completely degraded' condition as this vegetation is dominated by non-native/weed species. No vegetation condition was assigned to the road.

The extent of vegetation by condition category is detailed in **Table 8** and shown in **Figure 5**.

Table 8: Extent of vegetation condition categories within the site

Condition category (Keighery 1994)	Size (ha)
Pristine	0
Excellent	0
Very good	0
Good	0
Degraded	1.03
Completely degraded	2.48
Not applicable (road)	3.71

4.3.4 Threatened and priority ecological communities

One TEC/PEC is considered to potentially occur within the site: 'tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain' TEC/PEC ('tuart TEC/PEC').

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Plant communities **EgAr** and **Eg** contain tuart trees and so may represent the tuart TEC/PEC. The extent of the potential TEC/PEC within the site is shown in **Figure 6**. Further targeted survey work would be required to confirm whether the TEC/PEC occurs within the site and to determine its full extent within the site. Plant communities **EgAr** and **Eg**, in conjunction with tuart vegetation adjacent to the site, was assessed against the tuart TEC/PEC criteria, as outlined in **Table 9**.

DBCA's *Priority Ecological Community* list indicates that the description, area and condition thresholds that apply to the Commonwealth-listed TEC of the same name also apply to the State listed 'tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain' PEC (DBCA 2020). Therefore, some or all of the **EgAr** and **Eg** vegetation in the site may also potentially represent the PEC.

The likelihood of occurrence of TECs and PECs are provided in **Appendix C**.

No other TECs or PECs occur within the site.

*Table 9: Assessment of site conditions against the tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain TEC criteria (adopted from (DoEE 2019))*

Criteria	Requirements for meeting criteria	Site implications
1. Must meet key diagnostic characteristics	<ul style="list-style-type: none"> • Located in appropriate bioregion and landform. • At least 2 living established <i>E. gomphocephala</i> trees with DBH \geq 15cm present in canopy layer and with <60 m between the outer edges of canopies[^] • Vegetation structure is a woodland, forest, open forest, open woodland, or mallee (various forms). 	<ul style="list-style-type: none"> • Site is located in appropriate bioregion and landform. • The EgAr and Eg vegetation either contains more than two living established <i>E. gomphocephala</i> (tuart) trees with DBH \geq 15cm in canopy layer and with <60 m between the outer edges of canopies AND/OR EgAr and Eg vegetation is located or likely located within the 30 m buffer of tuart tree canopy adjacent to the site. • EgAr and Eg vegetation comprises open forest to open woodland structure.
2. Must meet size threshold	<ul style="list-style-type: none"> • A patch must be larger than 0.5 ha[#] 	<ul style="list-style-type: none"> • Individual areas of EgAr and Eg vegetation in the site are less than 0.5 ha in size. Calculation of patch size using the TEC method has not been undertaken and so this criterion cannot be confirmed. • The areas of EgAr and Eg vegetation in the site are likely connected to additional areas of tuart vegetation adjacent to the site, which would contribute to patch size. Further survey of the vegetation adjacent to the site would be required to confirm this.
3. Must meet condition thresholds	<ul style="list-style-type: none"> • Patches >5 ha: no condition threshold • Patches \geq0.5 – <2 ha: 'very high' or 'high' condition[†] • Patches \geq2 – \leq5 ha: 'very high', 'high' or 'moderate' condition[†] 	<ul style="list-style-type: none"> • The patch size of EgAr and Eg vegetation in the site is unknown (refer criterion 2) and so condition thresholds cannot be applied. • Further survey would be required in spring to determine condition category of patches (if present).

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Table 9: Assessment of site conditions against the tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain TEC criteria (adopted from (DoEE 2019)) (continued)

Criteria	Requirements for meeting criteria	Site implications
4. Must incorporate surrounding context	<ul style="list-style-type: none"> • Breaks (e.g. tracks, cleared areas) <30 m do not separate vegetation into separate patches • The site should be thoroughly sampled in the appropriate season. • Survey timing should be appropriate. • Surrounding environment should be considered (e.g. connectivity, conservation values, fauna habitat) 	<ul style="list-style-type: none"> • Further survey work of the tuart vegetation adjacent to the site is required to determine whether the EgAr and Eg vegetation is part of a larger patch. • The survey timing was appropriate to determine that tuart trees occur within the EgAr and Eg vegetation. Additional survey in vegetation adjacent to the site during spring may be required to determine vegetation condition.
Result	<p>The site supports 0.98 ha of potential tuart (<i>Eucalyptus gomphocephala</i>) woodlands and forests of the Swan Coastal Plain TEC/PEC (defined as vegetation containing tuart trees/EgAr and Eg plant communities)</p> <p>Further survey work would be required to determine whether this TEC/PEC occurs within the site and the full extent of the TEC/PEC.</p>	

[^]Includes dead trees. Where species of dead tree is unclear it is assumed to be *E. gomphocephala* if its canopy is within 60 m of an identified *E. gomphocephala* tree. [#]Note that a patch comprises a 30 m buffer around the canopy of each *E. gomphocephala* canopy tree, may extend beyond a lot boundary and may include areas of bare ground, waterbodies and hardscape. [†]Using the condition scale provided in (DoEE 2019).

4.3.5 Locally and regionally significant vegetation

Mature tuart trees (diameter at breast height ≥ 50 cm) are present in the site, as outlined in **Section 4.4**. These trees have the potential to provide foraging, roosting and nesting habitat for threatened species of black cockatoo, along with other ecological services. Other plants within the site may also provide foraging habitat to species of black cockatoo, including *Acacia* spp. and *Xanthorrhoea preissii*.

4.4 Trees

A total of 50 trees were recorded within the site, comprising 30 habitat trees and 20 other trees.

The 30 habitat trees consisted of two with potentially suitable hollow(s) and 28 with no suitable hollow(s). The 20 other trees consisted of tuarts and non-native species **Ficus macrophylla* (Moreton Bay fig), **Eucalyptus* sp., **Melia azedarach* (Cape lilac) and **Olea europaea* (olive).

A summary of the trees recorded within the site is provided in **Table 10** and an inventory in **Appendix E**. The locations of the trees are shown in **Figure 7**.

Table 10: Habitat trees recorded within the site

Category	No. trees
Habitat tree - potentially suitable hollow(s)	2
Habitat tree - no suitable hollow(s)	28
Other tree	20

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5 Discussion

5.1 Threatened and priority flora

No threatened or priority flora species were recorded within the site and none are expected to occur due to the lack of suitable habitat and as they were not recorded during the site visit. The species considered to have potential to occur in the site prior to the field survey (**Table 6**) comprise mainly perennial species which would be visible throughout the year. Since no unidentified perennial taxa were recorded in the site during the field survey, none of these species are considered likely to occur. The survey was not undertaken when the one perennial geophyte species listed in **Table 6**, *Caladenia huegelii*, would be visible. However, due to historical disturbance no suitable habitat for *C. huegelii* exists in the site and so this species is unlikely to occur.

5.2 Vegetation condition

The vegetation within the site showed obvious signs of long-term historical disturbance and clearly met the Keighery (1994) descriptions for degraded and completely degraded categories.

5.3 Threatened and priority ecological communities

Plant communities **EgAr** and **Eg** contain tuart trees. Whilst tuarts are a diagnostic feature of the tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain TEC/PEC, detailed assessment against the criteria outlined in the (DoEE 2019) conservation advice is required to determine if the TEC/PEC occurs. This includes identifying a patch of the ecological community, which consists of identifying groups of at least two tuart trees with a DBH \geq 15cm, mapping the canopy boundary and applying a 30 m buffer. Following this, size and condition thresholds can be applied.

Due to the presence of many tuart trees with DBH \geq 15cm within the **EgAr** and **Eg** vegetation, and tuart trees noted adjacent to the site that may be part of the same patch, it is likely that most of the potential TEC/PEC shown in **Figure 6** meets the criteria to represent the TEC/PEC. Furthermore, the TEC extent within the site may be larger than the **EgAr** and **Eg** vegetation due to the 30 m buffer.

Further survey work of the **EgAr** and **Eg** vegetation within the site, and vegetation adjacent to the site, would be required to determine whether the TEC/PEC occurs and to confirm its full extent within the site.

5.4 Locally and regionally significant flora and vegetation

Flora and vegetation may be significant irrespective of protection under policy or legislation. One reason that flora or vegetation within the site may be significant is that the vegetation has value as habitat for threatened or priority fauna species. In particular, the **EgAr** and **Eg** vegetation contains mature *Eucalyptus gomphocephala* trees that have the potential to provide nesting (further discussed in **Section 5.5** below), foraging and/or roosting values for black cockatoos listed as threatened under the EPBC Act and BC Act.

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5.5 Trees

As some of the habitat trees recorded within the site contain hollows that are potentially suitable for use by black cockatoos for breeding, the site may provide breeding habitat for black cockatoos. However, hollows were assessed from ground level only based on hollow location and trunk size. An internal hollow inspection would be required to confirm whether the internal dimensions of potentially suitable hollows are suitable for breeding by black cockatoos. The habitat trees without suitable hollow(s) have the potential to form suitable hollows in the future but it will likely take many decades for hollows to form that are large enough to be suitable for use by black cockatoos for breeding.

The precise boundary of the site was sometimes difficult to interpret during the survey due to lack of physical markers and spatial error associated with handheld GPS receivers. Where habitat trees and other trees were close to the boundary these were recorded as being located within the site and so the number of trees recorded may be an overestimation. Specialist survey pick up of trees and demarcation of the site boundary would be required to determine the number of habitat trees and other trees that are actually located within the site.

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6 Conclusions

The site is highly disturbed and modified, with approximately 6.19 ha of the site containing 'completely degraded', predominantly non-native vegetation or cleared areas such as roads. The remaining 1.03 ha of the site comprises native vegetation that is present in 'degraded' condition.

No threatened or priority flora species were recorded within the site and none are considered likely to occur given the lack of suitable habitat in the site or because they were not recorded during the field survey.

The **EgAr** and **Eg** plant communities contain tuart trees and extend over 0.98 ha within the site. Tuart trees can indicate that vegetation represents the *tuart (Eucalyptus gomphocephala) woodlands and forests of the Swan Coastal Plain* TEC/PEC. Further survey within and adjacent to the site would be required to confirm if this TEC/PEC occurs within the site and to identify its full extent.

Vegetation within the site may provide habitat for conservation significant fauna, particularly threatened species of black cockatoo.

Fifty trees were recorded in the site, comprising 30 habitat trees and 20 other trees. The 30 habitat trees consisted of two with potentially suitable hollow(s) and 28 with no suitable hollow(s). The habitat trees with potentially suitable hollow(s) may provide breeding habitat for black cockatoos but an internal hollow inspection would be required to confirm whether the hollows are in fact suitable and whether they are being used by black cockatoos for breeding.

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7 References

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Reconnaissance Flora, Vegetation and Tree Assessment

Part Mandurah Road Reserve between Dixon Road and Office Road



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7.2 Online references

The online resources that have been utilised in the preparation of this report are referenced in **Section 6.1**, with access date information provided in **Table R 1**.

Table R 1 Access dates for online references

Reference	Date accessed	Website or dataset name
BoM (2022)	4 July 2022	Climate Data Online
DAWE (2021a)	10 May 2022	Threatened Ecological Communities
DAWE (2021b)	04 July 2022	Weeds of National Significance (WoNS)
DAWE (2022)	10 May 2022	Protected Matters Search Tool
WALIA (2022)	28 June 2022	Landgate Map Viewer
Western Australian Herbarium (2022)	4 July 2022	Florabase

Reconnaissance Flora, Vegetation and Tree Assessment

Part Mandurah Road Reserve between Dixon Road and Office Road



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Figures



Figure 1: Site Location

Figure 2: Soils, Topography and Hydrology

Figure 3: Environmental Features

Figure 4a-e: Plant Communities

Figure 5a-e: Vegetation Condition

Figure 6a-e: Threatened and Priority Ecological Community

Figure 7a-e: Trees

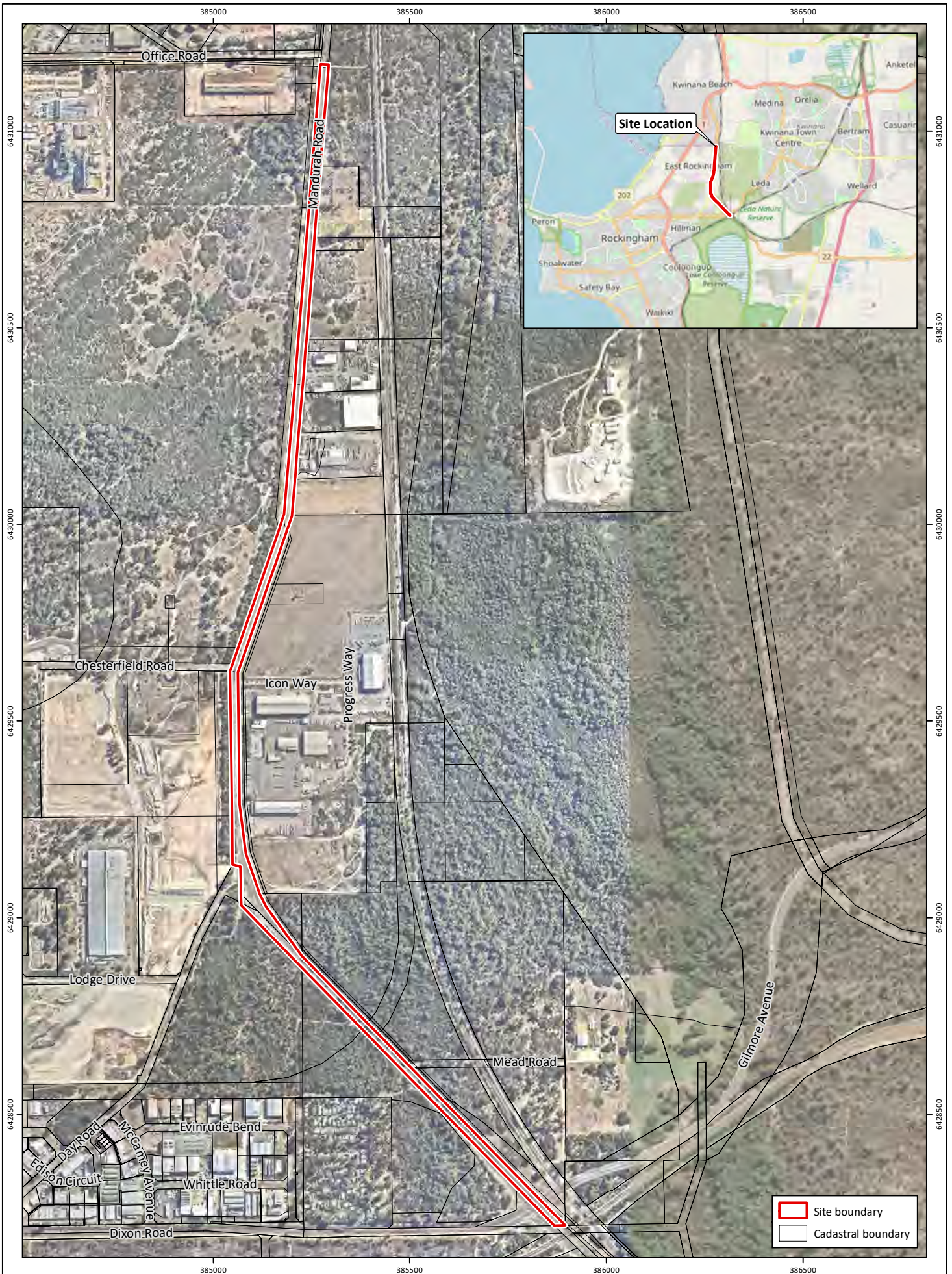


Figure 1: Site Location

Project: Reconnaissance Flora, Vegetation and Tree Assessment
Part Mandurah Road Reserve between Dixon Road and Office Road

Client: City of Rockingham

Plan Number: EP22-039(01)-F01
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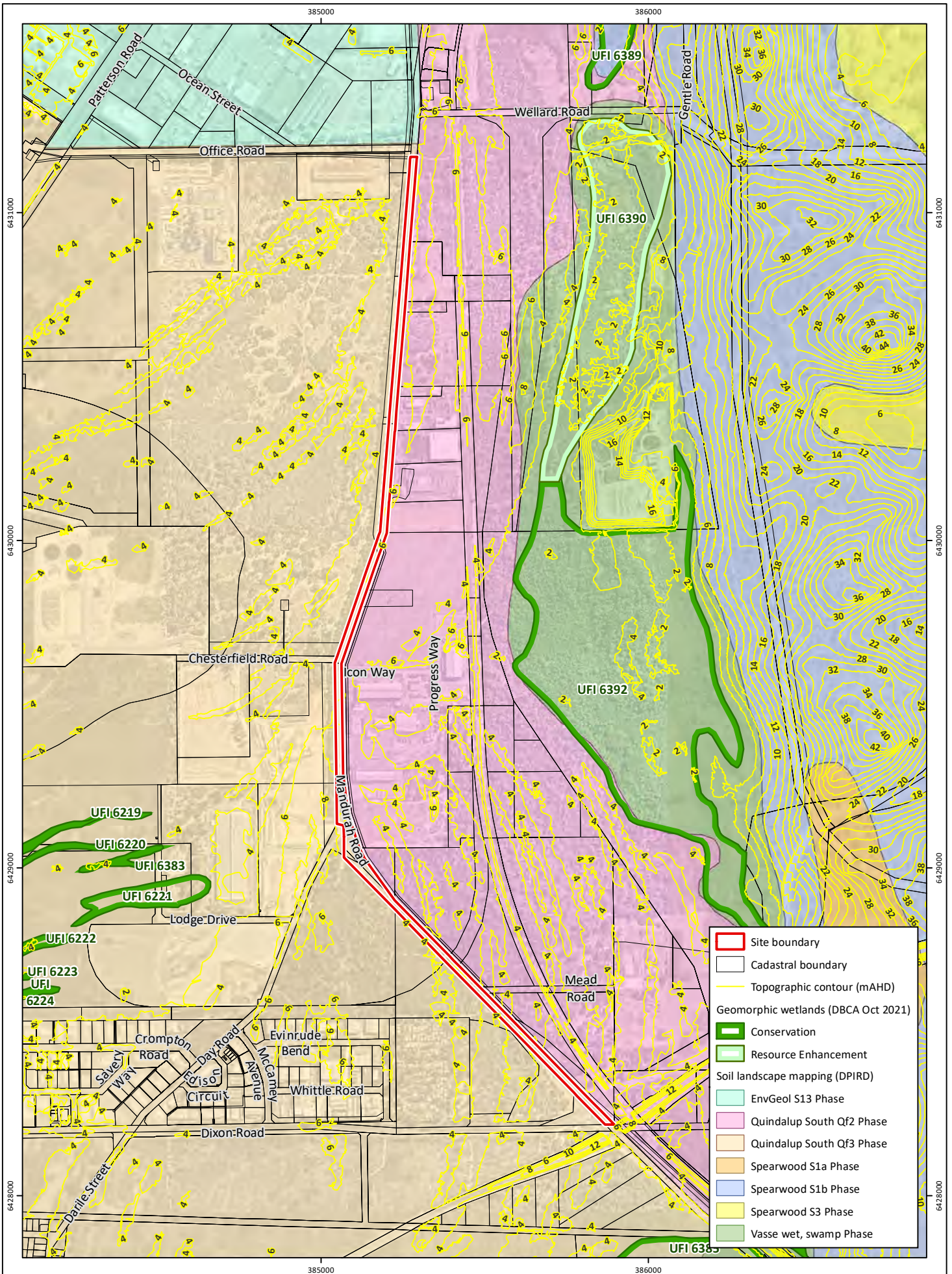


Figure 2: Soils, Topography and Hydrology

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Client: City of Rockingham

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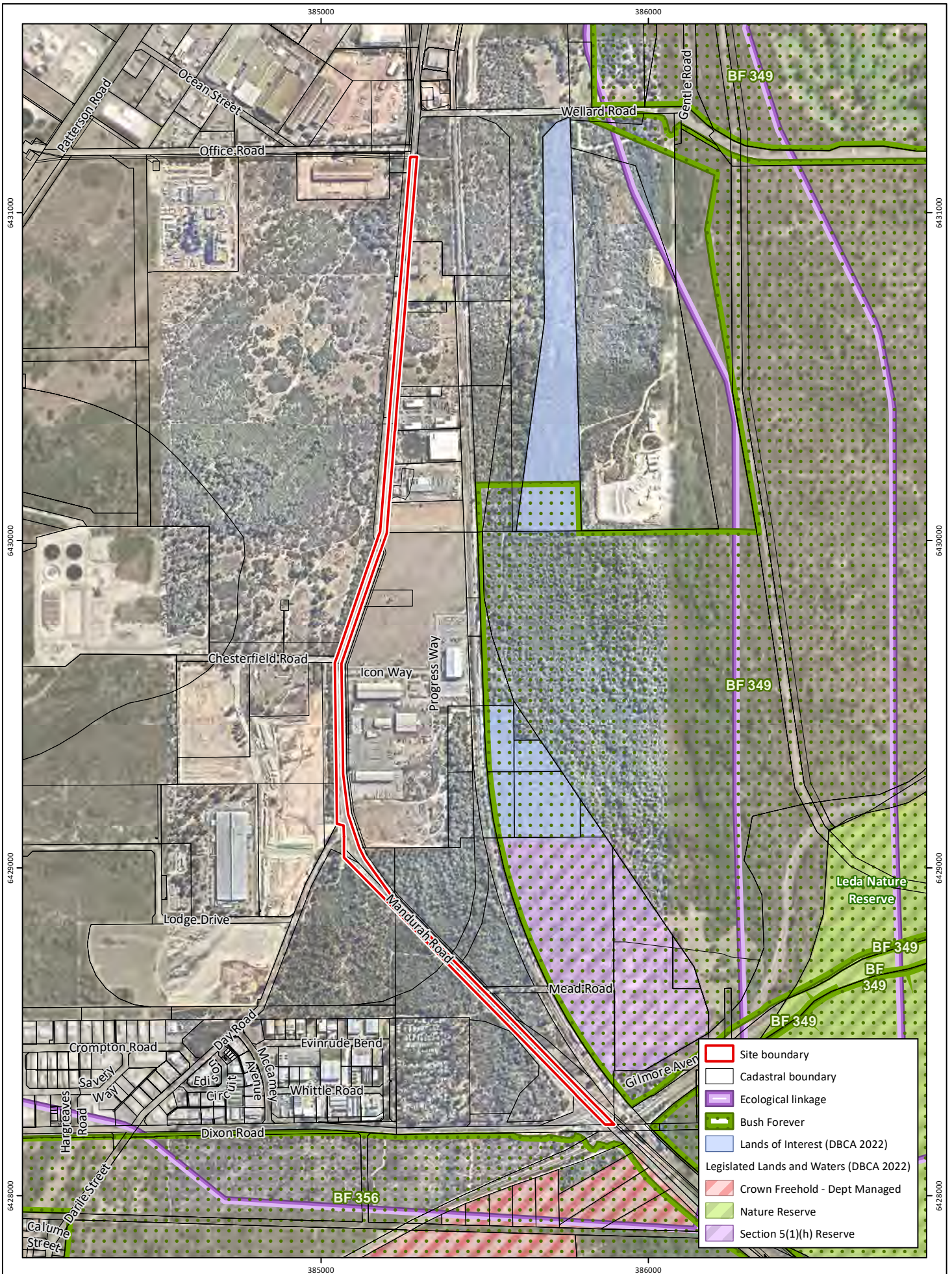


Figure 3: Environmental Features

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Part Mandurah Road Reserve between Dixon Road and Office Road

Client: City of Rockingham

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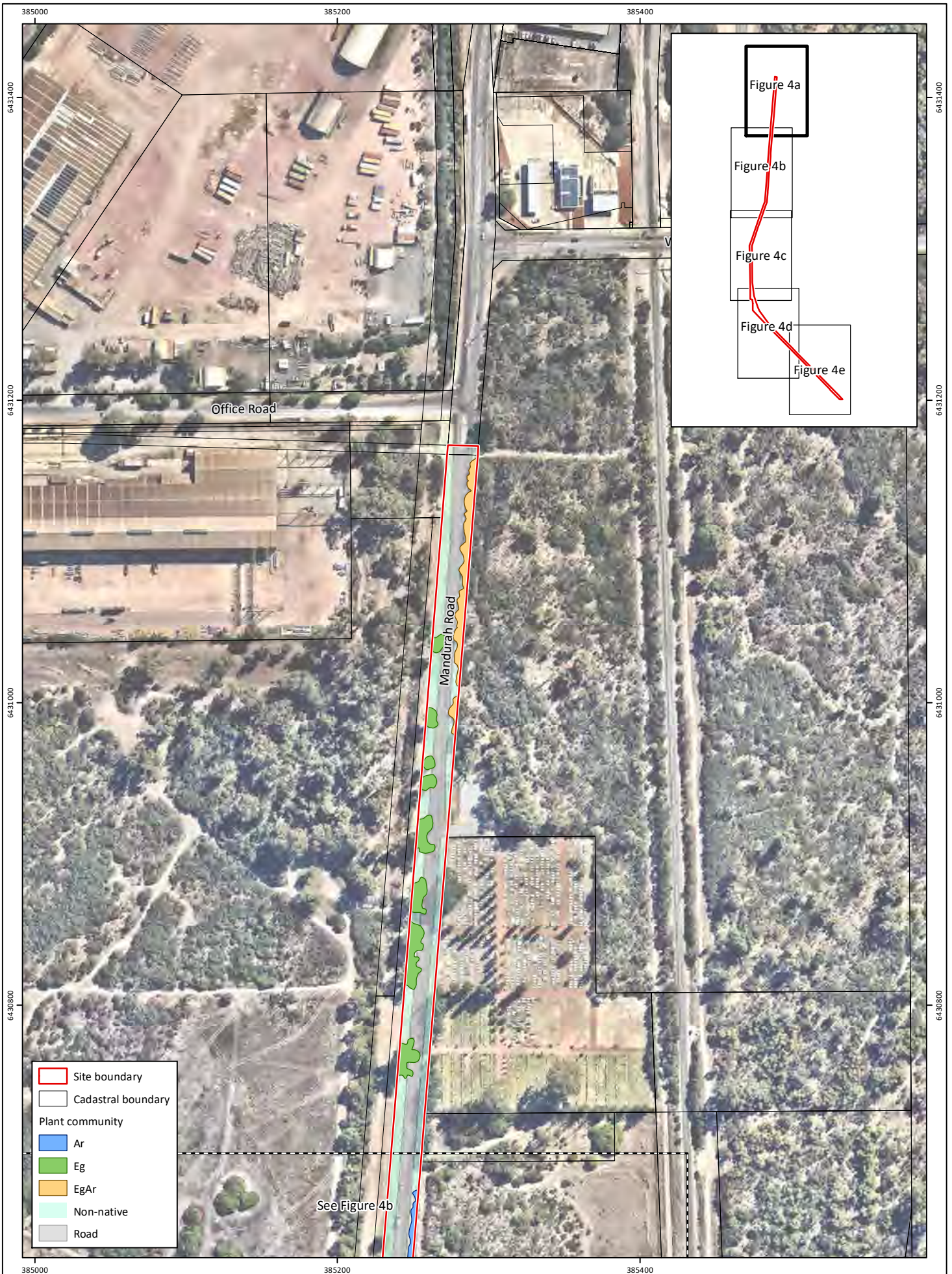


Figure 4a: Plant Communities

Project: Reconnaissance Flora, Vegetation and Tree Assessment
Part Mandurah Road Reserve between Dixon Road and Office Road

Client: City of Rockingham

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GDA 1994 MGA Zone 50



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Figure 4b: Plant Communities

Project: Reconnaissance Flora, Vegetation and Tree Assessment
Part Mandurah Road Reserve between Dixon Road and Office Road

Client: City of Rockingham

Plan Number: EP22-039(01)-F04
Drawn: GAR
Date: 24/06/2022
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Date: 30/06/2022

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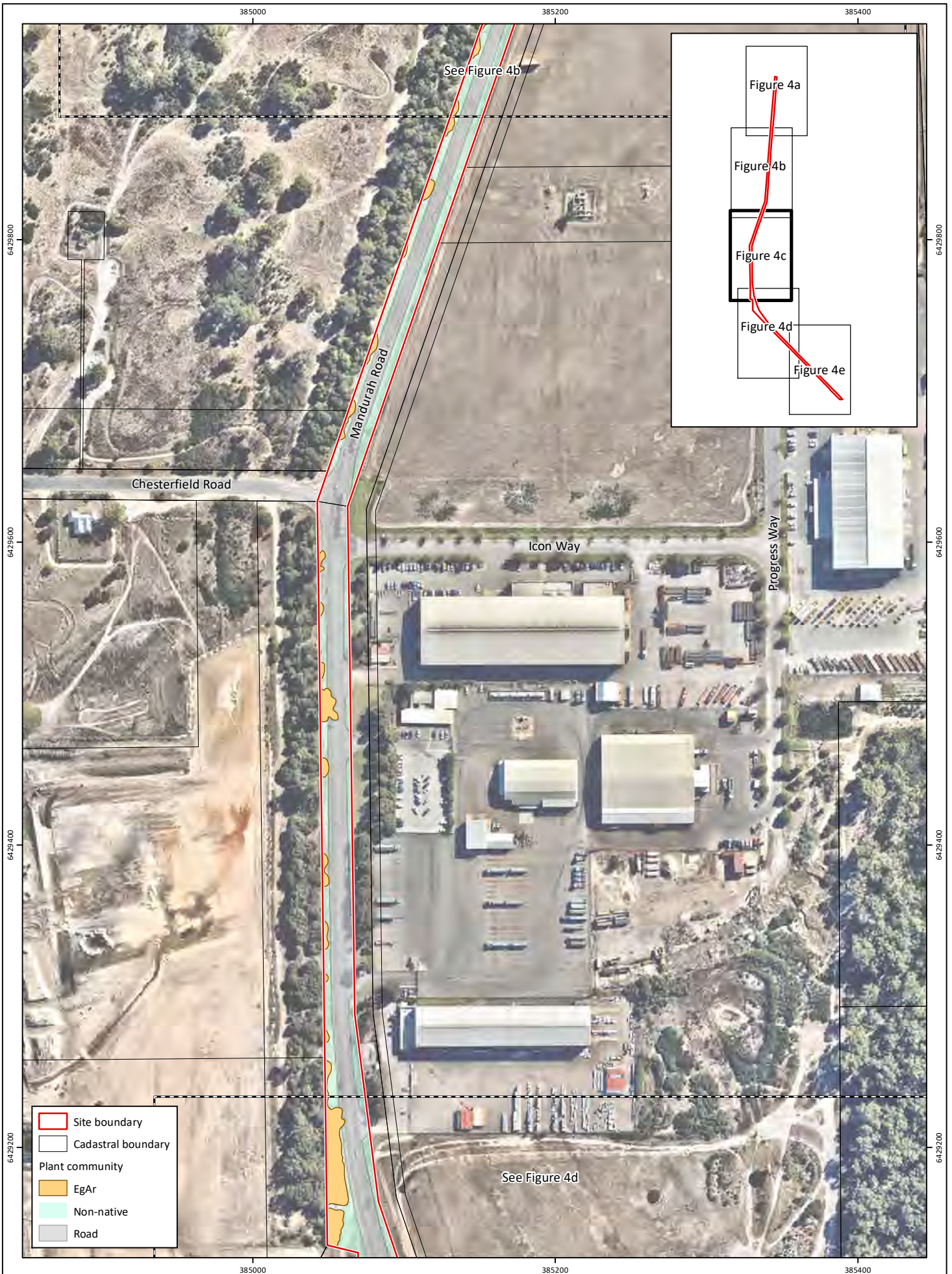


Figure 4c: Plant Communities

Project: Reconnaissance Flora, Vegetation and Tree Assessment
Part Mandurah Road Reserve between Dixon Road and Office Road

Client: City of Rockingham

Plan Number: EP22-039(01)-F04
Drawn: GAR
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Approved: RAW
Date: 30/06/2022



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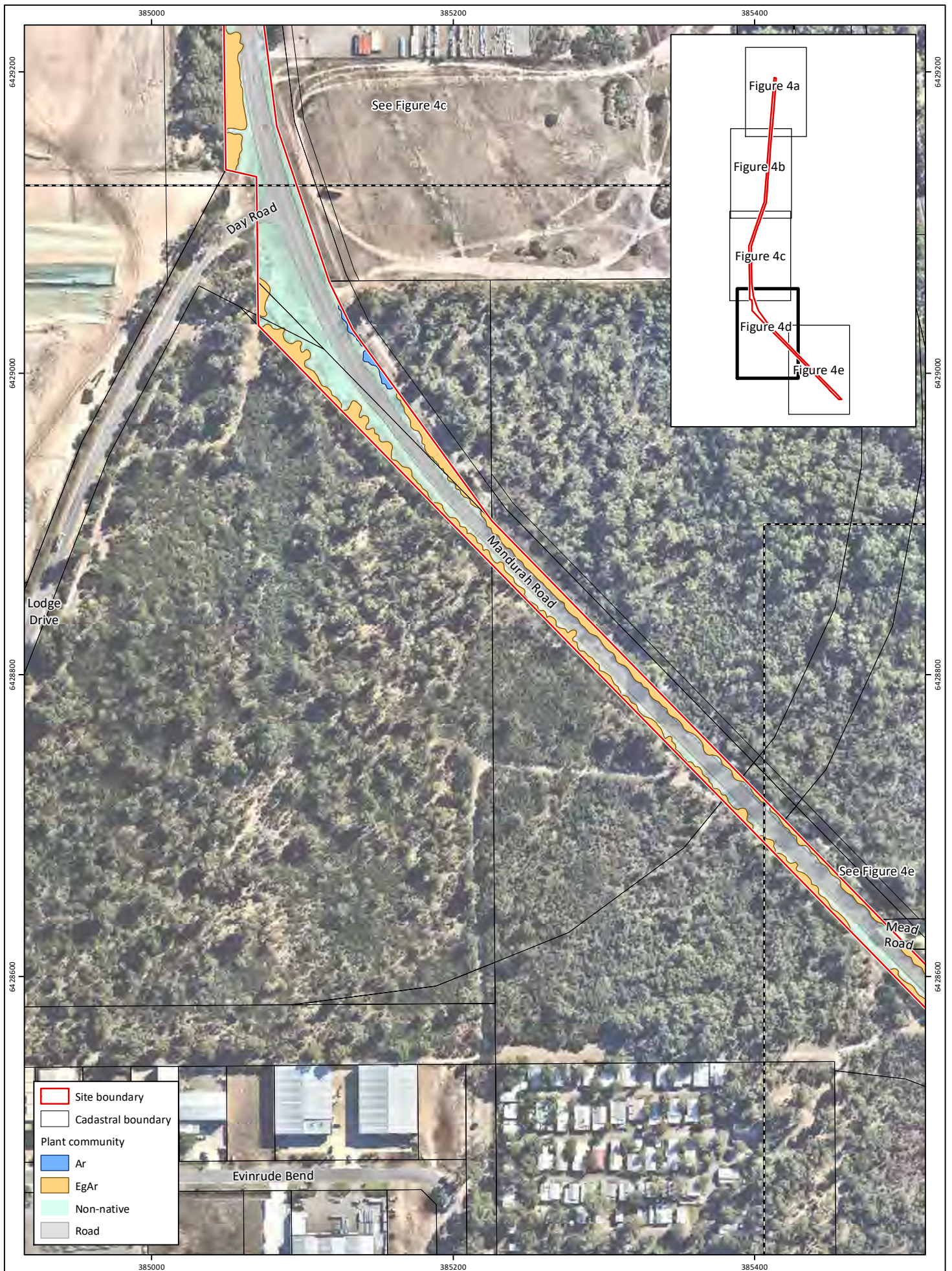
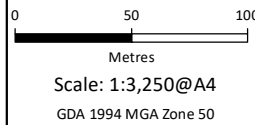


Figure 4d: Plant Communities

Project: Reconnaissance Flora, Vegetation and Tree Assessment
Part Mandurah Road Reserve between Dixon Road and Office Road

Client: City of Rockingham

Plan Number: EP22-039(01)-F04
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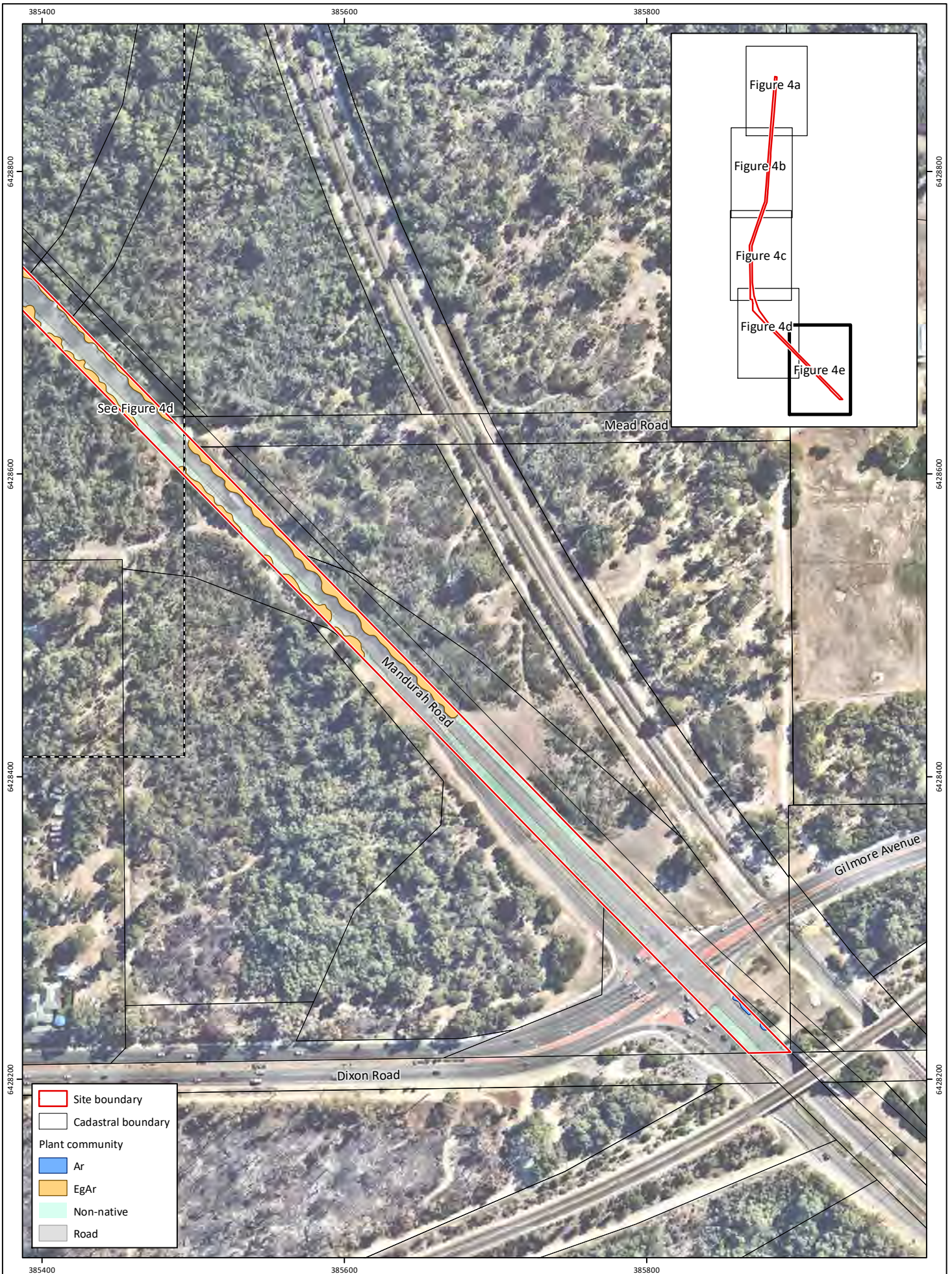
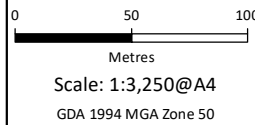


Figure 4e: Plant Communities

Project: Reconnaissance Flora, Vegetation and Tree Assessment
Part Mandurah Road Reserve between Dixon Road and Office Road

Client: City of Rockingham

Plan Number: EP22-039(01)-F04
Drawn: GAR
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Date: 30/06/2022



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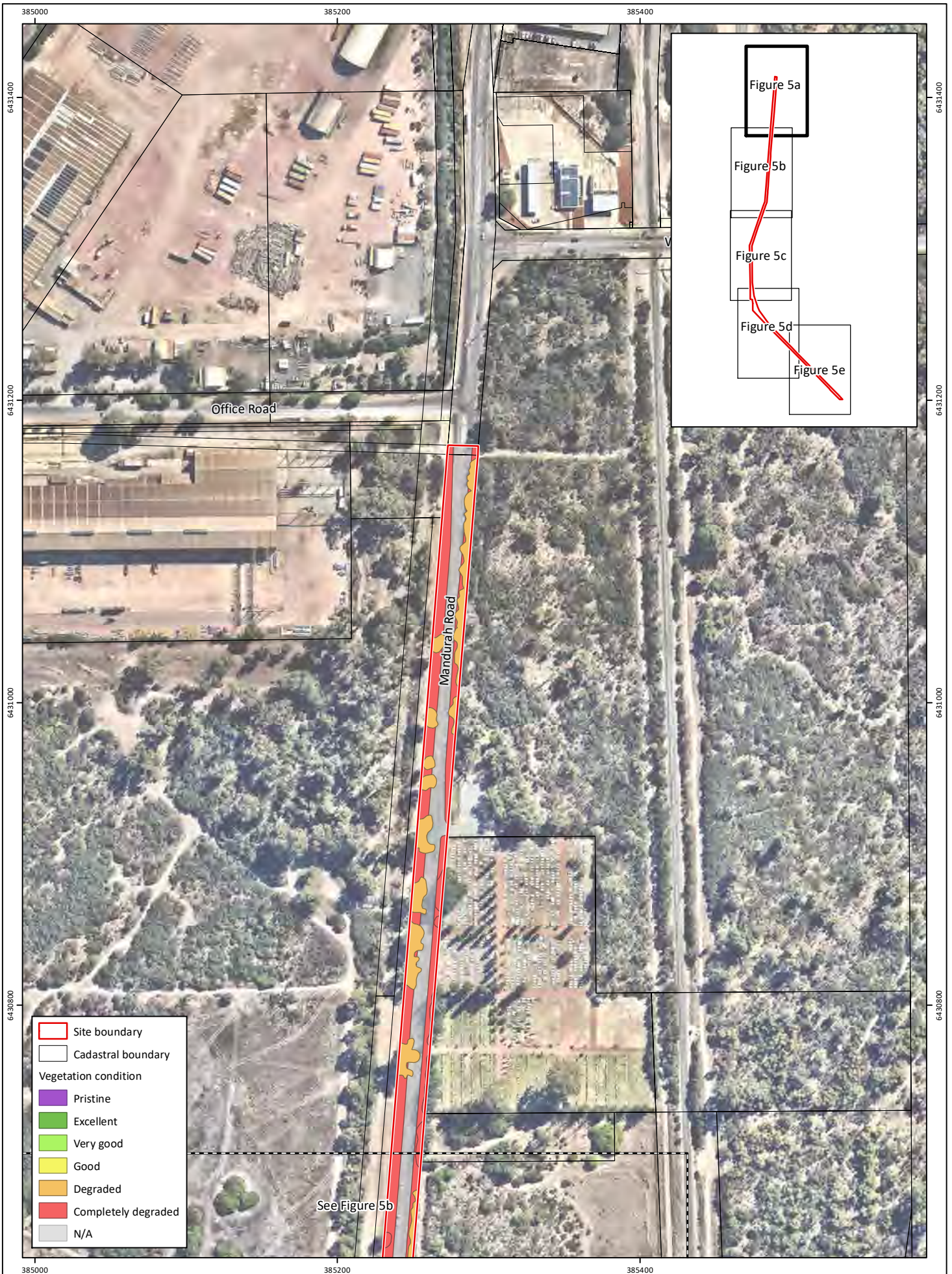


Figure 5a: Vegetation Condition

Project: Reconnaissance Flora, Vegetation and Tree Assessment
Part Mandurah Road Reserve between Dixon Road and Office Road

Client: City of Rockingham

Plan Number: EP22-039(01)-F05
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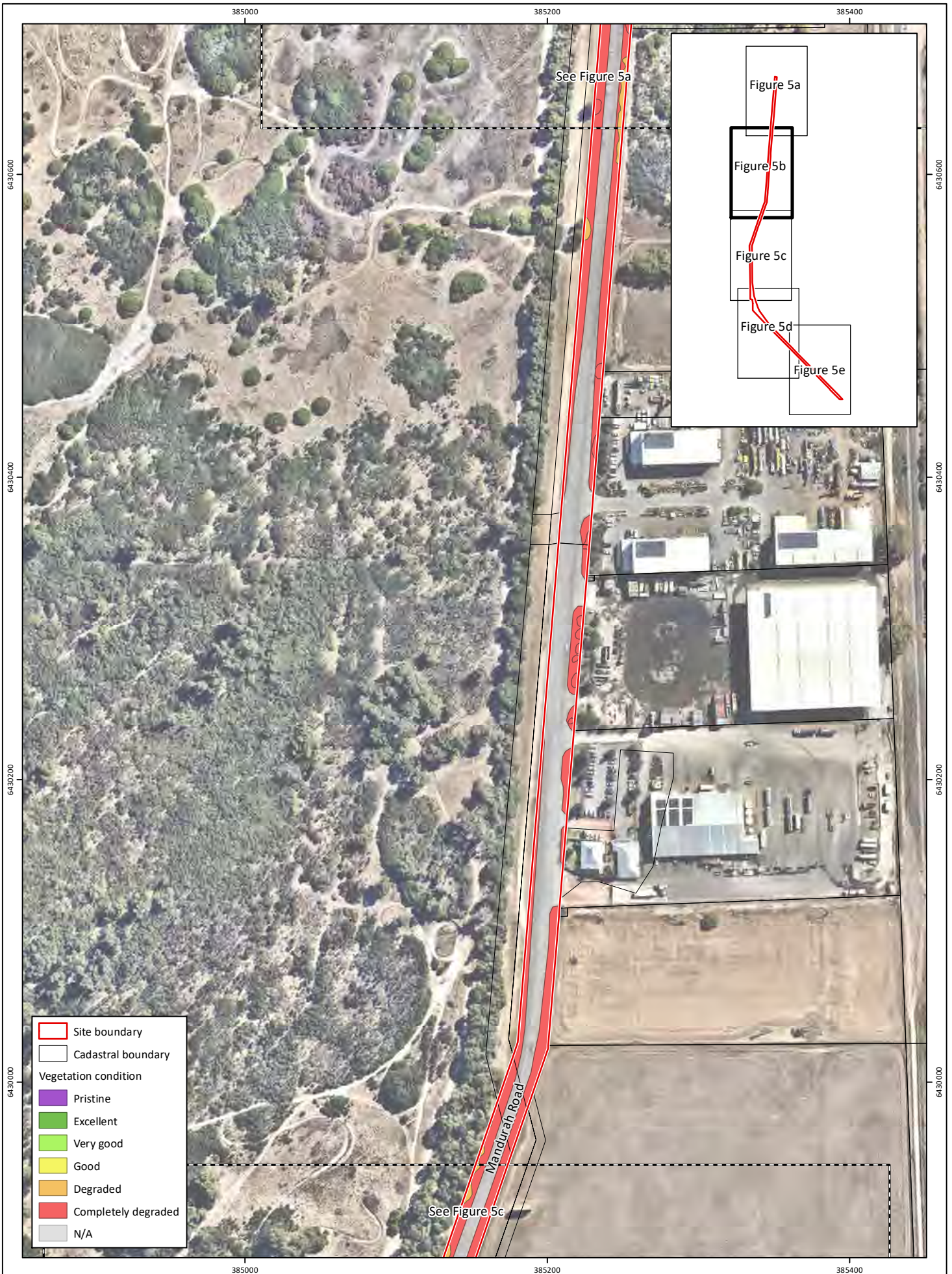


Figure 5b: Vegetation Condition

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Part Mandurah Road Reserve between Dixon Road and Office Road

Client: City of Rockingham

Plan Number: EP22-039(01)-F05
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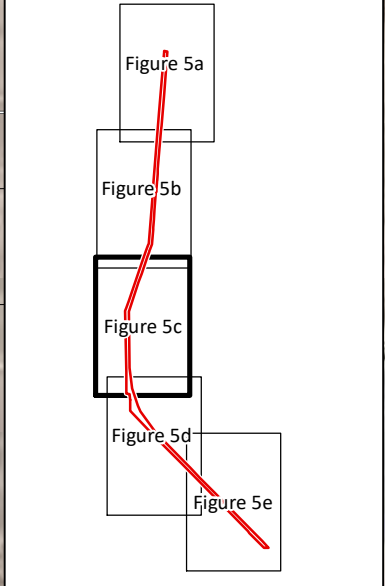
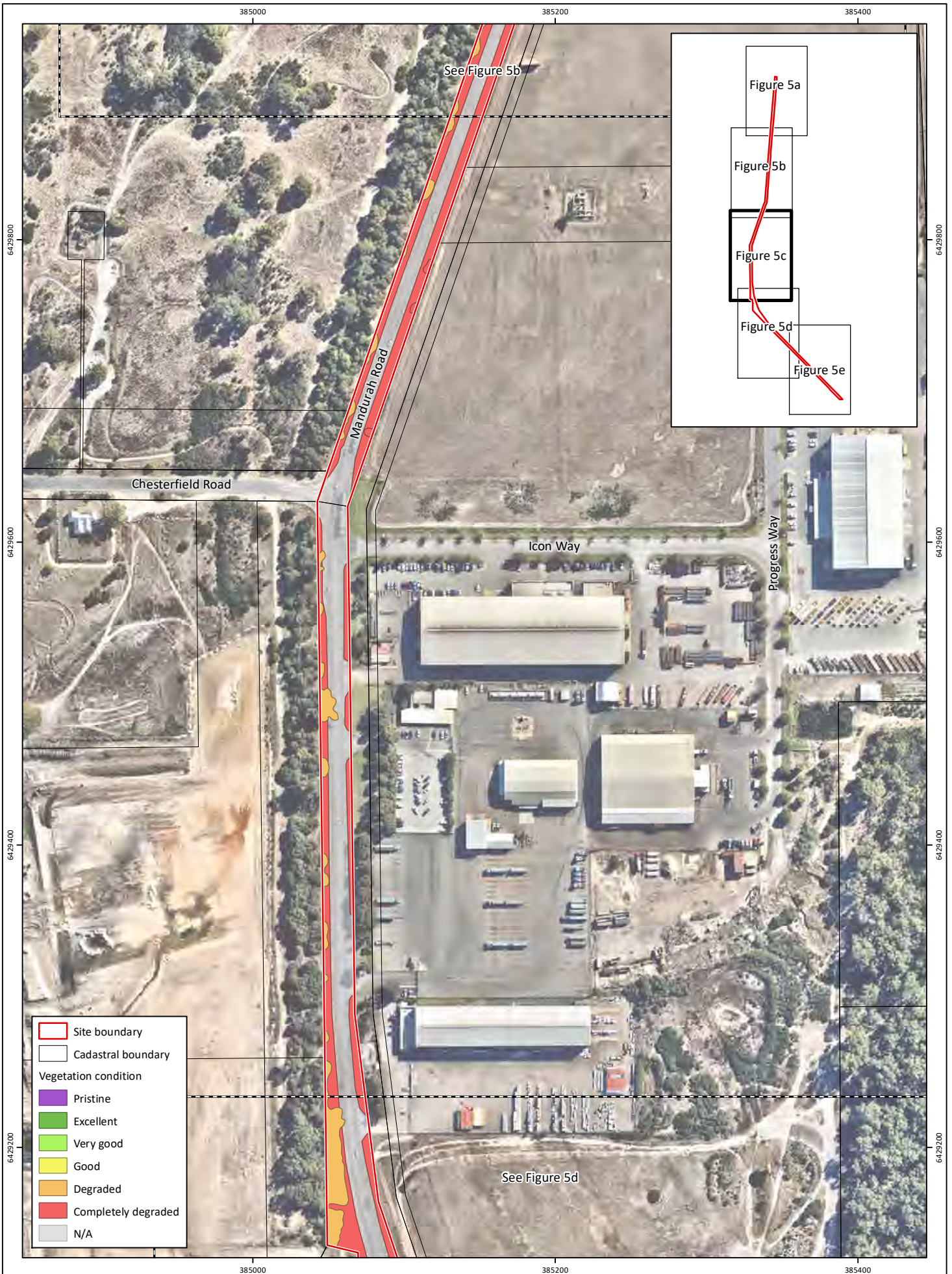


Figure 5c: Vegetation Condition

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Part Mandurah Road Reserve between Dixon Road and Office Road

Client: City of Rockingham

Plan Number: EP22-039(01)-F05
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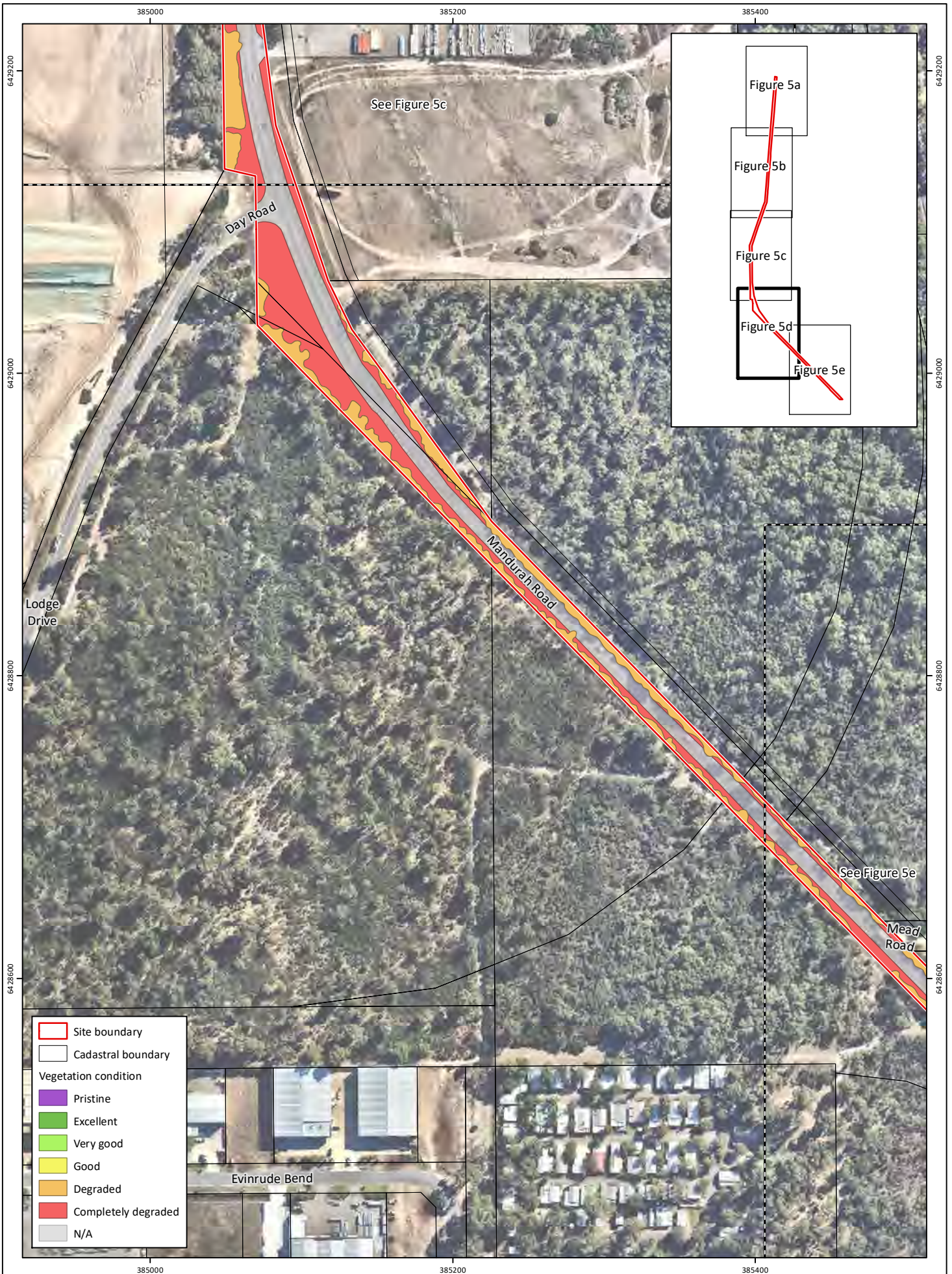


Figure 5d: Vegetation Condition

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Part Mandurah Road Reserve between Dixon Road and Office Road

Client: City of Rockingham

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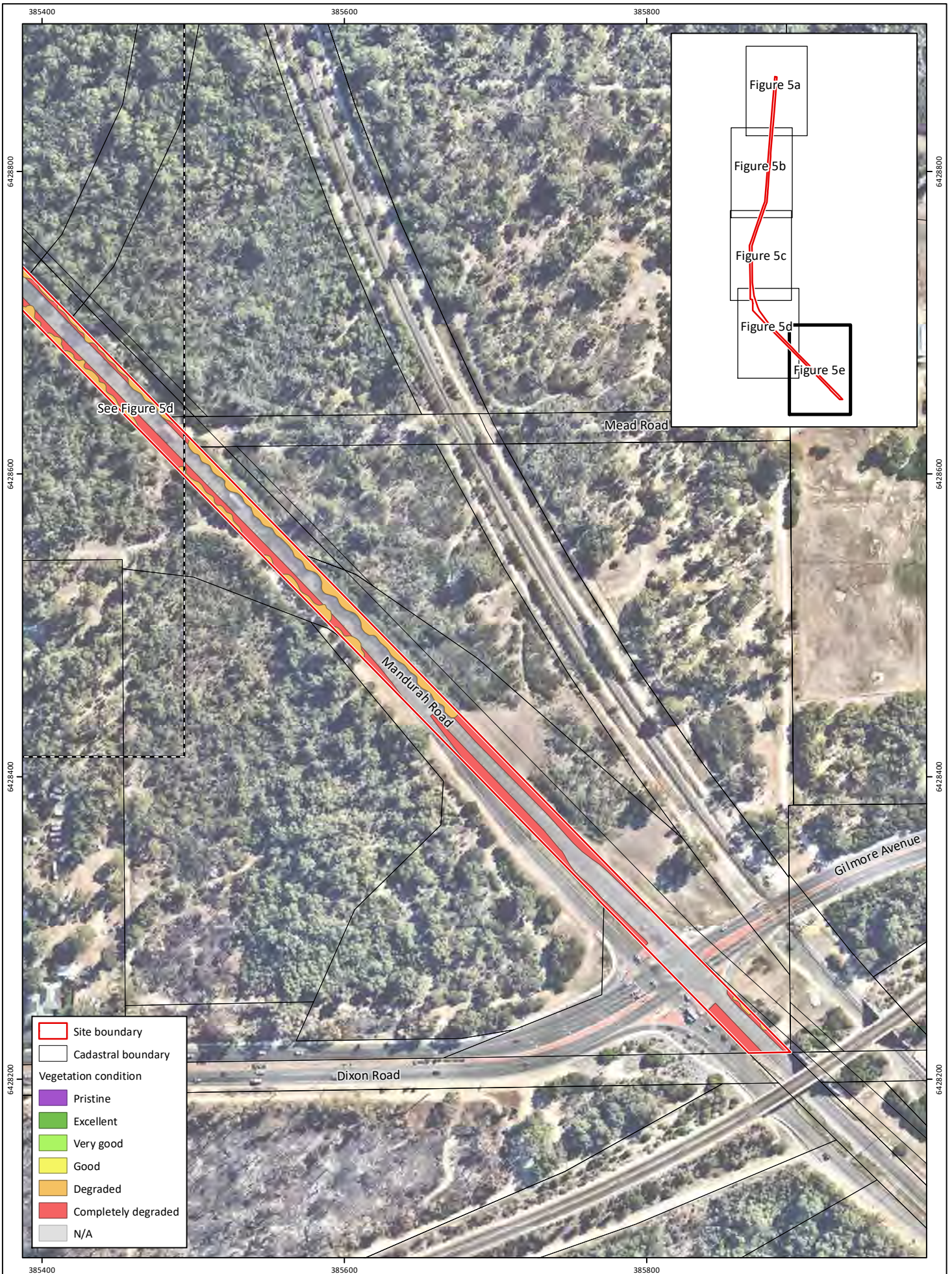
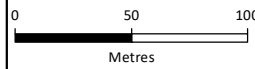


Figure 5e: Vegetation Condition

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Date: 30/06/2022



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Project: Reconnaissance Flora, Vegetation and Tree Assessment
Part Mandurah Road Reserve between Dixon Road and Office Road

Client: City of Rockingham

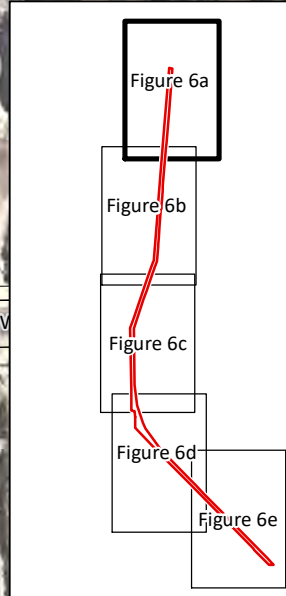
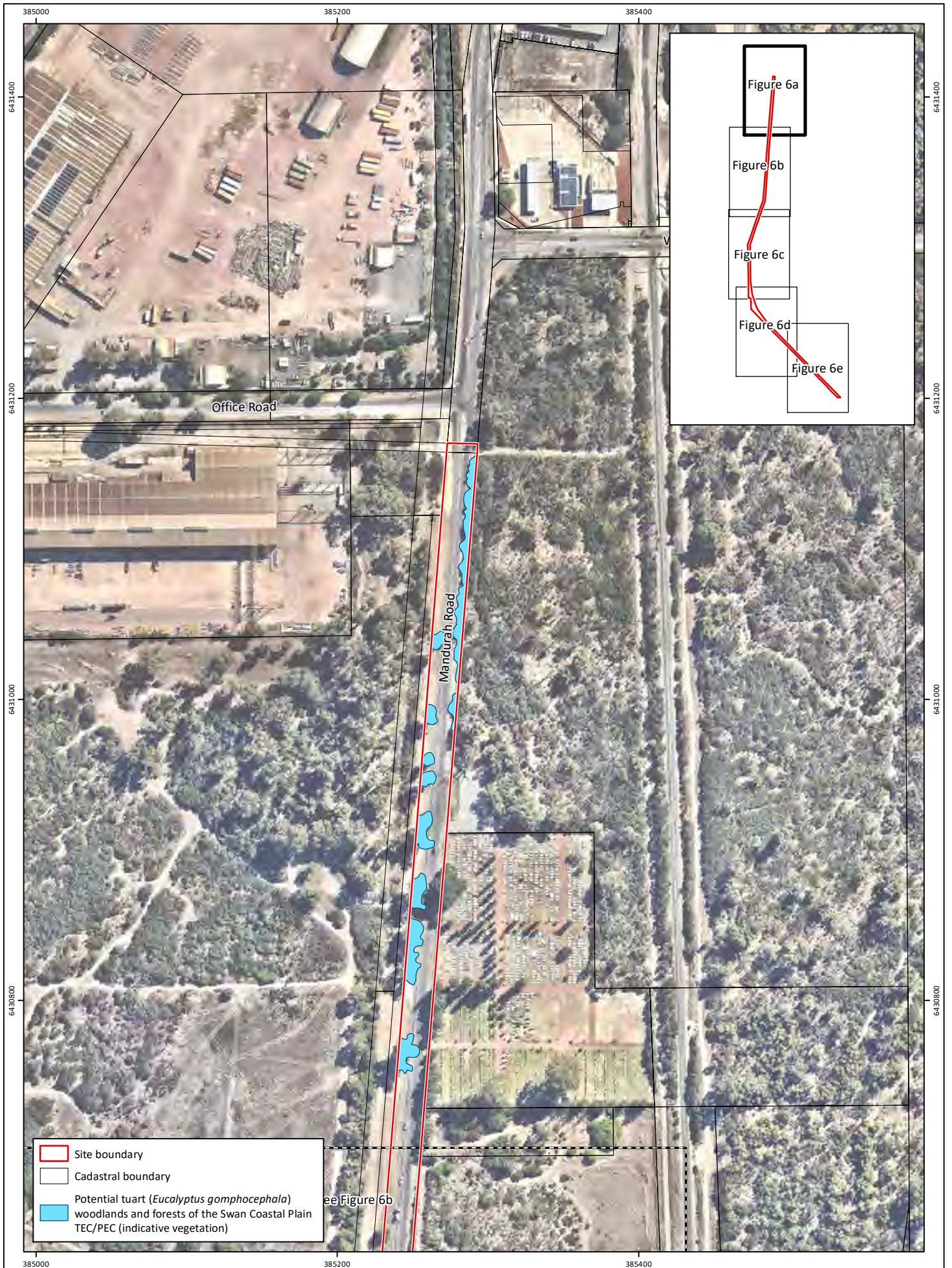


Figure 6a: Threatened and Priority Ecological Community

Project: Reconnaissance Flora, Vegetation and Tree Assessment
Part Mandurah Road Reserve between Dixon Road and Office Road

Client: City of Rockingham

Plan Number: EP22-039(01)-F06
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Figure 6b: Threatened and Priority Ecological Community

Project:	Reconnaissance Flora, Vegetation and Tree Assessment Part Mandurah Road Reserve between Dixon Road and Office Road
Client:	City of Rockingham

Plan Number:	EP22-039(01)-F06
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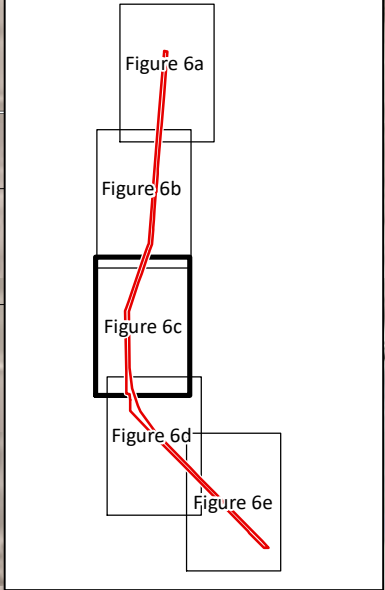
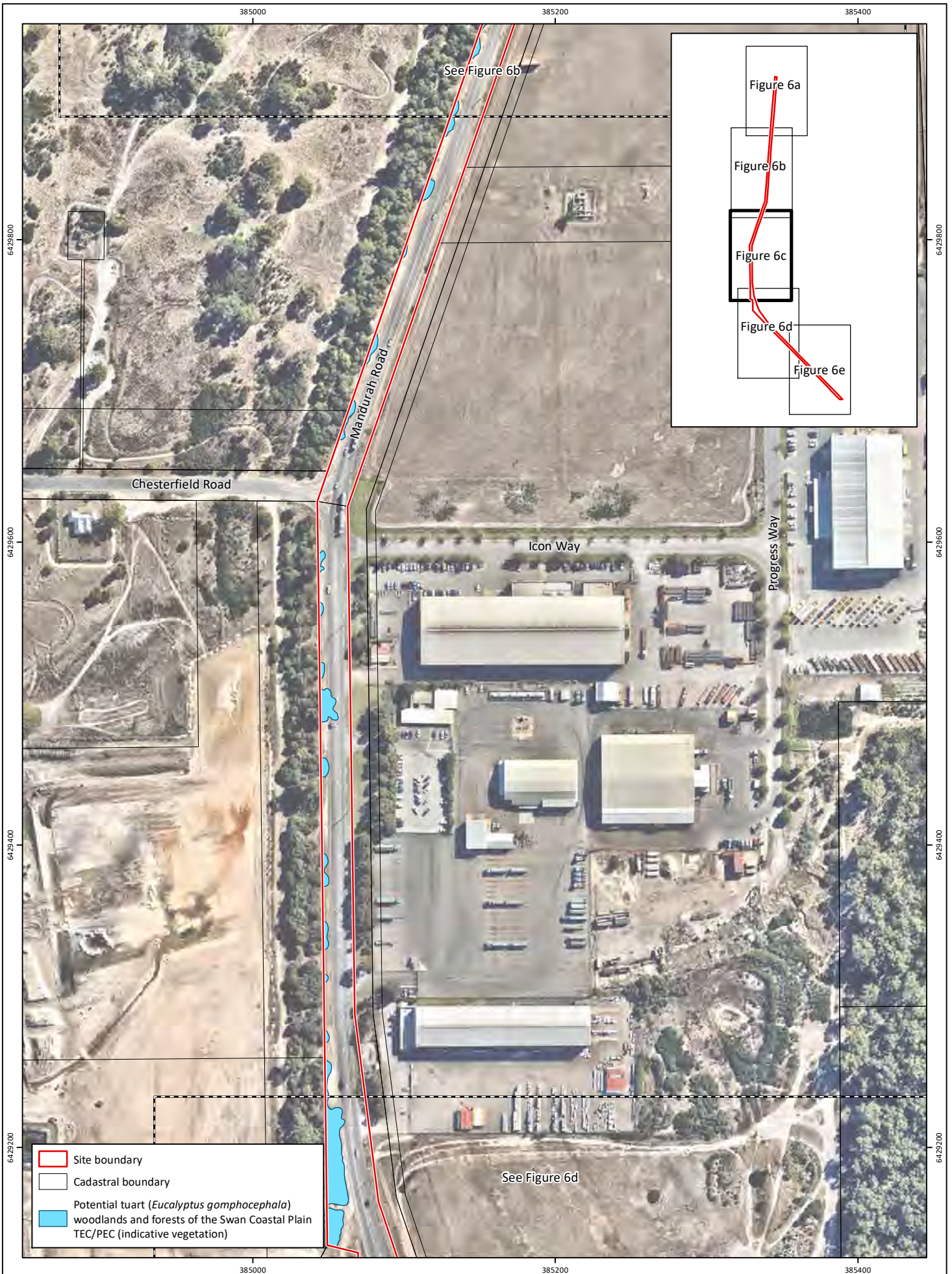


Figure 6c: Threatened and Priority Ecological Community

Project: Reconnaissance Flora, Vegetation and Tree Assessment
Part Mandurah Road Reserve between Dixon Road and Office Road

Client: City of Rockingham

Plan Number: EP22-039(01)-F06
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Date: 24/06/2022
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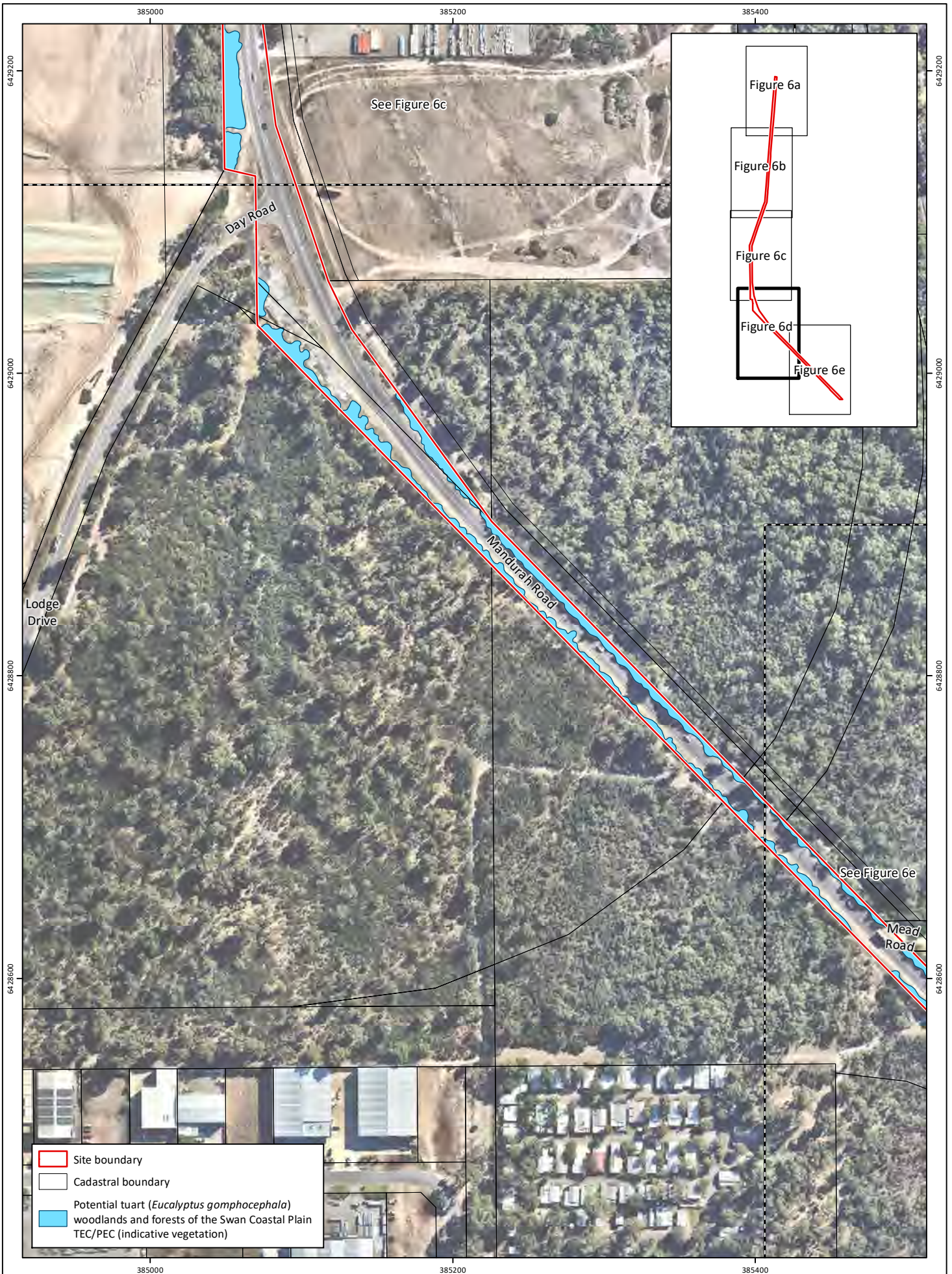
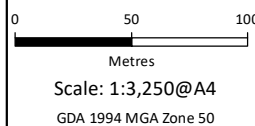


Figure 6d: Threatened and Priority Ecological Community

Project: Reconnaissance Flora, Vegetation and Tree Assessment
Part Mandurah Road Reserve between Dixon Road and Office Road

Client: City of Rockingham

Plan Number: EP22-039(01)-F06
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Date: 24/06/2022
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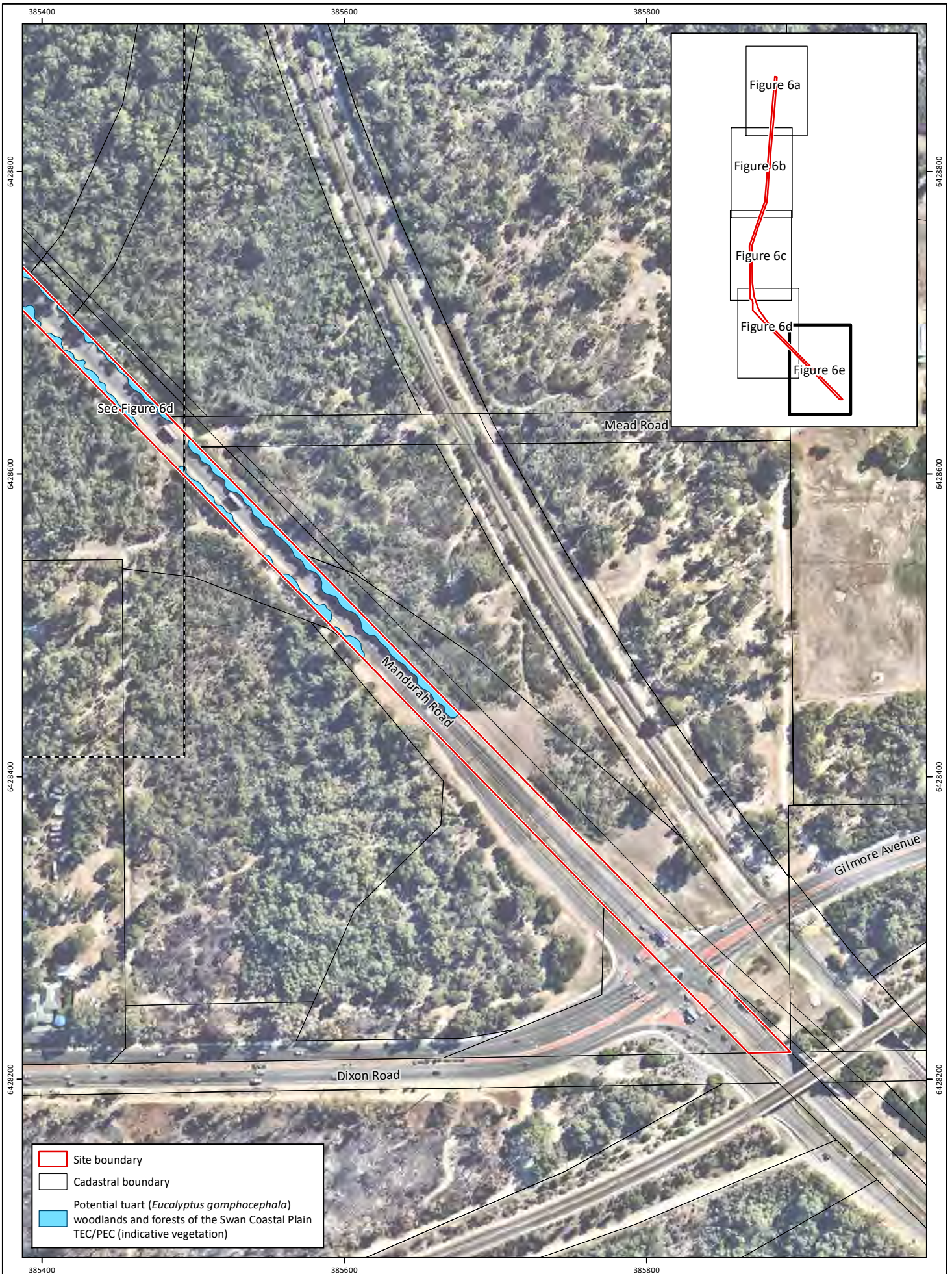


Figure 6e: Threatened and Priority Ecological Community

Project: Reconnaissance Flora, Vegetation and Tree Assessment
Part Mandurah Road Reserve between Dixon Road and Office Road

Client: City of Rockingham

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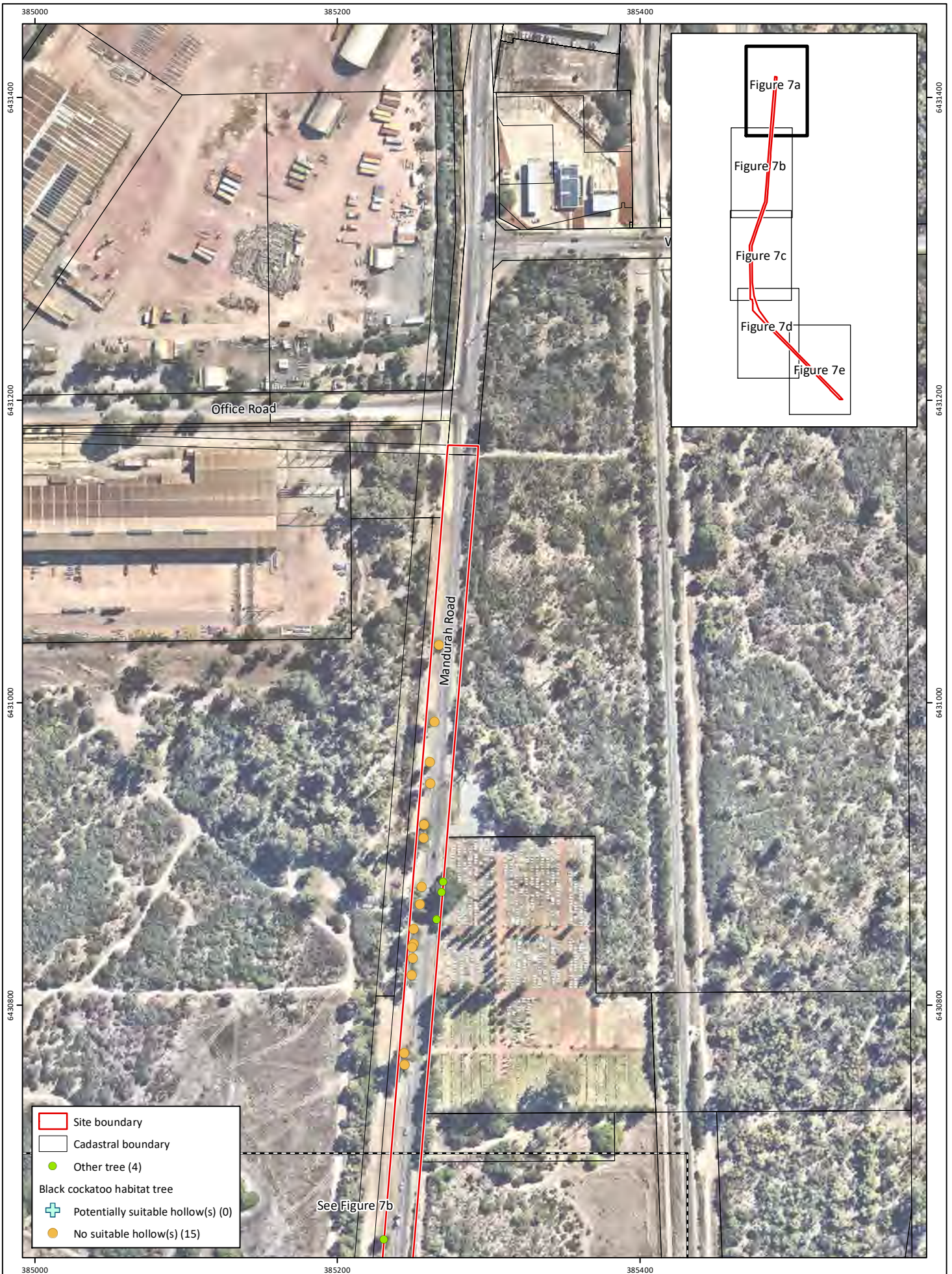


Figure 7a: Trees

Project: Reconnaissance Flora, Vegetation and Tree Assessment
 Part Mandurah Road Reserve between Dixon Road and Office Road

Client: City of Rockingham

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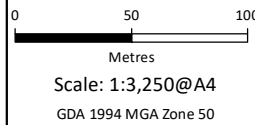




Figure 7b: Trees

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Part Mandurah Road Reserve between Dixon Road and Office Road

Client: City of Rockingham

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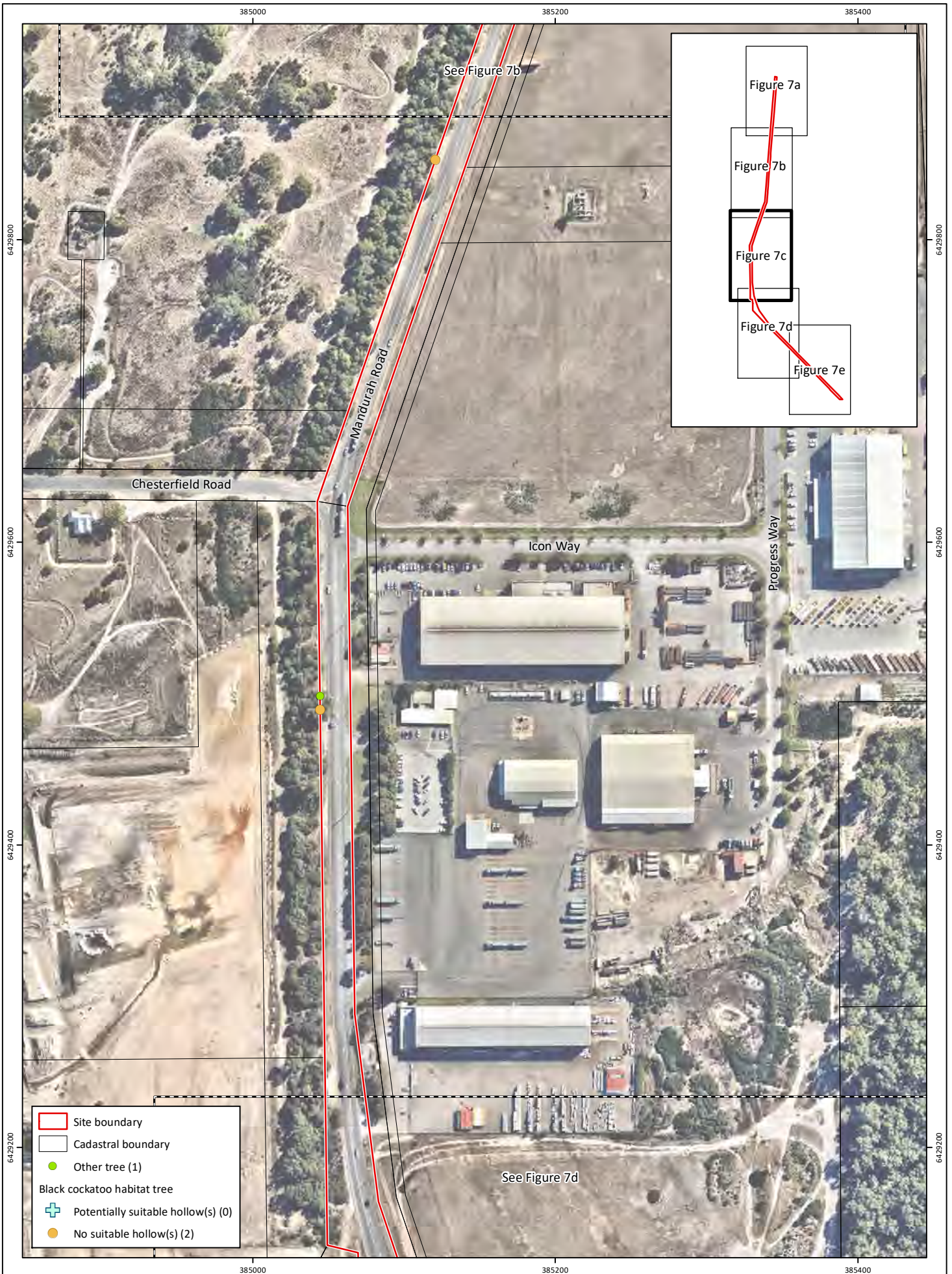


Figure 7c: Trees

Project: Reconnaissance Flora, Vegetation and Tree Assessment
Part Mandurah Road Reserve between Dixon Road and Office Road

Client: City of Rockingham

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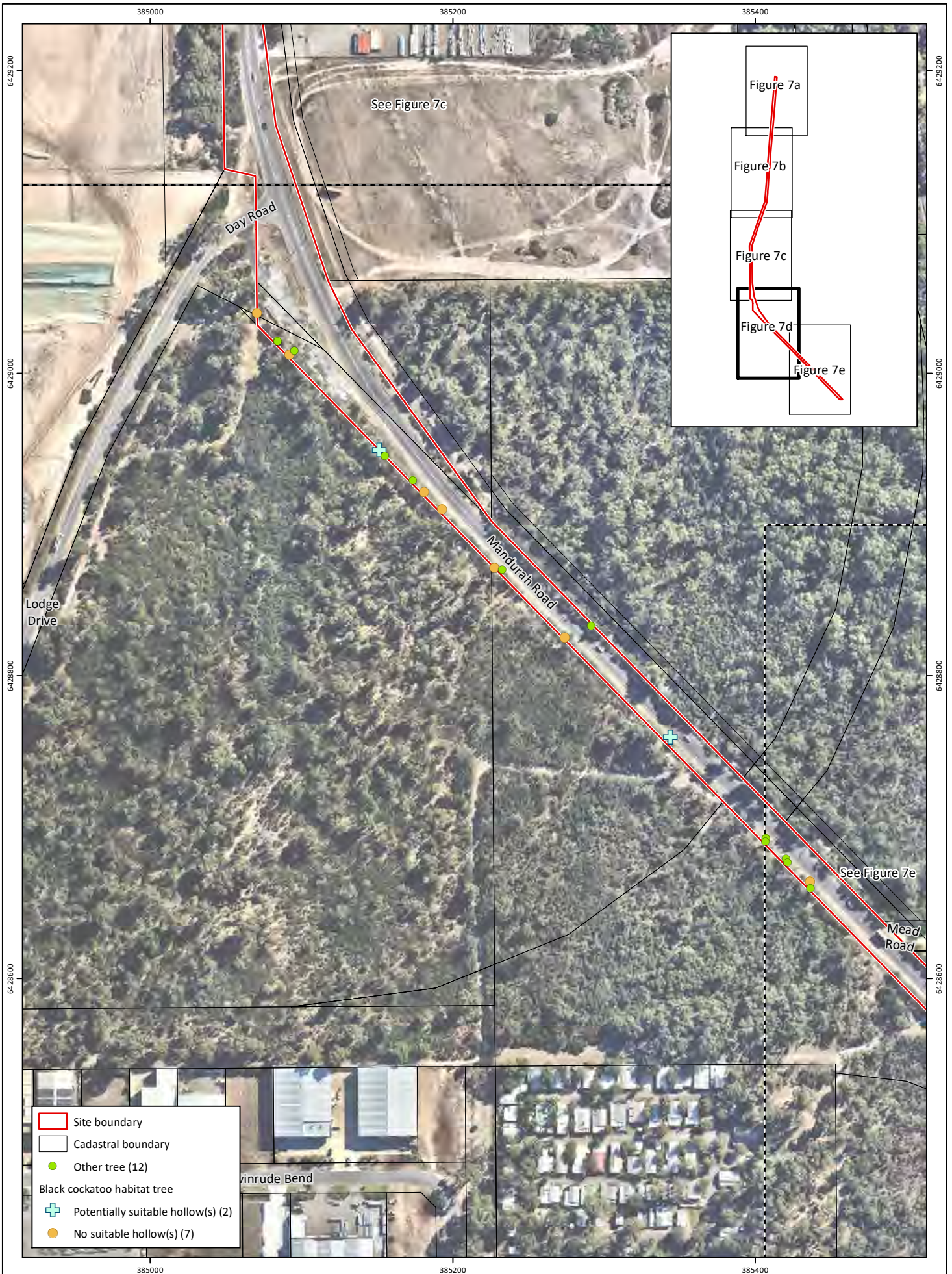


Figure 7d: Trees

Project: Reconnaissance Flora, Vegetation and Tree Assessment
Part Mandurah Road Reserve between Dixon Road and Office Road

Client: City of Rockingham

Plan Number: EP22-039(01)-F07
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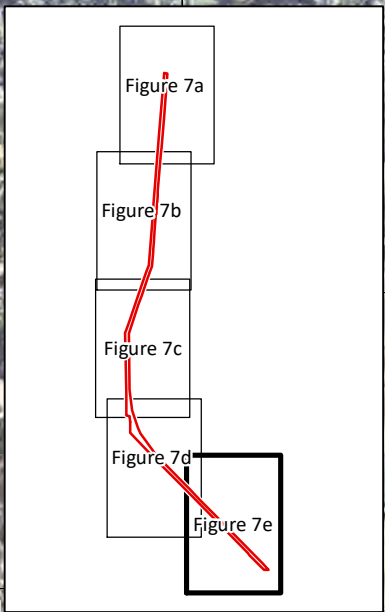
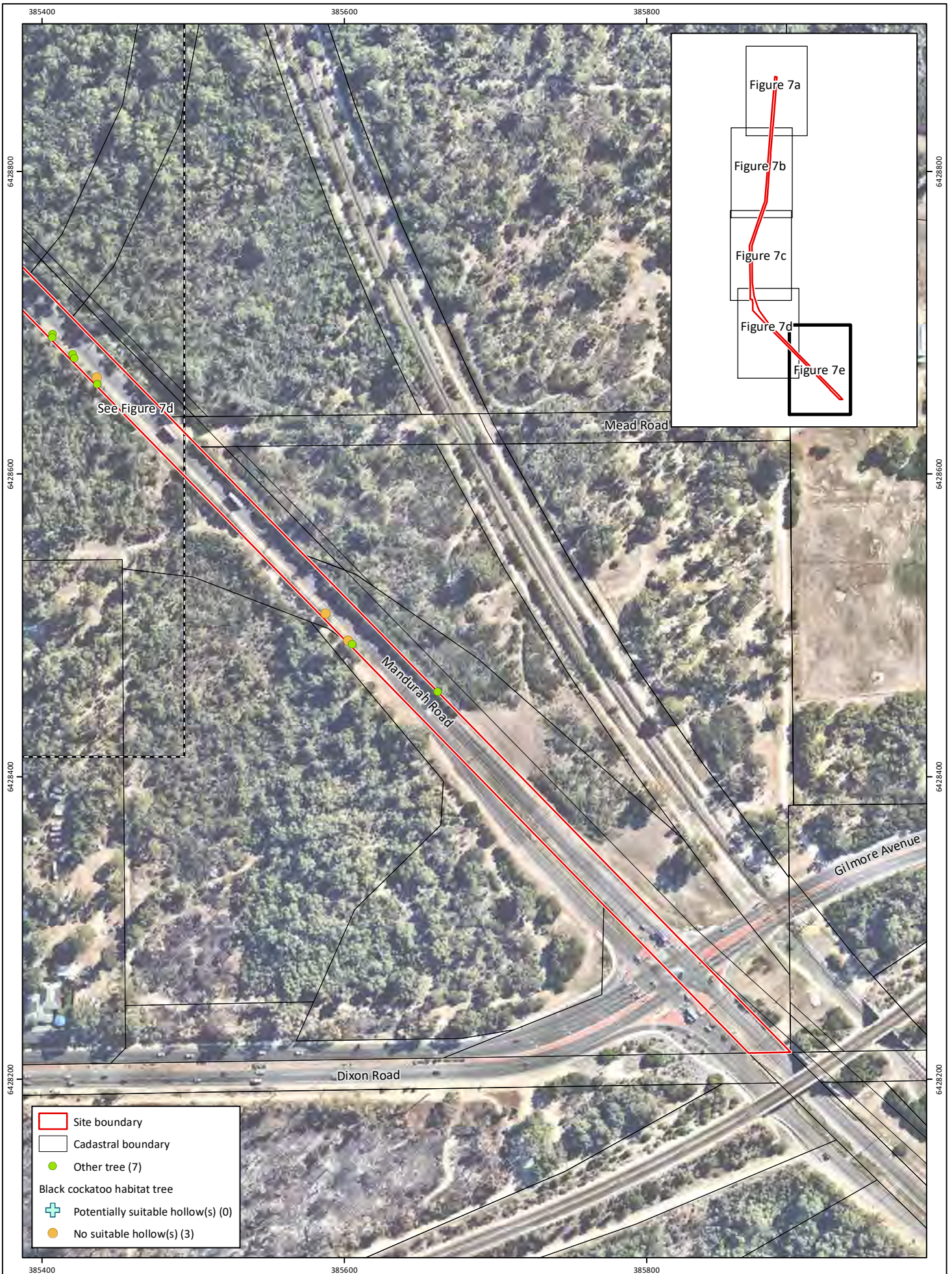


Figure 7e: Trees

Project: Reconnaissance Flora, Vegetation and Tree Assessment
Part Mandurah Road Reserve between Dixon Road and Office Road

Client: City of Rockingham

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GDA 1994 MGA Zone 50



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Appendix A

Additional Information



Conservation Significant Flora and Vegetation

Threatened and priority flora

Flora species considered rare or under threat warrant special protection under Commonwealth and/or State legislation. At the Commonwealth level, flora species can be listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Flora species considered 'threatened' pursuant to Schedule 1 of the EPBC Act are assigned categories according to their conservation status, as outlined in **Table 1**.

In Western Australia, plant taxa may be classed as 'threatened' under the *Biodiversity Conservation Act 2016* (BC Act) which is enforced by Department of Biodiversity Conservation and Attractions (DBCA). Threatened flora species are listed under sections 19(1) and 26(2) of the BC Act. It is an offence to 'take' or disturb threatened flora without Ministerial approval. Section 5(1)1 of the Act defines to take as including "... to gather, pluck, cut, pull up, destroy, dig up, remove, harvest or damage flora by any means" or to cause or permit the same to be done. The definition of threatened flora under the BC Act is provided in **Table 1**.

Section 43 of the BC Act requires that an occurrence of a threatened species or threatened ecological community is reported to DBCA where the occurrence has been identified as part of field work completed:

- as part of an assessment under Part IV of the *Environmental Protection Act 1986*; or
- in relation to an application for a clearing permit under the *Environmental Protection Act 1986* section 51E(1)(d).

Penalties apply to individuals and organisations that fail to provide accurate reports of threatened species or communities.

The *Biodiversity Conservation Regulations 2018* (BC Regulations 2018) came into effect on January 1 2019. The BC Regulations include provisions for licencing, charges, penalties and other provisions associated with the BC Act.

Flora species that may be threatened or near threatened but lack sufficient information to be listed under the BC Act may be added to the DBCA's *Priority Flora List* (DBCA 2018c). Priority flora species are considered during State approval processes. Priority flora categories and definitions are listed in **Table 1**.

Additional Background Information

Table 1: Definitions of conservation significant flora species pursuant to the EPBC Act and BC Act and on DBCA's Priority Flora List (DBCA 2018c)

Conservation code	Description
EX [†]	Threatened Flora – Presumed Extinct Taxa which have not been collected, or otherwise verified, over the past 50 years despite thorough searching, or of which all known wild populations have been destroyed more recently, and have been gazetted as such.
T [†]	Threatened Flora – Extant Taxa which are declared to be likely to become extinct or is rare, or otherwise in need of special protection.
CR [^]	Threatened Flora – Critically Endangered Taxa which are considered to be facing an extremely high risk of extinction in the wild.
EN [^]	Threatened Flora – Endangered Taxa which are considered to be facing a very high risk of extinction in the wild.
VU [^]	Threatened Flora – Vulnerable Taxa which are considered to be facing a high risk of extinction in the wild.
P1 [□]	Priority One – Poorly Known Taxa which are known from one or a few (generally <5) populations which are under threat, either due to small population size, or being on lands under immediate threat e.g. road verges, urban areas, farmland, active mineral leases etc., or the plants are under threat, e.g. from disease, grazing by feral animals etc. May include taxa with threatened populations on protected lands. Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey.
P2 [□]	Priority Two – Poorly Known Taxa which are known from one or a few (generally <5) populations, at least some of which are not believed to be under immediate threat (i.e. not currently endangered). Such taxa are under consideration for declaration as 'rare flora', but urgently need further survey.
P3 [□]	Priority Three – Poorly Known Taxa which are known from several populations, and the taxa are not believed to be under immediate threat (i.e. not currently endangered), either due to the number of known populations (generally >5), or known populations being large, and either widespread or protected. Such taxa are under consideration for declaration as 'rare flora' but needs further survey.
P4 [□]	Priority Four – Rare Taxa which are considered to have been adequately surveyed and which, whilst being rare (in Australia), are not currently threatened by any identifiable factors. These taxa require monitoring every 5-10 years.

[^]pursuant to the EPBC Act, [†]pursuant to the BC Act, [□]on DBCA's Priority Flora List

Threatened and priority ecological communities

'Threatened ecological communities' (TECs) are recognised as ecological communities that are rare or under threat and therefore warrant special protection. Selected TECs are afforded statutory protection at a Commonwealth level under section 181 of the EPBC Act. TECs nominated for listing under the EPBC Act are considered by the Threatened Species Scientific Committee and a final decision is made by the Commonwealth Minister for the Environment. Once listed under the EPBC Act, communities are categorised as either 'critically endangered', 'endangered' or 'vulnerable' as defined in **Table 2**. Any action likely to have a significant impact on a community listed under the EPBC Act requires approval from the Minister for the Environment.

Additional Background Information

Within Western Australia TECs are determined by the Western Australian Threatened Ecological Communities Scientific Advisory Committee (WATECSAC) and endorsed by the State Minister for the Environment. The WATECSAC is an independent group comprised of representatives from organisations including tertiary institutions, the Western Australian Museum and DBCA. The TECs endorsed by the State Minister are published by DBCA (DBCA 2018b).

TECs are assigned to one of the categories outlined in **Table 2** according to their status (in relation to the level of threat). TECs are afforded direct statutory protection at a State level under the BC Act and BC Regulations. Ecological communities are listed under Section 27(1) and 33 of the BC Act. Their significance is also acknowledged through other state environmental approval processes such as 'environmental impact assessment' pursuant to Part IV of the *Environmental Protection Act 1986* (EP Act) and the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*.

Table 2: Categories of threatened ecological communities (English and Blyth 1997; DEC 2009)

Conservation code	Description
PD	Presumably Totally Destroyed An ecological community that has been adequately searched for but for which no representative occurrences have been located.
CE	Critically Endangered An ecological community that has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future.
E	Endangered An ecological community that has been adequately surveyed and is not critically endangered but is facing a very high risk of total destruction in the near future.
V	Vulnerable An ecological community that has been adequately surveyed and is not critically endangered or endangered but is facing a high risk of total destruction or significant modification in the medium to long-term future.

An ecological community that is under consideration for listing as a TEC, but does not yet meet survey criteria or has not been adequately defined may be listed as a 'priority ecological community' (PEC). PECs are categorised as priority category 1, 2 or 3 as described in **Table 3**. Ecological communities that are adequately known and are rare but not threatened, or meet criteria for 'near threatened', or that have been recently removed from the threatened list, are placed in 'priority 4'. These ecological communities require regular monitoring. Conservation dependent ecological communities are placed in 'priority 5' (DEC 2013). Listed PECs are published by DBCA (DBCA 2017b).

Additional Background Information

Table 3: Categories of priority ecological communities (DEC 2013)

Priority code	Description
P1	<p>Priority One: Poorly known ecological communities</p> <p>Ecological communities that are known from very few occurrences with a very restricted distribution (generally ≤ 5 occurrences or a total area of ≤ 100ha). Occurrences are believed to be under threat either due to limited extent, or being on lands under immediate threat (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) or for which current threats exist. May include communities with occurrences on protected lands. Communities may be included if they are comparatively well-known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.</p>
P2	<p>Priority Two: Poorly known ecological communities</p> <p>Communities that are known from few occurrences with a restricted distribution (generally ≤ 10 occurrences or a total area of ≤ 200ha). At least some occurrences are not believed to be under immediate threat (within approximately 10 years) of destruction or degradation. Communities may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under threat from known threatening processes.</p>
P3	<p>Priority Three: Poorly known ecological communities</p> <p>(i) Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or:</p> <p>(ii) communities known from a few widespread occurrences, which are either large or with significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat (within approximately 10 years), or;</p> <p>(iii) communities made up of large, and/or widespread occurrences, that may or may not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, inappropriate fire regimes, clearing, hydrological change etc.</p> <p>Communities may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and/or are not well defined, and known threatening processes exist that could affect them.</p>
P4	<p>Priority Four: Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list. These communities require regular monitoring.</p> <p>(i) Rare. Ecological communities known from few occurrences that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These communities are usually represented on conservation lands.</p> <p>(ii) Near Threatened. Ecological communities that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for a higher threat category.</p> <p>(iii) Ecological communities that have been removed from the list of threatened communities during the past five years.</p>
P5	<p>Priority Five: Conservation Dependent ecological communities</p> <p>Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.</p>

Weeds

A number of legislative and policy documents exist in relation to weed management at state and national levels. The *Biosecurity and Agriculture Management Act 2007* (BAM Act) is the principle legislation guiding weed management in Western Australia and lists declared pest species. At a national level, the Australian government has compiled a list of 32 Weeds of National Significance (WoNS) (DoEE 2018), of which many are also listed under the BAM Act.

Declared Pests

Part 2.3.23 of the BAM Act requires a person must not; “a) keep, breed or cultivate the declared pest; b) keep, breed or cultivate an animal, plant or other thing that is infected or infested with the declared pest; c) release into the environment the declared pest, or an animal, plant or other thing that is infected or infested with the declared pest; or d) intentionally infect or infest, or expose to infection or infestation, a plant, animal or other thing with a declared pest”.

Under the BAM Act, all declared pests are assigned a legal status, as described in **Table 7**. Species assigned to the ‘declared pest, prohibited - s12’ category are placed in one of three control categories, as described in **Table 8**.

The *Biosecurity and Agriculture Management Regulations 2013* specify keeping categories for species assigned to the ‘declared pest - s22(2)’ category, which relate to the purposes of which species can be kept, as well as the entities that can keep them. The categories are described in **Table 9**.

The Western Australian Organism List (WAOL) provides the status of organisms which have been categorised under the BAM Act (DPIRD 2020).

Table 4: Legal status of declared pest species listed under the BAM Act (DPIRD 2020)

Category	Description
Declared Pest Prohibited - s12	May only be imported and kept subject to permits. Permit conditions applicable to some species may only be appropriate or available to research organisations or similarly secure institutions.
Declared Pest s22(2)	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

Table 5: Control categories of declared pest species listed under the BAM Act (DPIRD 2020)

Category	Description
C1	Exclusion Not established in Western Australia and control measures are to be taken, including border checks, in order to prevent them entering and establishing in the State.
C2	Eradication Present in Western Australia in low enough numbers or in sufficiently limited areas that their eradication is still a possibility.
C3	Management Established in Western Australia but it is feasible, or desirable, to manage them in order to limit their

Additional Background Information

Category	Description
	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.

Table 6: Keeping categories of declared pest species listed under the BAM Act (DPIRD 2020)

Category	Description
Prohibited	Can only be kept under a permit for public display and education purposes, and/or genuine scientific research, by entities approved by the state authority.
Exempt	No permit or conditions are required for keeping.
Restricted	Organisms which, relative to other species, have a low risk of becoming a problem for the environment, primary industry or public safety and can be kept under a permit by private individuals.

Wetland Habitat

Geomorphic wetland types

On the Swan Coastal Plain DBCA (2017a) have used the geomorphic wetland classification system developed by Semeniuk (1987) and Semeniuk and Semeniuk (1995) to classify wetlands based on the landform shape and water permanence (hydro-period) as outlined in **Table 10**.

Table 7: Geomorphic Wetlands of the Swan Coastal Plain classification categories (DBCA 2017a)

Level of inundation	Geomorphology			
	Basin	Flat	Channel	Slope
Permanently inundated	Lake	-	River	-
Seasonally inundated	Sumpland	Floodplain	Creek	-
Seasonally waterlogged	Dampland	Palusplain	-	Paluslope

Wetland management categories

DBCA maintains the *Geomorphic Wetland of the Swan Coastal Plain* dataset (DBCA 2018a), which also categorises individual wetlands into specific management categories as described in **Table 11**.

Table 8: Geomorphic Wetlands of the Swan Coastal Plain classification categories (DBCA 2017a)

Management category	Description of wetland	Management objectives
Conservation (CCW)	Support high levels of attributes	Preserve wetland attributes and functions through reservation in national parks, crown reserves and state owned land. Protection provided under environmental protection policies.
Resource enhancement (REW)	Partly modified but still supporting substantial functions and attributes	Restore wetland through maintenance and enhancement of wetland functions and attributes. Protection via crown reserves, state or local government owned land, environmental protection policies and sustainable management on private properties.
Multiple use (MUW)	Few wetland attributes but still provide important hydrological functions	Use, development and management considered in the context of water, town and environmental planning through land care.

The management categories of wetland features are determined based on hydrological, biological and human use features. The DBCA document *A methodology for the evaluation of specific wetland types on the Swan Coastal Plain, Western Australia* (DBCA 2017a) details the methodology by which wetlands on the Swan Coastal Plain are assigned management categories based on a two tiered evaluation system, with preliminary and secondary evaluation stages. The preliminary evaluation aims to identify any features of conservation significance that would immediately place the wetland within the CCW management category. Examples of these significant features include presence on significant wetland lists, presence of TECs or PECs (Priority 1 and 2), presence of threatened flora and

Additional Background Information



over 90% of vegetation in good or better condition based on the Keighery (1994) scale. If such environmental values are identified the wetland would be categorised as CCW without further evaluation.

Should the preliminary evaluation indicate that no such features occur, the secondary evaluation and site assessment are then applied. In the secondary evaluation, an appropriate management category is determined through the assessment of a range of environmental attributes, functions and values.

Wetland reclassification

DBCA have a protocol for proposing changes to the wetland boundaries and management categories of the existing geomorphic wetland dataset (DEC 2007). The procedure involves a wetland desktop evaluation and site assessment which culminates in a recommended management category.

Relevant information should be obtained in the optimal season for vegetation condition and water levels, which is usually spring (DEC 2007). In the case of larger wetlands that have undergone a degree of disturbance, a separate management category may be assigned to parts of the wetland in order to reflect the current values.

References

General references

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Additional Background Information



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Appendix B

Conservation Significant Flora Species and likelihood of
Occurrence Assessment



Species name	Level of significance		Life strategy	Habitat	Flowering period	Likelihood of occurrence
	WA	EPBC Act				
<i>Caladenia huegelii</i>	CR	EN	PG	Well-drained, deep sandy soils in lush undergrowth in a variety of moisture levels.	Sep-early Nov	Unlikely
<i>Synaphea</i> sp. Fairbridge Farm (D. Papenfus 696)	CR	CR	P	Low woodland on grey, clayey sand with lateritic pebbles (Pinjarra Plain) near winter wet flats.	Sep-Nov	Unlikely
<i>Synaphea</i> sp. Serpentine (G.R. Brand 103)	CR	CR	P	Seasonally damp areas, loam - sand.	Sep-Oct	Unlikely
<i>Drakaea elastica</i>	CR	EN	PG	Bare patches of sand within otherwise dense vegetation in low-lying areas alongside winter-wet swamps. Typically in banksia woodland or thickets of <i>Kunzea glabrescens</i> .	late Sep-Oct/Nov, survey Jul-Aug	Unlikely
<i>Eucalyptus x balanites</i>	CR	EN	P	Light coloured sandy soils over laterite. Habitat consists of gently sloping heathlands; open mallee woodland over shrubland (Population 2) or heathland with emergent mallees (population 1)	Oct - Feb	Unlikely
<i>Drakaea micrantha</i>	EN	VU	PG	Open sandy patches often adjacent to winter-wet swamps.	Sept- early Oct	Unlikely
<i>Diuris purdiei</i>	EN	EN	PG	Sand to sandy clay soils in areas subject to winter inundation.	late September to mid-October	Unlikely
<i>Eleocharis keigheryi</i>	VU	VU	P	Clay or sandy loam in freshwater creeks and transient waterbodies such as seasonally wet clay pans.	Aug-Dec	Unlikely
<i>Andersonia gracilis</i>	VU	EN	P	Seasonally damp, black sandy clay flats near or on the margins of swamps.	Sep-Nov	Unlikely
<i>Diuris drummondii</i>	VU	VU	PG	In low-lying depressions in peaty and sandy clay swamps.	Nov-Jan	Unlikely
<i>Diuris micrantha</i>	VU	VU	PG	Dark grey-black sandy clay-loam in winter wet depressions or swamps. Often in shallow standing water.	Aug/Sep-early Oct	Unlikely
<i>Acacia</i> sp. Binningup (G. Cockerton et al. WB 37784)	P1	-	P	Woodland and shrubland on sand, often in degraded areas	Aug	Unlikely
<i>Boronia juncea</i> subsp. <i>juncea</i>	P1	-	P	Sand in low scrub.	Apr	Unlikely
<i>Lachnagrostis nesomytica</i> subsp. <i>paralia</i>	P1	-	A/P	Calcareous sands. Coastal dunes and swales.	Unknown	Unlikely

Species name	Level of significance		Life strategy	Habitat	Flowering period	Likelihood of occurrence
	WA	EPBC Act				
<i>Acacia lasiocarpa</i> var. bracteolata long peduncle variant (G.J. Keighery 5026)	P1	-	P	Grey or black sand over clay. Swampy areas, winter wet lowlands.	May or Aug	Unlikely
<i>Acacia benthamii</i>	P2	-	P	Sand, typically on limestone breakaways	Aug-Sept	Unlikely
<i>Thelymitra variegata</i>	P2	-	P	Sandy clay, sand, laterite.	Jun-Sep	Unlikely
<i>Netrostylis</i> sp. Chandala (G.J. Keighery 17055)	P2	-	P	Peaty soils on edges of swamps.	Feb, July	Unlikely
<i>Austrostipa mundula</i>	P3	-	P	Grey sand over limestone.	Sept-Nov	Unlikely
<i>Beyeria cinerea</i> subsp. <i>cinerea</i>	P3	-	P	Sand, limestone.	May-Oct	Unlikely
<i>Calandrinia oraria</i>	P3	-	A/P	Coastal dunes, in low heath, sand over limestone.	Aug-Oct	Unlikely
<i>Pimelea calcicola</i>	P3	-	P	Sand, limestone on coastal ridges.	Sep-Nov	Unlikely
<i>Sphaerolobium calcicola</i>	P3	-	P	White-grey-brown sand, sandy clay over limestone, black peaty sandy clay. Tall dunes, winter-wet flats, interdunal swamps, low-lying areas.	Jun or Sep-Nov	Unlikely
<i>Dillwynia dillwynioides</i>	P3	-	P	Winter wet depressions on sandy soils	Aug - Dec	Unlikely
<i>Schoenus capillifolius</i>	P3	-	A	Brown mud in claypans.	Oct-Nov	Unlikely
<i>Cyathochaeta teretifolia</i>	P3	-	P	Grey sand, sandy clay in swamps and creek edges.	Oct-Jan	Unlikely
<i>Stylidium paludicola</i>	P3	-	P	Peaty sand over clay. Winter wet habitats. Marri and Melaleuca woodland, Melaleuca shrubland	Oct-Dec	Unlikely
<i>Jacksonia gracillima</i>	P3	-	P	Sand, often adjacent to winter wet areas	Sep-Dec	Unlikely
<i>Dodonaea hackettiana</i>	P4	-	P	Sand, outcropping limestone.	Jul-Oct	Unlikely
<i>Jacksonia sericea</i>	P4	-	P	Calcareous and sandy soils on Swan Coastal Plain	Dec-Feb	Unlikely
<i>Aponogeton hexatepalus</i>	P4	-	P	Mud. Freshwater: ponds, rivers, claypans.	Jul-Oct	Unlikely
<i>Stylidium ireneae</i>	P4	-	P	Sandy loam in valleys near creeklines.	Oct-Dec	Unlikely
<i>Stylidium longitubum</i>	P4	-	A	Sandy clay, clay. Seasonal wetlands.	Oct-Dec	Unlikely

Note: T=threatened, CE=critically endangered, E=endangered, V=vulnerable, P1=Priority 1, P2=Priority 2, P3=Priority 3, P4=Priority 4, P=perennial, PG=perennial geophyte, A=annual.

Appendix C

Species List



Family	Status	Species
Aizoaceae	*	<i>Carpobrotus edulis</i>
Araceae	*DP	<i>Zantedeschia aethiopica</i>
Asparagaceae		<i>Acanthocarpus preissii</i>
	*,DP, WoNS	<i>Asparagus asparagoides</i>
Asteraceae	*	<i>Arctotheca calendula</i>
	*	<i>Erigeron bonariensis</i>
	*	<i>Erigeron</i> sp.
	*	<i>Sonchus oleraceus</i>
	*	<i>Ursinia anthemoides</i>
Cupressaceae	PI	<i>Callitris preissii</i>
Euphorbiaceae	*	<i>Euphorbia</i> sp.
Fabaceae		<i>Acacia rostellifera</i>
		<i>Acacia saligna</i>
		<i>Hardenbergia comptoniana</i>
		<i>Jacksonia furcellata</i>
	*	<i>Lupinus</i> sp.
		<i>Templetonia retusa</i>
Iridaceae	*	<i>Gladiolus caryophyllaceus</i>
Goodeniaceae	*	<i>Romulea rosea</i>
	*	<i>Watsonia</i> sp.
Myrtaceae		<i>Eucalyptus gomphocephala</i>
Oxalidaceae	*	<i>Oxalis pes-caprae</i>
Plantaginaceae	*	<i>Plantago lanceolata</i>
Poaceae	*	<i>Cynodon dactylon</i>
	*	<i>Ehrharta</i> sp.
	*	<i>Eragrostis curvula</i>
	*	<i>Stenotaphrum secundatum</i>
Ranunculaceae		<i>Clematis linearifolia</i>
Rhamnaceae		<i>Spyridium globulosum</i>
Xanthorrhoeaceae		<i>Xanthorrhoea preissii</i>

*=non-native, DP=declared pest, WoNS=Weed of national environmental significance, PI=planted

Appendix D

Conservation Significant Communities and Likelihood of
Occurrence Assessment



Code	Community name	TEC/ PEC	Level of significance		Likelihood of occurrence
			State	EPBC Act	
SCP3a	<i>Corymbia calophylla</i> - <i>Kingia australis</i> woodlands on heavy soils of the Swan Coastal Plain	TEC	CR	EN	Unlikely
SCP3c	<i>Corymbia calophylla</i> - <i>Xanthorrhoea preissii</i> woodlands and shrublands of the Swan Coastal Plain (floristic community type 3c as originally described in in Gibson et al. (1994))	TEC	CR	EN	Unlikely
SCP08	Herb rich shrublands in clay pans (floristic community type 8 as originally described in Gibson et al. (1994))	TEC	VU	CR	Unlikely
SCP09	Dense shrublands on clay flats (floristic community type 9 as originally described in Gibson et al. (1994))	TEC	CR	CR	Unlikely
-	Clay Pans of the Swan Coastal Plain	TEC	-	CR	Unlikely
SCP19a	Sedgeland in Holocene dune swales of the southern Swan Coastal Plain (floristic community type 19 as originally described in in Gibson et al. (1994))	TEC	CR	EN	Unlikely
SCP19b	Woodlands over sedgelands in Holocene dune swales of the southern Swan Coastal Plain (original description; Gibson et al. (1994)).	TEC	CR	EN	Unlikely
Mound Springs SCP	Communities of Tumulus Springs (Organic Mound Springs, Swan Coastal Plain)	TEC	CR	EN	Unlikely
Tuart woodlands	Tuart (<i>Eucalyptus gomphocephala</i>) woodlands and forests of the Swan Coastal Plain	TEC/ PEC	P3	CR	Likely
Banksia WL SCP	Banksia Woodlands of the Swan Coastal Plain ecological community	TEC/ PEC	P3	EN	Unlikely
SCP22	<i>Banksia ilicifolia</i> woodlands	TEC/ PEC	P3	EN	Unlikely
SCP21c	Low lying <i>Banksia attenuata</i> woodlands or shrublands	TEC/ PEC	P3	EN	Unlikely
SCP26a	<i>Melaleuca huegelii</i> - <i>Melaleuca systema</i> shrublands on limestone ridges (floristic community type 26a as originally described in Gibson et al. (1994))	TEC	EN	-	Unlikely
Richmond-microbial	Thrombolite (microbial) community of coastal freshwater lakes of the Swan Coastal Plain (Lake Richmond)	TEC	CR	EN	Unlikely
Coastal Saltmarsh	Subtropical and Temperate Coastal Saltmarsh	TEC/ PEC	P3	VU	Unlikely
SCP30a	<i>Callitris preissii</i> (or <i>Melaleuca lanceolata</i>) forests and woodlands, Swan Coastal Plain (floristic community type 30a as originally described in Gibson et al. (1994))	TEC	VU	-	Unlikely
Walyungup Microbial	Microbial community of a coastal saline lake (Lake Walyungup)	PEC	P1	-	Unlikely
SCP24	Northern Spearwood shrublands and woodlands	PEC	P3	-	Unlikely
SCP25	Southern <i>Eucalyptus gomphocephala</i> - <i>Agonis flexuosa</i> woodlands	PEC	P3	-	Unlikely
SCP29a	Coastal shrublands on shallow sands	PEC	P3	-	Unlikely
SCP29b	Acacia shrublands on taller dunes	PEC	P3	-	Unlikely

Note: TEC=threatened ecological community, PEC=priority ecological community, CR=critically endangered, EN=endangered, VU=vulnerable, P1=Priority 1, P3=priority 3. Communities considered to potentially occur within the site are shaded green

Appendix E

Tree data



Part Mandurah Road Reserve between Dixon Road and Fifty Road

Tag No.	Easting	Northing	DBH (cm)	Species	Category	Notes
-	385587.55	6428507.7	53	Eucalyptus gomphocephala	Black cockatoo habitat tree	No suitable hollow/s
-	385436.39	6428663.98	81	Eucalyptus gomphocephala	Black cockatoo habitat tree	No suitable hollow/s
-	385092.1	6429012.31	53	Eucalyptus gomphocephala	Black cockatoo habitat tree	No suitable hollow/s
-	385223.98	6430561.26	94	Eucalyptus gomphocephala	Black cockatoo habitat tree	No suitable hollow/s
-	385244.36	6430760.39	76	Eucalyptus gomphocephala	Black cockatoo habitat tree	No suitable hollow/s
-	385249.05	6430819.98	92	Eucalyptus gomphocephala	Black cockatoo habitat tree	No suitable hollow/s
-	385250.52	6430840.51	88	Eucalyptus gomphocephala	Black cockatoo habitat tree	No suitable hollow/s
-	385254.55	6430866.61	113	Eucalyptus gomphocephala	Black cockatoo habitat tree	No suitable hollow/s
-	385256.98	6430910.44	114	Eucalyptus gomphocephala	Black cockatoo habitat tree	No suitable hollow/s
-	385261.37	6430946.52	84	Eucalyptus gomphocephala	Black cockatoo habitat tree	No suitable hollow/s
-	385264.11	6430987.35	90	Eucalyptus gomphocephala	Black cockatoo habitat tree	No suitable hollow/s
-	385602.36	6428489.91	106	Eucalyptus gomphocephala	Black cockatoo habitat tree	No suitable hollow/s
-	385274.24	6428825.13	68	Eucalyptus gomphocephala	Black cockatoo habitat tree	No suitable hollow/s
-	385227.66	6428871.37	62	Eucalyptus gomphocephala	Black cockatoo habitat tree	No suitable hollow/s
-	385044.47	6429489.44	101	Eucalyptus gomphocephala	Black cockatoo habitat tree	No suitable hollow/s
-	385120.57	6429852.81	90	Eucalyptus gomphocephala	Black cockatoo habitat tree	No suitable hollow/s
-	385224.53	6430568.14	63	Eucalyptus gomphocephala	Black cockatoo habitat tree	No suitable hollow/s
-	385244.27	6430768.15	133	Eucalyptus gomphocephala	Black cockatoo habitat tree	No suitable hollow/s
-	385249.87	6430830.86	62	Eucalyptus gomphocephala	Black cockatoo habitat tree	No suitable hollow/s
-	385249.5	6430838.39	63	Eucalyptus gomphocephala	Black cockatoo habitat tree	No suitable hollow/s
-	385250.4	6430850.38	88	Eucalyptus gomphocephala	Black cockatoo habitat tree	No suitable hollow/s
-	385255.74	6430878.05	91	Eucalyptus gomphocephala	Black cockatoo habitat tree	No suitable hollow/s
-	385257.44	6430919.09	81	Eucalyptus gomphocephala	Black cockatoo habitat tree	No suitable hollow/s
-	385261.31	6430960.71	68	Eucalyptus gomphocephala	Black cockatoo habitat tree	No suitable hollow/s
-	385267.31	6431038.06	79	Eucalyptus gomphocephala	Black cockatoo habitat tree	No suitable hollow/s
-	385343.94	6428759.28	86	Eucalyptus gomphocephala	Black cockatoo habitat tree	Potentially suitable hollow/s
-	385192.92	6428910.13	74	Stag	Black cockatoo habitat tree	No suitable hollow/s
-	385070.65	6429039.88	78	Stag	Black cockatoo habitat tree	No suitable hollow/s
-	385181.21	6428921.53	62	Stag	Black cockatoo habitat tree	No suitable hollow/s
-	385151.37	6428949.39	113	Stag	Black cockatoo habitat tree	Potentially suitable hollow/s
-	385291.67	6428833.31	15-35	Eucalyptus gomphocephala	Tree	-

Part Mandurah Road Reserve between Dixon Road and Fifty Road

Tag No.	Easting	Northing	DBH (cm)	Species	Category	Notes
-	385661.94	6428456.08	15-35	Eucalyptus gomphocephala	Tree	-
-	385605.11	6428487.5	35-<50	Eucalyptus gomphocephala	Tree	-
-	385420.39	6428679.1	15-35	Eucalyptus gomphocephala	Tree	-
-	385407.15	6428692.59	15-35	Eucalyptus gomphocephala	Tree	-
-	385406.89	6428690.48	15-35	Eucalyptus gomphocephala	Tree	-
-	385232.94	6428870.45	15-35	Eucalyptus gomphocephala	Tree	-
-	385173.58	6428929.2	15-35	Eucalyptus gomphocephala	Tree	-
-	385155.26	6428945.41	35-<50	Eucalyptus gomphocephala	Tree	-
-	385095.27	6429015.12	35-<50	Eucalyptus gomphocephala	Tree	-
-	385044.35	6429498.28	15-35	Eucalyptus gomphocephala	Tree	-
-	385436.72	6428659.66	15-35	Eucalyptus gomphocephala	Tree	-
-	385421.55	6428676.79	15-35	Eucalyptus gomphocephala	Tree	-
-	385084.18	6429021.43	15-35	Eucalyptus gomphocephala	Tree	-
-	385084.27	6429021.43	15-35	Eucalyptus gomphocephala	Tree	-
-	385265.69	6430856.65	>50	Eucalyptus sp.	Tree	-
-	385268.88	6430874.65	>50	Ficus macrophylla	Tree	-
-	385270.03	6430881.56	>50	Ficus macrophylla	Tree	-
-	385233.64	6430468.12	35-<50	Melia azedarach	Tree	-
-	385230.74	6430645.08	15-35	Olea europaea	Tree	-