AECOM

Main Roads Western Australia
17-Nov-2016

Biological Assessments

Toodyay Road Widening Metro and Wheatbelt Regions Biological Surveys

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Toodyay Road Widening Metro and Wheatbelt Regions Biological Surveys

Client: Main Roads Western Australia

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17-Nov-2016

Job No.: 60515588

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Quality Information

Document Biological Assessments

Ref 60515588

Date 17-Nov-2016

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Reviewed by L Kirchner

Revision History

Revision	Revision Date	Details	Authorised	
			Name/Position	Signature
A	11-Mar-2015	Draft Report		
B	17-Dec-2015	Draft Report for Internal Review		
C	18-Dec-2015	Draft Report for Client Review	Jared Leigh Principal Environmental Scientist	
0	01-Feb-2016	Final Report	Linda Kirchner Associate Director - Environment	
1	03-Mar-2016	Updated Report - Draft for Client Review	Linda Kirchner Associate Director - Environment	
2	09-May-2016	Draft Report	Jamie Shaw Technical Director - Environment	
3	13-Sep-2016	Draft for client review	Linda Kirchner Associate Director - Environment	
4	16 Nov-2016	Draft for client review	Linda Kirchner Associate Director - Environment	

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Executive Summary

Main Roads has identified Toodyay Road as requiring immediate upgrades (the Project) to improve the safety of road users. Biological assessments have been conducted to assess the environmental values within a 100 - 200 metres (m) corridor along Toodyay Road for approximately 52 kilometres (km) on both sides of the road between Toodyay and the Red Hill Waste Facility (the Study area).

The biological assessment included a desktop assessment, field surveys and the preparation of a concise technical report.

Environmental values in the Study area identified during the desktop assessment and field surveys included:

- Three MNES fauna species were recorded during the field surveys including the Endangered Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*), Vulnerable Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii* subsp. *naso*) and the Marine listed Rainbow Bee-eater (*Merops ornatus*)
- Seven other conservation significant fauna species have been assessed as likely to utilise habitats within the Study area, although they were not recorded during the survey. These include Baudin's Black Cockatoo (*Calyptorhynchus baudinii*), Chuditch (*Dasyurus geoffroii*), Common Sandpiper (*Actitis hypoleucos*), Fork-tailed Swift (*Apus pacificus*), Eastern Great Egret (*Ardea modesta*), Western Brush Wallaby (*Macropus irma*) and Peregrine Falcon (*Falco peregrinus)*
- Nine fauna habitats were mapped within the Study area, these comprised Eucalypt Woodland, Native Shrublands, Heath, Wetland, Planted Vegetation, Rehabilitation, Isolated Trees, River and Cleared
- 7,235 potential Black Cockatoo breeding trees containing 278 potentially suitable hollows
- 90 ha of native vegetation was considered to represent 'Good' quality foraging habitat for Carnaby's Black Cockatoo
- 82 ha of native vegetation was considered to represent 'Good' quality foraging habitat for the Forest Red-tailed Black Cockatoo
- Two A Class nature reserves, including Morangup Nature Reserve and one unnamed Recreational Area
- Two pre-European vegetation associations (Beard 1981) and three Heddle *et al.* (1980) vegetation complexes are below the 30% threshold remaining
- Five vegetation communities are considered significant as they support populations of Priority flora species. Furthermore, an additional two communities are significant as they support a unique composition of species in Morangup Nature Reserve
- Four Declared Pest species were recorded within the Study area including two flora species (*Asparagus asparagoides*/Bridal Creeper (also a WoNS) and *Gomphocarpus fruticosus*/Narrow Leaf Cotton Bush), and two fauna species (*Oryctolagus cuniculus*/Rabbit and *Vulpes vulpes*/Red Fox)
- Multiple waterways intersect the Study area including Avon River and Susannah Brook
- Vegetation mapping showed 22 distinct vegetation communities, including nine Eucalypt woodlands, eight wetlands, one heath community and four disturbed/degraded communities. Of these, five are considered significant (CcXpHh, EaXpBe, EdBn, EwBsLp and EwGtAl) as they support populations of Priority flora
- Seven Priority flora species were recorded during the Spring 2015 surveys. Of these, two species were located in Morangup Nature Reserve including *Banksia nivea* sp. Morangup (M. Pieroni 94/2) and *Verticordia citrella* (both Priority 2 species). These were not further assessed as the reserve will not be impacted by the project. Additional targeted surveys were undertaken in Spring 2016 to count individuals and map the population boundaries of the five species located outside the nature reserve. These species included:

- *Boronia scabra* subsp. *condensata* (Priority [P] 2) – two populations comprising 321 individuals
- *Calytrix oncophylla* (P2) – one population comprising 10 individuals
- *Grevillea candolleana* (P2) – six populations comprising 276 individuals
- *Caladenia integra* (P4) – one individual was recorded in Spring 2015
- *Hibbertia montana* (P4) – three populations comprising 1909 individuals.

A targeted Chuditch survey is being undertaken in October / November 2016. The level of assessment and detail provided in the report is considered suitable for meeting the objective of the project.

1.0 Introduction

1.1 Project background

Main Roads Western Australia (Main Roads) proposes to widen approximately 50 kilometres (km) of Toodyay Road to increase road user safety (the Project). The project design and works are still being finalised but may include up to four replacement bridges, two intersection upgrades, three passing lanes and potential realignments. AECOM Australia Pty Ltd (AECOM) was engaged to conduct biological assessments to inform further project scoping. The biological assessments are required to assess the environmental values within the defined Study area. The assessments included a single-phase Level 2 flora and vegetation survey and Level 1 fauna survey.

1.2 Project location

The proposed Project is located approximately 90 km northeast of Perth in the Shire of Toodyay (Figure 1). The Study area is a 100 - 200 m corridor along Toodyay Road, commencing 1.7 km east of the Red Hill Waste Facility and extending east to the Toodyay townsite. The Study area has been split by Main Roads into the Metro section and Wheatbelt section. This is shown on Figure 1.

1.3 Objective

The primary objective of the biological assessments was to define floristic, vegetation and fauna values within the Study area. This information will be used to assess potential impacts and inform the environmental assessment process.

Specifically, the objectives included:

- A desktop assessment that comprised:
  - data searches through Department of Parks and Wildlife (DPaW), Department of the Environment and Energy (DotEE) and the Western Australian Museum (WAM) which informs the identification of conservation significant species likely to be present in the Study area and include a likelihood of occurrence assessment
  - identifying significant values likely to be present in the Study area and potential sensitivity to impact including flora, fauna, soil, groundwater and surface water
  - identifying the location of any conservation estates or reserves within or in the vicinity of the Study area
  - identifying broad vegetation types present using pre-European types (Beard, 1981).
- Biological field surveys, in accordance with Environmental Protection Authority (EPA) Guidance Statement No.51, the Terrestrial Flora Survey Technical Guide (EPA & DPaW, 2015), and EPA Guidance Statement No.56, that comprised:
  - ecological community mapping and vegetation condition mapping using Keighery (1994)
  - surveying and mapping of the extent of Threatened and Priority flora populations within and in close proximity to the Study area and GPS tagging individuals
  - identifying and mapping the presence and extent of Threatened or Priority Ecological Communities (TECs and PECs)
  - identifying locations of Weeds of National Significance (WoNS) and Declared Pests listed under the *Biosecurity Agricultural Management Act 2007* (BAM Act)
  - surveying and mapping of suitable breeding, roosting and foraging habitat for Black Cockatoos
  - defining and mapping fauna habitat features and assessing significance of fauna habitat present.

The results of the desktop assessment and field surveys are presented in this technical report.

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GDA 1994 MGA Zone 50

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Metres

1:125,000 (when printed at A3)

LEGEND

Study Area
- Metro
- Wheatbelt

Data sources:

Base Data: © Western Australia Land Information Authority (Landgate) (2016)

Toodyay Biological Assessment

Project Location

PROJECT ID	60515588
CREATED BY	DGF
LAST MODIFIED	fotheringhamd - 16 Nov 2016
VERSION:	1

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2.0 Legislative Framework

2.1 Overview

Table 1 summarises the key legislation governing the protection and management of Western Australia's conservation significant species and communities, which are further discussed below and in Appendix A.

Table 1 Relevant legislation, regulations and guidance

Legislation	Purpose
Commonwealth of Australia	
Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)	Provides for the protection of the environment and the conservation of biodiversity.
EPBC Act Referral Guidelines for Three Threatened Black Cockatoo Species.	To assist in determining whether an action needs to be referred to the Australian Government. Also provides guidance on Black Cockatoo survey methodology.
Western Australia	
Wildlife Conservation Act 1950 (WC Act)	Provides for the conservation and protection of Western Australia's wildlife.
Environmental Protection Act 1986 (EP Act)	Preventing, controlling and abating environmental harm and conserving, preserving, protecting, enhancing and managing the environment.
Biosecurity and Agriculture Management Act 2007 (BAM Act)	Provides for the management, control and prevention of certain plants and animals, and for the protection of agriculture and related resources generally.
EPA Position Statement No. 2 *Environmental Protection of Native Vegetation in Western Australia: Clearing of native vegetation, with particular reference to the agricultural area*	Provides guidance on clearing of native vegetation, with particular reference to the agricultural area.
EPA Guidance Statement No. 51 *Guidance for the Assessment of Environmental Factors – Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia*	Provides guidance on the standard of survey required to assist in collecting the appropriate data for decision-making associated with the protection of Western Australia's terrestrial flora and vegetation and their ecosystems.
EPA and DPaW Technical Guide –Flora and Vegetation Surveys for Environmental Impact Assessment	Provides guidance on survey preparation, undertaking desktop studies and determining level of survey required, sampling techniques and survey design, and data analysis and reporting.
EPA Technical Guide – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment	Provides guidance on fauna sampling techniques and methodologies for different regions of the State and the analysis, interpretation and reporting requirements for EIA.
Land Administration Act 1997 (LAA)	An Act to consolidate and reform the law about Crown land and the compulsory acquisition of land generally, to repeal the *Land Act 1933* and to provide for related matters. The Act allows for the
Rights in Water and Irrigation Act 1914 (RIWI Act)	An Act relating to rights in water resources, to make provision for the regulation, management, use and protection of water resources, to provide for irrigation schemes, and for related purposes.

2.2 Commonwealth

2.2.1 Matters of National Environmental Significance

MNES include:

- listed threatened species and ecological communities
- migratory species protected under international agreements
- Ramsar wetlands of international importance
- the Commonwealth marine environment
- world Heritage properties
- national Heritage places
- Great Barrier Reef Marine Park
- a water resource, in relation to coal seam gas development and large coal mining development
- nuclear actions.

If an action is likely to have a significant impact on a MNES this action must be referred to the Minister for the Environment for a decision on whether assessment and approval is required under the EPBC Act.

2.2.2 Flora and fauna

The EPBC Act is the main piece of Federal legislation protecting biodiversity in Australia. Species at risk of extinction are recognised at a Commonwealth level and are categorised in one of six categories as outlined in Table 2.

Table 2 Categories of Species Listed under Schedule 179 of the EPBC Act (Commonwealth)

Conservation	Code Category
Ex	Extinct Taxa
ExW	Extinct in the Wild
CE	Critically Endangered
E	Endangered
V	Vulnerable
CD	Conservation Dependent

2.2.3 Vegetation Communities

Communities can be classified as Threatened Ecological Communities (TECs) under the EPBC Act. The EPBC Act protects Australia's ecological communities by providing for:

- identification and listing of ecological communities as threatened
- development of conservation advice and recovery plans for listed ecological communities
- recognition of key threatening processes
- reduction of the impact of these processes through threat abatement plans.

Categories of federally listed TECs are described in Table 3.

Table 3 Categories of TECs that are listed under the EPBC Act

Conservation Code	Category
CE	Critically Endangered If, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future.
E	Endangered If, at that time, it is not critically endangered and is facing a very high risk of extinction in the wild in the near future.
V	Vulnerable If, at that time, it is not critically endangered or endangered, and is facing a high risk of extinction in the wild in the medium-term future.

2.3 Western Australian

2.3.1 Flora and fauna

Plants and animals that are considered Threatened and need to be specially protected because they are under identifiable threat of extinction are listed under the WC Act. These categories are defined in Table 4.

Table 4 Conservation codes for WA flora and fauna listed under the *Wildlife Conservation Act 1950* updated November 2015

Code	Category
CR	Critically endangered species
EN	Endangered species
VU	Vulnerable species
EX	Presumed extinct species
IA	Migratory birds protected under an international agreement (fauna only)
CD	Special conservation (fauna only)
OS	Special protection for reasons other than those already mentioned (fauna only)

Species that have not yet been adequately surveyed to warrant being listed under the WA Act are added to a Priority flora List by the State Minister of Environment. Categories and definitions of Priority Flora and Fauna species are provided in Table 5 and expanded in Appendix A.

Table 5 Conservation codes for WA flora and fauna as listed by DPaW and endorsed by the Minister for Environment

Conservation Code	Category
Priority One	Poorly Known Species
Priority Two	Poorly Known Species
Priority Three	Poorly Known Species
Priority Four	Rare, Near Threatened and other species in need of monitoring
Priority Five	Conservation Dependent species

2.3.2 Vegetation Communities

State listed TECs are not protected under any legislation, rather they are endorsed by the Minister for Environment. Categories of TECs are defined in Table 6. PECs are endorsed by the Minister for Environment as having insufficient information available to be considered a TEC, or which are rare but not currently threatened. These categories are described in Table 7.

Table 6 Conservation codes for State listed Ecological Communities

Conservation Code	Category
PD	Presumed Totally Destroyed
CR	Critically Endangered
EN	Endangered
VU	Vulnerable

Table 7 Categories for Priority Ecological Communities

Conservation	Code Category
P1	Priority One: poorly-known ecological communities
P2	Priority Two: poorly-known ecological communities
P3	Priority Three: poorly known ecological communities
P4	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.
P5	Priority Five: Conservation Dependent ecological communities.

2.3.3 Biosecurity and Agriculture Management Act 2007

Biosecurity is the management of the risk of animal and plant pests and diseases entering, emerging, establishing or spreading in WA to protect the economy, environment and community. Biosecurity is managed under the BAM Act which came into effect 1 May 2013. Exotic animals and plants can become an invasive species if they can establish in new areas where local conditions are favourable for their growth.

The Act and its categories are explained in **Appendix B**.

2.3.4 Land Administration Act 1997

The *Land Administration Act 1997* (LAA) is Western Australia's legislation dealing with the disposition of State land. The LAA is administered by the Minister for Lands, assisted by the Department of Regional Development and Lands (RDL).

Class A Reserves are established under the LAA. They are afforded the greatest degree of protection for Crown land and this classification is used solely to protect areas of high conservation or high community value. Should a proposal require development within a Class A Reserve, the subject land would require excision from the Class A Reserve. The process of excision requires that the proposal be tabled before, and gain approval from, both Houses of Parliament.

2.3.5 *Environmental Protection Act 1986* (and Clearing Regulations)

Section 38 (Part IV) of the EP Act provides that any person may refer a significant proposal (one that is likely to have a significant effect on the environment) to the EPA. The EP Act also states that where the environmental impact of a proposal can be adequately assessed and managed through other legislative mechanisms the proposal is unlikely to require formal environmental impact assessment.

If a proposal is not formally assessed by the EPA under Part IV of the EP Act, a Part V native Vegetation Clearing Permit may be required. Under Section 51C of the EP Act, clearing of native vegetation without a Native Vegetation Clearing Permit is an offence unless an exemption applies. Exemptions offered for clearing under Regulation 5 of the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* do not apply within Environmentally Sensitive Areas (ESA).

2.3.6 Rights in Water and Irrigation Act 1914

A licence under the RIWI Act is required if water is proposed to be taken from a watercourse or groundwater aquifer. In addition, a permit is required under the RIWI Act for any activity that will disturb the bed and banks of a watercourse or wetland.

3.0 Methodology

The biological assessment included a desktop assessment, field surveys and a reporting component. The methodologies for these components are described below.

3.1 Desktop assessment

The desktop assessment required:

- undertaking data searches through DPaW, DotEE and the WAM databases
- identifying significant environmental values likely to be present in the Study area (including flora, fauna, soil, groundwater and surface water)
- identifying the location of any conservation estates or reserves within or nearby the Study area
- identifying broad vegetation types present using pre-European types (Beard, 1981)
- identifying conservation significant species likely to be present in the Study area and include a likelihood of occurrence assessment.

Significant values likely to be present in the Study area were assessed by reviewing publicly available information including Geological Survey of Western Australia and Geoscience (2008), and WA Atlas (Landgate, 2016), and information on DPaW reserves and national parks. Beard (1981) Swan region mapping was used to identify the pre-European vegetation types present within the Study area.

Data searches were conducted in August 2015 prior to the initial 2015 Spring field survey. Databases searched included the DPaW Threatened flora, communities and fauna databases (Sep 2015), and the EPBC Protected Matters Search Tool (online resource) (Oct 2015).

The search results were reviewed to assess the potential presence of conservation significant environmental values. The desktop assessment was also used to define the survey time to maximise capturing the ideal flowering period for conservation significant flora species. All conservation significant matters including flora, fauna and communities were reviewed and a likelihood of occurrence was completed based on the categories outlined in Table 1 of **Appendix C**. Species or communities considered likely to occur were targeted during the field survey.

3.2 Field surveys

3.2.1 Flora and vegetation

A flora and vegetation survey was conducted in accordance with EPA Guidance Statement No. 51 (EPA, 2004a) and the Flora and Vegetation Technical Guide (EPA & DPaW, 2015). The flora and vegetation survey was conducted by two botanists Floora de Wit (Collection Permit SL011555 and Regulation 4 Collection Permit CE005103) and Lyn van Gorp (Collection Permit SL011558). The field survey was undertaken in Spring 2015; between 19-25 September and 16-20 November. Small additional areas were then surveyed over 23-24 February 2016 and 7-9 September 2016.

3.2.1.1 Ecological community mapping

Floristic data was collected at sample point locations using a combination of 10 x10 m non-permanent quadrats and relevés to document the floristics, vegetation composition and structure, condition, and other identifying features of the vegetation community. Floristic data was collected at 75 non-permanent quadrats and 7 relevès within the Study area. Sample point locations were selected to ensure accurate representation of native vegetation within the Study area in areas large enough to support this number of quadrats. The distribution of quadrats is shown in Figure 5.

Any species unable to be identified in the field were collected for identification in AECOM's in-house herbarium and the specimens and taxonomic references and keys at the Western Australian Herbarium (WAH). Naming of species followed the convention of the WAH.

Quantitative flora species data were used to define the vegetation communities. Vegetation communities were described and mapped based on changes in dominant species composition and landform. Vegetation community descriptions were based on the National Vegetation Information System (NVIS) framework (Commonwealth of Australia, 2003) to Association level with the dominant growth form, height, cover and up to three species for the three traditional strata used to describe the vegetation communities. These are represented as codes in the vegetation map.

Delineation of vegetation communities was supported by analysing floristic data collected within quadrats. The program PC Ord was used to assess the similarity between sites and review dendrograms using Ward's distance measure. This identified those sites that are most similar to one another and suitable for representing the same vegetation community. The analysis was done using presence absence data and scaled percentage cover applying the Braun-Blanquet scale as outlined in Table 2 of **Appendix C**. Floristic analysis was undertaken following the September and November 2015 surveys. No additional analysis was undertaken following the February and September 2016 surveys.

3.2.1.2 Vegetation condition mapping

Vegetation condition was determined using the scale developed by M.E. Trudgen (1991) and published by the Wildflower Society WA (Keighery, 1994) condition scale (Table 3 of **Appendix C**). The scale is based on disturbance (e.g. grazing, erosion), degree of alteration to community and habitat structure and site ecology.

3.2.1.3 Targeted Threatened and Priority flora and Declared Pests

Following the September and November 2015 field surveys, seven Priority flora species were identified. These were not counted or mapped in the field at the time. Follow-up surveys were undertaken in February and September 2016 to map population boundaries and count number of individuals for the species listed below.

The searches included:

- *Boronia scabra* subsp. *condensata* (P2)
- *Calytrix oncophylla* (P2)
- four locations of *Grevillea candolleana* (P2)
- *Caladenia integra* (P4)
- two locations of *Hibbertia montana* (P4). This species was limited to only those locations where collections were made and confirmed at the WAH due to its similarity to the common *Hibbertia commutata*.

As the Study area was traversed on foot, individuals were recorded with a hand-held GPS. For each population additional information was collected including population count, boundary, associated species, soils and landform. Where populations were extensive, i.e. the *Boronia scabra* subsp. *condensata,* boundary points were taken as well as sub-samples of individuals to ascertain density of individuals within the boundary.

WoNS and Declared Pests locations were recorded using a GPS. At most locations, one GPS point represents one individual.

3.2.1.4 Threatened Ecological Community Assessment

Patches of native vegetation within the Study area that are located in the Avon Wheatbelt Interim Biogeographic Regionalisation for Australia (IBRA) region were visited and assessed to determine whether the EPBC Act-listed TEC *Eucalypt Woodlands of the Western Australian Wheatbelt* occurs within the Study area. Each patch of native vegetation was visited on 6 September 2016. All vegetated sections of the survey corridor were traversed on foot and vegetation assessed against the key diagnostic features and condition thresholds as published in the Approved Conservation Advice and summarised in Table 8 and Table 9.

Table 8 Key diagnostic features that will be considered during the field survey

Key Diagnostic Features – the patch must show the following key diagnostic features	Y/N
Distribution of the ecological community is limited to one of the following IBRA regions: · Avon Wheatbelt - subregions AVW01 Merredin and AVW02 Katanning; · Mallee - MAL02 Western Mallee only; · Jarrah Forest – outlying patches in the eastern parts of JAF01 Northern Jarrah Forests and JAF02 Jarrah Forests adjacent to the Avon Wheatbelt that are off the Darling Range, and receive less than 600 mm mean annual rainfall.	
Community is a woodland in which the minimum crown cover of the tree canopy in a mature woodland is 10%	
Key species of the tree canopy are species of *Eucalyptus* as identified in Table 2a (see Attachment A)	
A native understorey is present but is of variable composition, being a combination of grasses, other herbs and shrubs, as specified in Table A1 of Appendix A of the Approved Conservation Advice	

Where the vegetation met the key diagnostic features contained in Table 8, the condition thresholds and considerations of Table 9 were applied.

Table 9 Condition thresholds applicable to the TEC

Cover of weeds AND	Mature trees AND	Min. patch size (non-roadside patches) OR	Min. patch width (roadsides only)
Category A: Patches likely to correspond to a condition of Pristine / Excellent / Very good (Keighery, 1994) or a High RCV (RCC, 2014).			
0-30% of total understorey vegetation cover	May be present or absent	2 ha+	5 m+
Category B: Patches likely to correspond to a condition of Good (Keighery, 1994) or a Medium-High RCV (RCC, 2014), AND retains important habitat features.			
30-50%	Present with at least 5 trees/0.5ha	2 ha+	5 m+
Category C: Patches likely to correspond to a condition of Good (Keighery, 1994) or a Medium-High RCV (RCC, 2014).			
30-50%	Either absent or LESS THAN 5 trees/0.5ha	5 ha+	5 m+
Category D: Patches likely to correspond to a condition of Degraded to Good (Keighery, 1994) or a Medium-Low to Medium-High RCV (RCC, 2014) BUT retains important habitat features.			
More than 50-70%	Present with at least 5 trees/0.5ha	5 ha+	5 m+

3.2.2 Fauna

A Level 1 fauna survey was conducted in accordance with EPA Guidance Statement No. 56 (EPA, 2004b). The fauna survey was conducted over four visits, two in Spring 2015, a third in late Summer 2016 and the fourth in Spring 2016. The Spring 2015 survey was conducted over ten days between 19-24 September and 9-12 November. These were conducted in conjunction with the Level 2 flora and vegetation survey. Conducting the two surveys concurrently enabled consistent and clear mapping of the fauna habitats and vegetation communities. Small areas were then added to the Study area and these areas were surveyed over three days over 23-24 February 2016 and 9 September 2016. The total number of field days for the fauna survey was 13 days. The fauna survey was conducted by zoologists Matt Cann and Jared Leigh, and field assistant Lucy Farley.

Where habitat for conservation significant species was located, site details were recorded using hand held computers with parameters including:

- GPS location
- species observed
- habitats present
- scats
- tracks.

In addition to recording all observed fauna and birds identified from distinctive calls, details of indirect evidence such as scats, tracks and diggings was documented. In particular, attention was given to conservation significant species identified in the desktop assessment as having the potential to occur in the area.

Opportunistic observations of fauna were recorded whilst traversing the Study area. Furthermore, micro habitat searches were conducted at each habitat. This included raking soil and leaf litter, inspecting dead logs and timber, inspecting burrows, lifting rocks and inspecting loose bark on trees.

The taxonomy and nomenclature of vertebrate species for mammals, reptiles and amphibians used is in accordance with the Checklist of Vertebrates of Western Australia (WAM, 2015), and for bird species the Bird's Australia Checklist of Australian Birds based on Christidis and Boles (2008) was used.

3.2.2.1 Targeted Black Cockatoo survey

A targeted Black Cockatoo survey was conducted to identify potential breeding habitat for the three Threatened Black Cockatoo species that occur in WA. These are the EPBC Act and WC Act listed Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*), Baudin's Black Cockatoo (*Calyptorhynchus baudinii*) and Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii* subsp. *naso*). Foraging habitat quality was also quantified for all three Black Cockatoo species. The Black Cockatoo survey was carried out in conjunction with the Level 1 fauna survey, by zoologist Matthew Cann (who has more than four years' experience in Black Cockatoo surveys), Botanist Floora de Wit (who has more than three years' experience in Black Cockatoo surveys), Lucy Farley (Field Assistant) and Jared Leigh (Zoologist). The surveys were undertaken in accordance with:

- *Referral guidelines for three species of Western Australian black cockatoos species: Carnaby's Cockatoo (endangered), Baudin's Cockatoo (vulnerable), Forest Red-tailed Black Cockatoo (vulnerable*) (Department of Sustainability, Environment, Water, Populations and Communities [DSEWPaC], 2012a)
- *Technical Guide - Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment* (EPA & DEC [Department of Environment and Conservation], 2010).

A Black Cockatoo breeding habitat assessment was conducted which focussed on quantifying potential breeding trees within the Study area. Hand-held GPS units were used to record all trees identified as suitable breeding trees in accordance with the DSEWPaC (2012a) guideline. Potential nesting habitat for these species as relevant to the Study area comprises trees of Bullich (*Eucalyptus patens*), Wandoo (*E. wandoo*), Jarrah (*E. marginata*), Flooded Gum (*E. rudis*), York Gum (*E. loxophleba* subsp. *loxophleba*), Powderbark (*E. accedens*) and Marri (*Corymbia calophylla*). Suitable diameter at breast height (DBH) for Wandoo breeding trees is 300 millimetres (mm) (DSEWPaC, 2012a). For all other tree species, 500 mm is considered suitable. The location, species, and presence of suitable breeding hollows was recorded for all potential breeding trees observed.

AECOM has developed a habitat quality assessment using the DSEWPAC *Offsets Assessment Guide* (2012b). DSEWPAC (2012b) describes key considerations in determining the quality of threatened species and their ecological habitat. The considerations (parameters) used include site condition, site context and species stocking rate. The value for each parameter is based on three factors which are averaged and weighted according to the importance of the parameter. Table 10 describes these parameters, the interpretation of the habitat quality assessment, and the formulas used to determine the final values.

Table 10 Habitat quality assessment

Site condition	Site context	Species stocking rate
a1. What is the structure and condition of the vegetation on the site?	b1. What is the connectivity with other suitable/known habitat or remnants?	c1. What is the presence of the species on the site? (i.e. confirmed / modelled).
a2. What is the diversity of relevant habitat species present (including both endemic and non-endemic)?	b2. What is the importance of the site in relation to the overall species population or the occurrence of the community?	c2. What is the density of species known to utilise the site?
a3. What relevant habitat features are on the site?	b3. What threats occur on or near site?	c3. What is the role of the site population in regards to the overall species population?
$A = \frac{(a1 + a2 + a3)}{3} \times 0.4$	$B = \frac{(b1 + b2 + b3)}{3} \times 0.4$	$C = \frac{(c1 + c2 + c3)}{3} \times 0.2$
Habitat quality score = $A + B + C$		

The habitat quality assessment was conducted for each vegetation type within the Study. The habitat quality numbers from this calculation were then categorised as per the definitions in Appendix C Section 4.0.

3.2.3 Environmental values mapping

The environmental values map was informed by the desktop assessment and field survey results and includes:

- All MNES identified within the Study area, including potential Black Cockatoo potential breeding trees and quality of Black Cockatoo foraging habitat (defined as habitat with a rating of 6 or higher)
- Priority flora species recorded by DPaW, WAH and field surveys
- Conservation significant fauna species observed during the field surveys
- Nature reserves and ESAs
- Vegetation communities considered significant as per EPA Guidance Statement No. 51 (EPA, 2004a).

4.0 Limitations

A review of limitations that may affect the Study was undertaken and none were found to have any impact on the results of the biological assessment. Limitations are addressed in Table 11.

Table 11 Limitations of the surveys

Limitation	Constraint	Flora and vegetation survey	Fauna survey
Competency/experience of consultant conducting survey	Nil	The survey was undertaken by Senior Botanist Floora de Wit and Botanist Lyn van Gorp. Both hold valid collection permits	The survey was undertaken by Zoologist Matthew Cann and Ecologist Jared Leigh who have both had experience undertaking surveys in similar bioregions.
Scope (i.e. what life forms were sampled)	Nil	The flora and vegetation survey conformed to a Level 2 flora and vegetation assessment as outlined in EPA (2004) GS51 and EPA & DPaW (2015) Technical guide. All appropriate life forms, including all vascular flora species, were sampled.	The fauna survey focussed on recording fauna evidence and direct sightings and call identification. The survey was undertaken in daylight hours therefore nocturnal species may be under-represented.
Proportion of flora/fauna identified, recorded and/or collected (based on sampling, timing and intensity)	Nil	Four field surveys were undertaken to capture the flora and vegetation data from the Study area. All vascular plant species were recorded from 75 quadrats and 7 relevès. This is considered suitable for meeting the objective of this project.	The fauna survey was undertaken simultaneously with the flora and vegetation assessment during daylight hours. The intensity of the survey is considered to comply to a Level 1 fauna survey.
Sources of information	Nil	Publicly available datasets were used including IBRA7 (Commonwealth of Australia, 2012); DPaW database search results, Florabase, and Beard (1981) vegetation mapping. A reference list is provided in Section 8.0.	
Completion (is further work needed)	Nil	Four field surveys were completed within the Study area, with all non-permanent quadrats sampled one time only. This complies with the 2015 Flora Survey Technical Guide.	The survey searched for Threatened species and associated habitat and this is considered suitable for meeting the objective of the assessment.
Timing, weather, season, cycle	Nil	Low rainfall in 2015 may have affected the presence of flora species. This has been partially offset by a good rainfall season in 2016 preceding the September 2016 field survey.	Fauna surveys were conducted during daylight hours between 0600 and 1800. The surveys were predominantly conducted during peak breeding season for the conservation significant species considered likely to occur within the Study area.

Limitation	Constraint	Flora and vegetation survey	Fauna survey
Disturbances (e.g. fire flood, accidental human intervention) which affected results of the survey	Nil	Fire affected approximately 10 ha of the Study area. These areas are denoted by a "b" after the community code and include part of Morangup Nature Reserve, and another area off Salt Valley Road. Evidence indicates the burn occurred between mid-2014 and the survey dates. Regrowth of species was limited.	
Intensity (was the intensity adequate)	Nil	Floristic data was collected from 75 quadrats and 7 relevés. This equals one quadrat per 5 hectares of native vegetation (excluding trees in paddocks).	The Fauna survey was conducted in accordance with EPA Guidance Statement 56 (EPA, 2004b).
Completeness (was relevant area fully surveyed)	Nil	All areas of remnant native vegetation were visited to sample the vegetation community and condition. A TEC assessment was undertaken in all patches of native vegetation within the portion of the Study area which fell within the Avon Wheatbelt IBRA region, and all Priority flora populations were visited to count and map the extent of populations.	The Study area was traversed on foot and all suitable tree species encountered were measured to determine whether they constituted Black Cockatoo Breeding Habitat
Resources (degree of expertise available in plant/animal identification)	Nil	Plant identification was undertaken by Senior Botanist Floora de Wit who has more than 9 years' experience with plant taxonomy and flora and vegetation assessments. Plants not able to be identified to species, or considered to be likely Priority species were submitted to DPaW for identification by Mike Hislop.	Matt Cann and Jared Leigh used available fauna resources to assist in the identification of scats, tracks and bird calls.
Remoteness and/or access problems	Nil	The entire Study area was easily accessible.	
Availability of contextual information on the region	Nil	Florabase and the DPaW database results were used to provide local and regional significance assessments for Priority flora species. Publicly available information on the local region is limited however is not considered to limit the assessment of environmental values of the Study area.	

5.0 Desktop Assessment

5.1 Climate

The Study area is located in the Jarrah Forest and Avon Wheatbelt IBRA regions, which have a warm Mediterranean climate, characterised by hot dry summers and cool to mild wet winters (Mitchell *et al.,* 2002). The closest Bureau of Meteorological (BoM) recording station to the Study area is Toodyay (Station 10125), which commenced recording data in 1877. The station is located less than two kilometres from the Study area at the closest point.

Toodyay receives an average rainfall of 518.8 mm rainfall per year (BoM, 2016). In 2015 (not including November and December), only 356.2 mm of rainfall has been received. As shown in Figure 2, there have been several months in 2015 with below average rainfall, in particular May, June and September.

The following year received above average rainfall for January, March and April, with close to average rainfall in July and August. At the end of September, Toodyay had already received 573 mm of rain, higher than the average annual rainfall. Climate is therefore not considered a limitation for the September 2016 surveys (Figure 2).

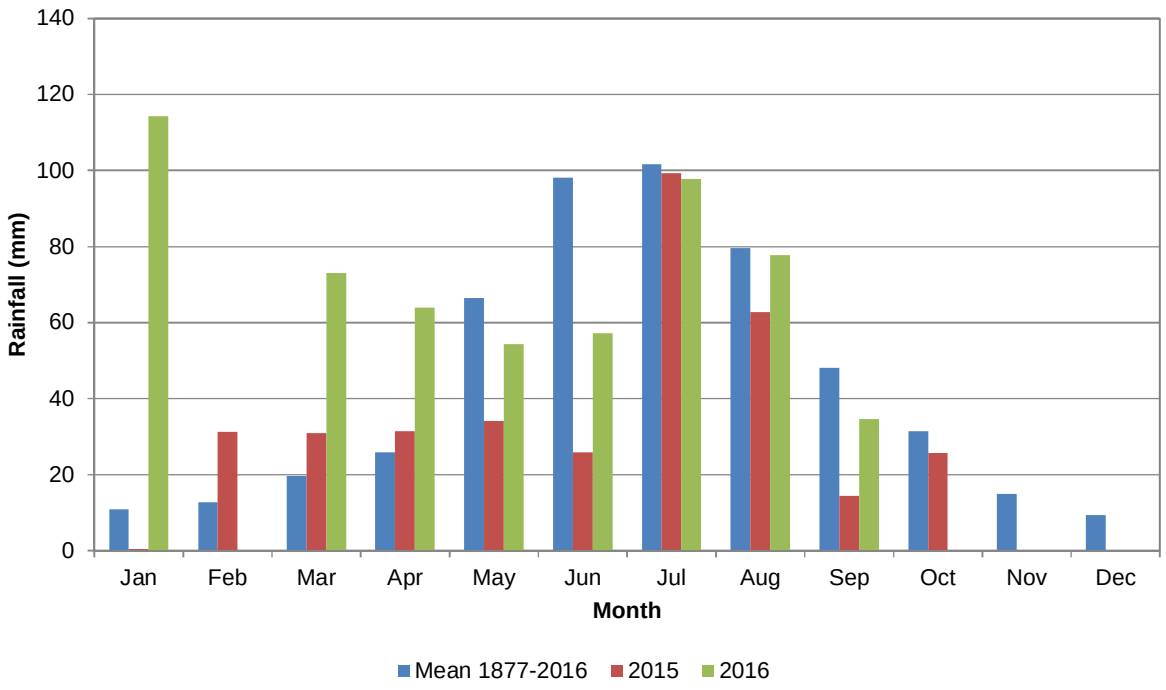


Figure 2 Rainfall recorded at Toodyay Station 10125 (BoM, 2016)

5.2 Database searches and likelihood of occurrence

5.2.1 Ecological communities

At the time of conducting the ecological communities database searches (August 2015) from DPaW, no TECs or PECs were identified as occurring in the vicinity or within the Study Area. Since the commencement of the project, a new community was listed, namely, “Eucalypt Woodlands of the Western Australian Wheatbelt”. This is the only TEC identified as occurring in the vicinity of the Study area.

This community was described by DotEE (2015) as comprising of a tree canopy dominated or co-dominated by a range of Eucalypt species, including iconic Wheatbelt trees such as *Eucalyptus salmonophloia* (Salmon Gum), *E. loxophleba* subsp. *loxophleba* (York Gum), *E. salubris* (Gimlet), *E. longicornis* (Red Morrel), *E. wandoo* (Wandoo) and various species of mallet, among other eucalypt species.

This TEC is applicable only in the Avon Wheatbelt subregion AVW01 Merredin, AVW02 Katanning and the Mallee subregion MAL02 Western Mallee. Some outlying patches of the ecological community may extend into adjacent areas south and east of the primary Wheatbelt bioregions, and in the easternmost parts of the Jarrah Forest bioregion. These outlier patches generally occur south of Northam, extending around the vicinity of localities such as Wandering, Williams, Kojonup and Mount Barker, and are limited to areas that are not on the Darling Range, receive less than 600 mm mean annual rainfall and overlie the Yilgarn Craton geology.

The Study area extends within the Avon Wheatbelt subregion AVW01 Merredin for 2 km, equalling 30.69 ha of the Study area. Of this, 14.3 ha comprises native vegetation. Analysis of the survey results and suitability to be considered a TEC is discussed in Section 6.1.1.

5.2.2 Flora

The search of the DPaW Threatened and Priority flora, WA herbarium database and the EPBC Act Protected Matters tool for the Study area resulted in 55 conservation significant flora species (Table 12) being compiled. This included six species listed under both the EPBC Act and WC Act. Of the 55 species:

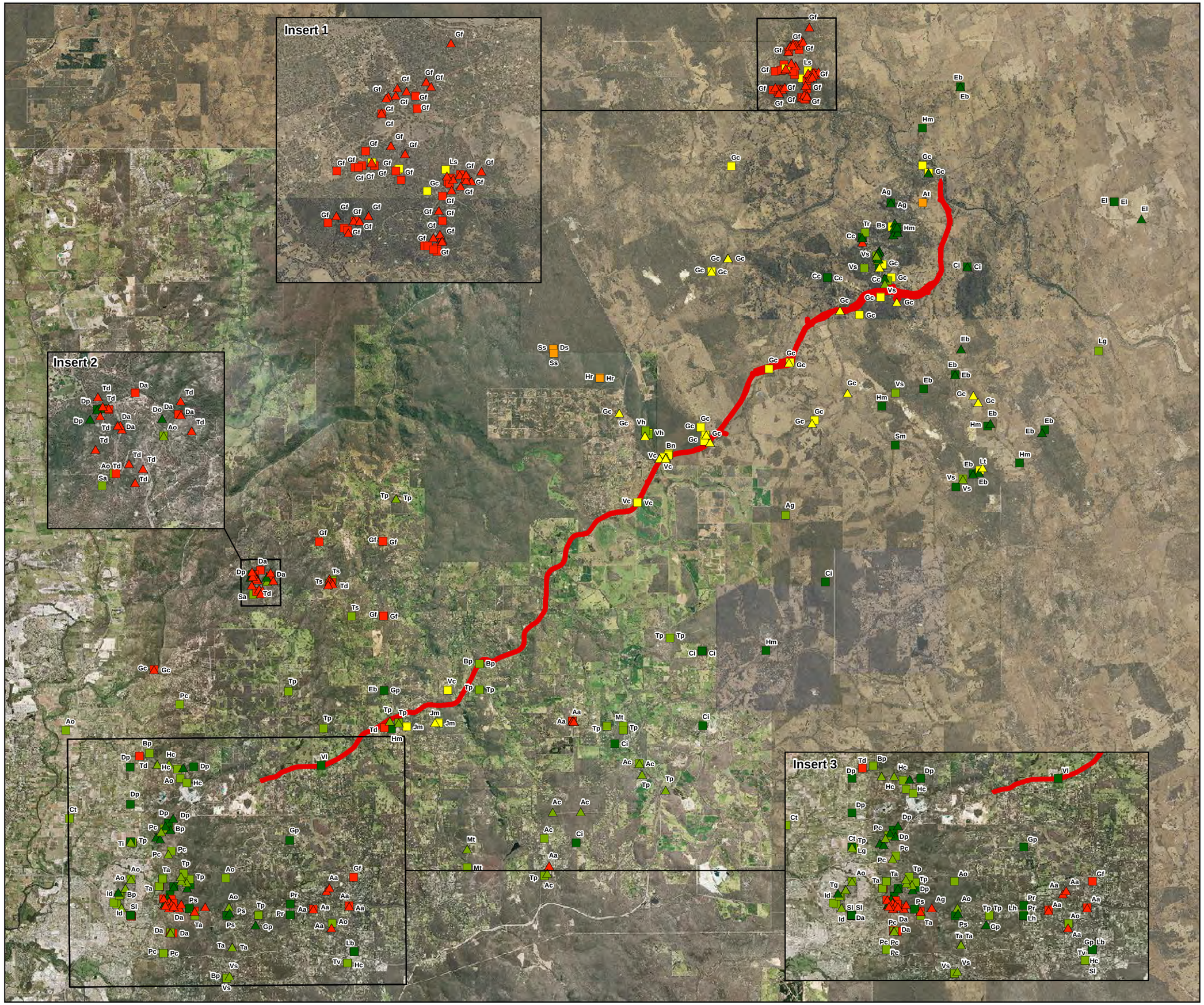
- five are known to occur according to database results
- eight are considered likely to occur in the Study area due to known records in close proximity to the Study area and suitable habitat present within the Study area
- 24 species may occur in the Study area due to habitat potentially being present and/or there are known populations in the vicinity of the Study area
- 18 species are considered unlikely to occur in the Study area due to no presence of suitable habitat and no known occurrences in close proximity of the Study area.

Section 6.3 provides further detail on the seven species recorded in the Study area during this survey.

The complete desktop assessment results are provided in **Appendix D**.

Table 12 Desktop flora results showing only species that are known to occur or considered likely to occur in the Study area

Species	Conservation code	Habitat	Likelihood
Grevillea flexuosa Zig Zag Grevillea	VU, V	Amongst medium trees, or low trees, or tall (sclerophyll) shrubland; in rocky or stony soil, or sand; occupying granite hill, breakaway.	Likely
Hemigenia rigida	P1	Sandy soils, lateritic gravelly soils. Hillslopes, granite outcrops, flats, ironstone ridges.	Likely
Banksia nivea subsp. Morangup (M. Pieroni 94/2)	P2	Non-lignotuberous shrub, 0.15-1.5 m high. Flowers cream-yellow-orange-pink/red-brown, flowers in April.	Likely
Grevillea candolleana	P2	Laterite, lateritic loam. Hillsides.	Known
Verticordia citrella	P2	Gravelly loam or sand. Low-lying damp areas, swamps in open shrubland. Only known from single locality north-east of Noble Falls.	Known
Beaufortia purpurea	P3	Erect or spreading shrub, 0.3-1.5 m high. Flowers are red-purple, Oct to Dec or Jan to Feb. Lateritic or granitic soils. Rocky slopes.	Known
Grevillea florida	P3	Erect shrub, to 0.9 m high. Flowers are cream-yellow, Jul to Sep. Sand, sandy clay, gravel, laterite. Sandplain, slopes, road verges.	Likely
Tetratheca pilifera	P3	Gravelly soils.	Known
Tetratheca retrorsa	P3	Lateritic breakaways	Likely
Chordifex chaunocoleus	P4	Grey, siliceous or peaty sand, well to poorly drained. Drainage lines, depressions.	Likely
Eremaea blackwelliana	P4	White sand. Sandy depressions, gentle hillside.	Likely
Hibbertia montana	P4	Loam over granite, lateritic soils, gravel. Granite rocks, lateritic ridges & boulders, hills.	Likely
Verticordia lindleyi subsp. *lindleyi*	P4	Sand, sandy clay. Winter-wet depressions.	Known



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WA Herb

- T
- 1
- 2
- 3
- 4
- Study Area

Data sources:

Base Data: © Western Australia Land Information Authority (Landgate) (2016)
NearMap Imagery 2016

Toodyay Biological Assessment

Flora Desktop Results

PROJECT ID	60515588
CREATED BY	DGF
LAST MODIFIED	fotheringhamd - 14 Nov 2016
VERSION:	1

Figure

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5.2.3 Fauna

Twenty-seven Threatened, Priority or Migratory species were identified from the DPaW Threatened and Priority flora, WAHERB database (including WAM records) and EPBC Act Protected Matters search of the Study area. Of these, 16 are bird species, nine are mammal species and two are invertebrate species. Of the 27 species identified, those that are considered likely to or may occur within the Study area are listed in Table 13.

For further descriptions and likelihood analysis refer to **Appendix E**.

Table 13 Conservation significant fauna species that may or are likely to occur in the Study area

Species	Vernacular	Conservation Status		Likelihood
		Commonwealth	State/DPaW	
Calyptorhynchus latirostris	Carnaby's Black Cockatoo	Endangered	EN	Likely to occur
Calyptorhynchus baudinii	Baudin's Black Cockatoo	Vulnerable	EN	Likely to occur
Calyptorhynchus banksii naso	Forest Red-tailed Black Cockatoo	Vulnerable	VU	Likely to occur
Dasyurus geoffroii	Chuditch, Western Quoll	Vulnerable	VU	Likely to occur
Merops ornatus	Rainbow Bee-eater	Marine	IA	Likely to occur
Actitis hypoleucos	Common Sandpiper	Migratory	IA	May overfly the Study area
Apus pacificus	Fork-tailed Swift	Migratory	IA	May overfly the Study area
Ardea modesta	Eastern Great Egret	Migratory	IA	May overfly the Study area
Falco peregrinus	Peregrine Falcon	-	IA	May overfly the Study area
Macropus irma	Western Brush Wallaby	-	Priority 4	Likely to occur
Oxyura australis	Blue-billed Duck	-	Priority 4	May occur

5.3 Soil, surface water and groundwater

5.3.1 Surface water and groundwater

The Study area traverses two water catchments including the Lower Swan and Main Avon. Multiple waterways dissect the Study area including:

- Avon River
- three unnamed watercourses
- Susannah Brook.

The riparian communities represent approximately 0.8 ha of the Study area as defined by the vegetation mapping, fauna habitat mapping and presence of waterways.

The Study area does not traverse any Public Drinking Water Source Areas.

5.3.2 Soils

Acid Sulfate Soils (ASS) are naturally-occurring soils and sediments containing sulfide minerals, commonly pyrite and iron sulfide. These soils are often associated with wetland areas. When ASS are exposed to air, typically as a result of ground disturbance during earthworks or following dewatering, iron sulfides may react with oxygen and water to produce iron compounds and sulphuric acid.

The majority of the Study area is mapped as having no known risk of ASS occurrence (DER, 2006). A small portion of the Study area intersects an area of High to Moderate risk of occurrence of ASS, and the northern portion of the Study area is classified as having a Moderate to low risk (DER 2006). The area of High to moderate risk of ASS occurrence is likely to be associated with low-lying, wetland areas. The area of Moderate to low risk, near the Toodyay townsite, corresponds to the location of the Avon River.

A search of the DER Contaminated Sites Register (DER, 2015) identified one registered contaminated site as occurring immediately adjacent to the Study area. The Contaminated site is located at Lot 12 on Plan 26468, Gidgegannup. The land parcel is associated with the Red Hill landfill facility and has been classified as *Contaminated – remediation required.* This is due to it being used for the disposal of Class III waste, including putrescible waste, into engineered and lined landfill cells. The DER (2015) recommends that the site not be developed for any other use without further contamination assessment and/or remediation. Groundwater abstraction is not permitted at the site. No other Registered contaminated sites occur within or adjacent to the Study area.

5.4 Conservation estates and reserves

One nature reserve, Morangup Nature Reserve (R 38924), is partially located within the Study area approximately 14 km east of Gidgegannup. This reserve is also classified as an A Class Reserve in accordance with the *Land Administration Act 1997* (LAA). The Reserve is for the purpose of conservation of flora and fauna and is vested in the Conservation and Parks Commission and managed by DPaW.

An additional unnamed A Class Reserve (R 2146) is partially intersected by the Study area, near Preedy Road. This Reserve is for the purpose of recreation. Its management is vested in the City of Swan.

One ESA intersects the Study area. This ESA is associated with the Morangup Nature Reserve. It is important to note that exemptions under the Environmental Protection (Clearing of Native Vegetation) Regulations 2004 do not apply in ESAs.

5.5 Interim Biogeographic Regionalisation for Australia

There are 89 recognised Interim Biogeographic Regionalisation for Australia (IBRA) regions across Australia that have been defined based on climate, geology, landforms and characteristic vegetation and fauna (Department of Conservation and Land Management [CALM], 2002). The majority of the Study area lies within the Northern Jarrah Forest subregion, with 2 km of the eastern end located within the Avon Wheatbelt region (Commonwealth of Australia, 2012).

The Northern Jarrah Forest subregion incorporates the area east of the Darling Scarp which overlies Archaean granite and metamorphic rocks capped by extensive lateritic duricrust, dissected by drainage and broken by occasional granite hills (Williams and Mitchell, 2001). The subregion consists of Jarrah-Marri forest in the west, Bullich-Blackbutt in the valleys which shifts to Wandoo-Marri in the east, and Powder bark on breakaways. The granite rocks support heath communities and comprise the common understorey of the woodlands in the north and east. Land use is predominantly forestry, conservation, grazing and mining. Rare features of the area include the extensive native forest cover.

5.6 Pre-European vegetation

Beard (1981) mapped the pre-European vegetation associations of the Swan region. The Study area intersects four of these vegetation associations, as described in Table 14.

Table 14 Beard (1981) pre-European vegetation communities within the Study area

Vegetation Association	Description	IBRA % remaining		LGA % remaining		State % remaining
		Jarrah Forest	Wheatbelt	Shire of Toodyay	City of Swan	
1006 Jarrah Forrest	Medium woodland; Jarrah, Wandoo & Powderbark. *Eucalyptus marginata*, *Eucalyptus wandoo*, *Eucalyptus accedens*	48.58	NA	60.77	NA	48.57
3003 Jarrah Forrest	Medium forest; Jarrah & Marri on laterite with Wandoo in valleys, sandy swamps with teatree and *Banksia*. *Eucalyptus marginata*, *Corymbia calophylla*, *Eucalyptus wandoo* trees over *Acacia browniana*, *Gastrolobium calycinum*, *Lasiopetalum floribundum*, *Leptomeria cunninghamii*, *Phyllanthus calycinus* shrubs over *Lepidosperma angustatum* and *Macrozamia riedlei*	58.81	NA	59.01	61.13	58.95
4 Jarrah Forrest	Medium woodland; Marri & Wandoo. *Corymbia calophylla, Eucalyptus wandoo, Eucalyptus patens* trees over *Acacia acuminata, Allocasuarina huegeliana, Banksia littoralis, Melaleuca preissiana* trees over *Adenanthos obovatus, Baeckea camphorosmae, Gastrolobium calycinum* and *Meeboldina scariosa*	28.05	18.67	53.58	53.86	27.88
352 Avon Wheatbelt	Medium woodland; York gum. *Eucalyptus loxophleba*, *Allocasuarina huegeliana* trees	21.02	17.36	13.85	NA	19.71

Vegetation complex mapping has been undertaken on the Darling Scarp with spatial data available from Heddle *et al*. (1980) and per cent remaining published by the Local Biodiversity Program (2013) and Perth Peel @ 3.5 Million (EPA, 2015). The data shows 12 complexes that intersect with the Study area, described in Table 15.

Table 15 Vegetation complexes within the Study area and percent remaining as provided in Local Biodiversity Program (2013) and EPA (2015)

Vegetation Complex	Description	% Remaining
Bindoon, Bi	Woodland of *Eucalyptus loxophleba* on the slopes flanked by woodlands of *Eucalyptus wandoo-Eucalyptus accedens* on the breakaways and upper slopes in the perarid zone.	30.11
Coolakin, Ck	Woodland of *Eucalyptus wandoo* with mixtures of *Eucalyptus patens, Eucalyptus marginata* subsp. *thalassica* and *Corymbia calophylla* on valley slopes in arid and perarid zones.	39.85
Dwellingup, D2	Open forest of *Eucalyptus marginata* subsp. *marginata-Corymbia calophylla* on lateritic uplands in subhumid and semiarid zones.	82.7*
Dwellingup, D4	Open forest to woodland of *Eucalyptus marginata* subsp. *thalassica-Corymbia calophylla* on lateritic uplands in semiarid and arid zones.	87.4*
Michibin, Mi	Open woodland of *Eucalyptus wandoo* over *Acacia acuminate* with some *Eucalyptus loxophleba* on valley slopes, with low woodland of *Allocasuarina huegeliana* on or near shallow granite outcrops in arid and perarid zones.	26.41
Murray, My2	Open forest of *Eucalyptus marginata* subsp. *thalassica-Corymbia calophylla-Eucalyptus patens* and woodland of *Eucalyptus wandoo* with some *Eucalyptus accedens* on valley slopes to woodland of *Eucalyptus rudis-Melaleuca rhaphiophylla* on the valley floors in semiarid and arid zones.	69.89
Pindalup, Pn	Open forest of *Eucalyptus marginata* subsp. *thalassica-Corymbia calophylla* on slopes and open woodland of *Eucalyptus wandoo* with some *Eucalyptus patens* on the lower slopes in semiarid and arid zones.	77.2*
Swamp, S	Mosaic of low open woodland of *Melaleuca preissiana-Banksia littoralis,* closed scrub of Myrtaceae species, closed heath of Myrtaceae species and sedgelands of *Baumea* and *Leptocarpus* species on seasonally wet or moist sand, peat and clay soils on valley floors in all climatic zones.	76.1*
Williams, Wi	Mixture of woodland of *Eucalyptus rudis-Melaleuca rhaphiophylla,* low forest of *Casuarina obesa* and tall shrubland of *Melaleuca* species on major valley systems in arid and perarid zones.	26.74
Yalanbee, Y5	Mixture of open forest of *Eucalyptus marginata* subsp. *thalassica-Corymbia calophylla* and woodland of *Eucalytpus wandoo* on lateritic uplands in semiarid to perarid zones.	66.5*
Yalanbee, Y6	Woodland of *Eucalytpus wandoo-Eucalyptus accedens* less consistently open forest of *Eucalyptus marginata* subsp. *thalassica-Corymbia calophylla* on lateritic uplands and breakaway landscapes in arid and perarid zones.	46.9*
Yarragil 1, Yg1	Open forest of *Eucalyptus marginata* subsp. *marginata-Corymbia calophylla* on slopes with mixtures of *Eucalyptus patens* and *Eucalyptus megacarpa* on the valley floors in humid and subhumid zones.	81.3*

* obtained from Perth-Peel paper (EPA 2015)

6.0 Field Survey Results and Discussion

6.1 Community mapping

High species diversity was expected within the Study area as the long linear corridor traverses two IBRA regions and is located within the northern extent of the Northern Jarrah Forrest Region. This means that unique compositions of vegetation occur as the vegetation grades from Northern Jarrah Forest to Avon Wheatbelt.

6.1.1 Threatened Communities

Eucalypt Woodlands of the Wheatbelt is listed as Critically Endangered under the EPBC Act. In accordance with the conservation advice, the national listing focusses on the legal protection of areas that remain in relatively good condition and retain their natural composition and ecological function to a large degree (TSSC, 2015).

A total of 14.30 ha of woodland native vegetation was considered to potentially represent this community as it occurs within the Wheatbelt bioregion portion of the Study area. This vegetation was therefore assessed to determine whether it should be considered representative of the TEC as described in the conservation advice (TSSC, 2015).

Seven representative observation points were selected based on the presence of native tree species and location within the Wheatbelt IBRA region (shown in Figure 4). The key diagnostic features and condition criteria as outlined in the conservation advice were assessed to verify whether the TEC was present.

The common characteristic of the seven observation points was the lack of native understorey species. The area is considered as Degraded, with vegetation comprising *Eucalyptus loxophleba* subsp. *loxophleba* over common grass and forb weeds. The absence of native understorey leads to the exclusion of this vegetation as the TEC as it does not meet the key diagnostic features which requires "*A native understorey is present but is of variable composition, being a combination of grasses, other herbs and shrubs, as specified in Table A1 of Appendix A of the Approved Conservation Advice"*.

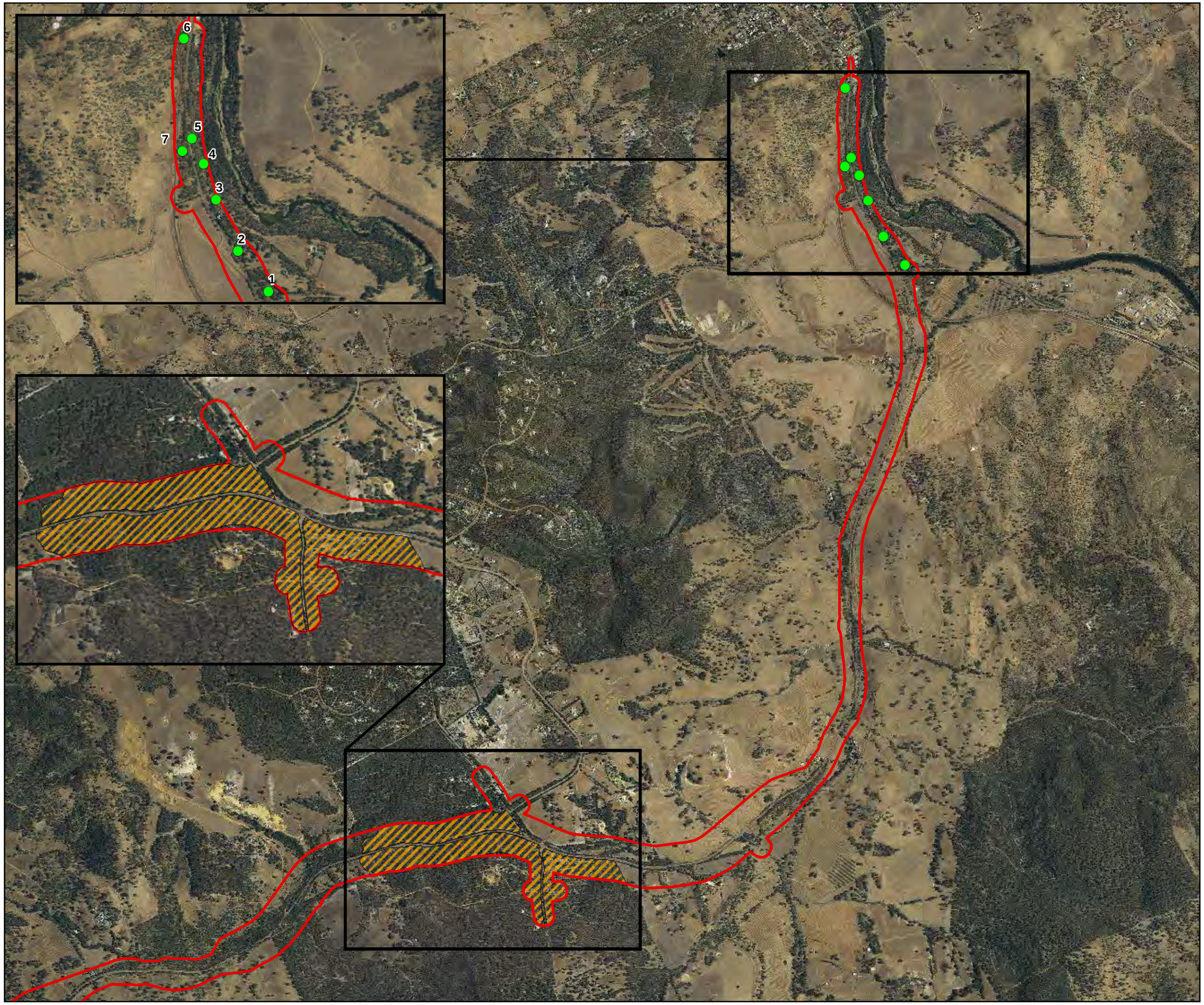
For this reason, all patches fail to meet the criteria for being considered the TEC. The completed observation data sheets are provided in Appendix F.

One additional patch has been identified as potentially occurring on the edge of the TEC distribution. Under the Conservation Advice requirements a large patch of *Eucalyptus accedens* and *Eucalyptus wandoo* woodland meets the requirements of being an outlying patch in the eastern parts of JAF01 Northern Jarrah Forest, and is located off the Darling Scarp in an area that receives less than 600 mm of rain. This patch of vegetation meets all other necessary key diagnostic requirements as it is dominated by trees identified in Table 2a of the conservation advice (i.e. *E. wandoo* and *E. accedens*), has the minimum crown cover of 10%, and has a native understorey.

This patch of native vegetation is therefore considered to represent the Eucalypt Woodlands of the Wheatbelt TEC and is illustrated in Figure 4. Representative photographs of this community are shown in Plate 2.

Plate 1 Condition of native vegetation patches that intersect with Study area and Avon Wheatbelt IBRA region

Plate 2 Native vegetation located in the eastern part of the Northern Jarrah Forest likely to represent the TEC



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LEGEND

- Observation Points
- Eucalypt Woodlands of the Western Australian Wheatbelt
- Study Area

Data sources:

Base Data: © Western Australia Land Information Authority (Landgate) (2016)
NearMap Imagery 2016

Toodyay Biological Assessment

Eucalypt Woodlands of the Western Australian Wheatbelt

PROJECT ID	60344161
CREATED BY	DGF
LAST MODIFIED	fotheringhamd - 14 Nov 2016
VERSION:	1

Figure 4

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6.1.2 Other Communities

Twenty-two vegetation communities were recorded and mapped within the Study area. This comprised eight wetland communities, nine eucalypt woodland communities, one heath community and four disturbed communities. These communities are described in Table 16. Representative community photographs are provided within this table showing the vegetation community in the best condition. The spatial distribution of the communities is shown in Figure 5. The species by community matrix is presented in **Appendix G**.

Five communities are considered significant vegetation communities according to Guidance Statement 51 (EPA, 2004a) and the Flora Survey Technical Guide (DPaW & EPA, 2015) parameters. Vegetation may be considered significant for a range of reasons, other than a statutory listing as TEC or because the extent is below a threshold level, which may include the following:

- scarcity
- unusual species
- novel combinations of species
- a role as a refuge
- a role as a key habitat for threatened species or large populations representing a significant proportion of the local to regional total population of a species
- being representative of the range of a unit (particularly, a good local and/or regional example of a unit in 'prime' habitat, at the extremes of range, recently discovered range extensions, or isolated outliers of the main range)
- a restricted distribution.

This may apply at a number of levels, so the unit may be significant when considered at the fine-scale (~intra-locality), intermediate-scale (~locality or interlocality) or broad-scale (~local to region) (EPA, 2004a).

Communities considered significant include CcXpHh, EaXpBe, EwBsLp, EwGtAl and EdBn, and support one or more populations of Priority flora. Community EdBn occurs within Morangup Nature Reserve and comprises a flora species composition that is considered unique in the local area. There were no other communities recorded that showed any similarity to this community. This, along with the high diversity of Priority species found only in this nature reserve, has led to the conclusion that the area is locally unique and likely to have some regional significance.

Table 16 Vegetation communities recorded within the Study area

AECOM vegetation community	Comments	Photograph
Eucalypt woodlands		
CcLeAp *Corymbia calophylla* with pockets of *Casuarina obesa* mid open woodland over *Leptospermum erubescens*, *Banksia sessilis* var. *sessilis,* and *Hakea prostrata* tall shrubland over *Acacia pulchella* var. *pulchella*, *Bossiaea eriocarpa* and *Verticordia densiflora* var. *densiflora* mid to low sparse shrubland. This community was isolated to one occurrence within the Study area along Sandplain Road. The condition of the community is Very Good in the northern extent, grading to Good further down slope. The community was recorded on white sand on lower slopes.	Quadrats: Too59, 60, 72 Species richness: 50 species including 45 native and 5 weed species Area: 1.22 ha all in Wheatbelt section. Condition was rated as Good and Very Good.	
CcXpHh *Corymbia calophylla* and *Eucalyptus marginata* mid open forest to woodland over *Xanthorrhoea preissii, Banksia sessilis* var. *sessilis* and *Acacia pulchella* mid to tall sparse shrubland over *Hibbertia hypericoides, Tetraria octandra* and *Phyllanthus calycinus* low open shrubland. . Along roadsides this community was in Completely Degraded to Excellent condition. Disturbance opportunists such as *Leptospermum erubescens* and *Banksia squarrosa* subsp. *squarrosa* were common and *Hibbertia hypericoides* and smaller herbs were absent. The community was recorded on brown sandy loamy gravel soils on undulating terrain. Despite the roadside vegetation creating a buffer between cleared paddocks and the road verge, invasive weeds were largely absent. This community is significant due to the presence of a large population of *Hibbertia montana*.	Quadrats: Too09, 10, 32, 37, 47, 48, 50, 56, 65, 81 Species richness: 151 species including 140 native and 11 weed species Area: 69.42 ha Metro: 37.92 ha Wheatbelt: 31.50 ha Condition ranged from Completely Degraded to Very Good.	

AECOM vegetation community	Comments	Photograph
CcXpLb *Corymbia calophylla* and *Casuarina obesa* low to mid open woodland over *Xanthorrhoea preissii*, *Leptospermum erubescens* and *Adenanthos cygnorum* subsp. *cygnorum* tall open shrubland over *Lechenaultia biloba*, *Bossiaea eriocarpa* and *Acacia pulchella* var. *pulchella* mid to low open heath shrubland. This community was recorded in Morangup Nature Reserve and was in Excellent condition. The community represents an ecotone of the adjacent heath community EdBn and the Eucalypt woodland. CcXpLb was recorded on mid-sloped of undulating terrain on sandy loam gravel with some exposed laterite rocks. Isolated occurrences of *Eucalyptus drummondii* were also recorded.	Quadrats: Too05, 07, 08 Species richness: 58 species including 53 native and 5 weed species Area: 13.43 ha in Wheatbelt section, including 8.5 ha of burnt vegetation. Condition was Excellent.	
EaXpBe *Eucalyptus accedens*, *Eucalyptus wandoo* subsp. *wandoo* and *Corymbia calophylla* mid open forest over *Xanthorrhoea preissii*, *Banksia squarrosa* subsp. *squarrosa* and *Acacia pulchella* var. *pulchella* mid to tall isolated clumps of shrubs over *Bossiaea eriocarpa*, *Petrophile divaricata* and *Astroloma* epacridis low open shrubland. The community was recorded in Degraded, Good and Excellent condition, on undulating terrain including lateritic outcrops. The community occurs on brown sandy loamy gravel with sparse understorey. Condition was Good to Excellent. This community is significant due to the presence of Priority flora populations including *Boronia scabra* subsp. *condensata, Calytrix oncophylla* and *Grevillea candolleana.*	Quadrats: Too17, 18, 19, 21, 22, 24, 38, 63, 64, 79, 80 Species richness: 117 species including 112 native and 5 weed species Area: 39.91 ha in Wheatbelt section including 5.64 ha burnt vegetation. Condition ranged from Degraded to Excellent.	

AECOM vegetation community	Comments	Photograph
ElAaAb *Eucalyptus loxophleba* subsp. *loxophleba* mid woodland over *Acacia acuminata* tall isolated to open shrubland over **Avena barbata*, **Lolium perenne* and **Arctotheca calendula* mixed tall to low tussock grass and herbland. This community was recorded in Good condition, isolated to the northern tip of the Study Area. The community occurs on mid to lower slopes on sandy loam. Mid-storey is predominantly absent, with the understorey dominated by invasive weeds common in the region. This community is isolated to the Avon Wheatbelt IBRA region in the north of the Study area.	Quadrats: Too76, 77, 78 Species richness: 8 including 2 native and 6 weed species Area: 12.97 ha in Wheatbelt section. Condition rated as Degraded.	
EmXpBd *Eucalyptus marginata* and *Corymbia calophylla* mid open forest over *Xanthorrhoea preissii*, *Banksia squarrosa* subsp. *squarrosa* and *Banksia sessilis* var. *sessilis* tall sparse shrubland over *Banksia dallanneyi* var. *dallanneyi*, *Lepidosperma tenue* and *Patersonia rudis* low mixed sedge and heath shrubland. The community was recorded in Completely Degraded to Excellent condition. This community was recorded on mid to upper slopes of undulating terrain on sandy loamy gravel with some exposed laterite present. Condition was recorded as Very Good to Excellent. Some areas included a low tree stratum of *Banksia grandis* and *Allocasuarina fraseriana*.	Quadrats: Too01, 35, 46, 49, 58 Species richness: 121 species including 117 native and 4 weed species Area: 52.92 ha Metro: 18.83 ha Wheatbelt: 34.12 ha Condition ranged from Completely Degraded to Excellent.	

AECOM vegetation community	Comments	Photograph
EwAaAb *Eucalyptus wandoo* subsp. *wandoo* and *Eucalyptus loxophleba* subsp. *loxophleba* mid open woodland over *Acacia acuminata* tall open shrubland over **Avena barbata*, **Briza maxima* and **Freesia alba* x *leightlinii* tall mixed grass and herbland. Condition was rated as Degraded. This community was isolated to one degraded area that has been historically grazed. This was evident in the lack of native understorey species. The community occurs on a granite outcrop on lower slopes near a minor drainage channel.	Quadrats: Too13 Species richness: 9 native and 9 weed species Area: 9.33 ha in Wheatbelt section. Condition was Degraded.	
EwGtAl *Eucalyptus wandoo* subsp. *wandoo, Corymbia calophylla* and *Eucalyptus accedens* mid open forest over *Gastrolobium truncatum, G. parviflorum* and *Xanthorrhoea preissii* mid open shrubland over *Acacia lasiocarpa* var. *sedifolia, Opercularia vaginata* and *Hakea lissocarpha* mid open heath shrubland. The community was considered in Very Good to Excellent condition. This Wandoo woodland was recorded on undulating terrain dissected by numerous minor drainage channels. No water was present at the time of the survey. Plant density increased in the drainage channels however species composition remained the same. This community is significant due to the presence of Priority flora populations including *Boronia scabra* subsp. *condensata, Calytrix oncophylla, Grevillea candolleana* and *Hibbertia montana*.	Quadrats: Too11, 14, 15, 20, 23, 28, 29 Species richness: 118 species including 104 native and 14 weed species Area: 55.15 ha in Wheatbelt section. Condition ranged from Degraded to Excellent.	

AECOM vegetation community	Comments	Photograph
EwXpTo *Eucalyptus wandoo* subsp. *wandoo, Corymbia calophylla* and *Eucalyptus accedens* mid woodland over *Xanthorrhoea preissii*, *Acacia pulchella* and *Hakea lissocarpha* mid to tall open shrubland over *Tetraria octandra*, *Hypocalymma angustifolium* and *Tricoryne elatior* low to mid open heath shrubland. Condition was recorded as Good to Very Good. This community was recorded on slopes with exposed granite and occasionally exposed laterite.	Quadrats: Too40, 41, 42, 45 Species richness: 79 species including 73 native and 6 weed species Area: 24.26 ha in Metro section. Condition ranged from Completely Degraded to Excellent. .	
Heath		
EdBn *Eucalyptus drummondii* mid isolated trees over *Banksia nivea* subsp. Morangup (P2), *Kunzea micrantha* subsp. *micrantha* and *Hakea incrassata* low heathland. EdBn was in Excellent condition, situated in Morangup Nature Reserve on sandy clay red soils. This community lacks a tall to mid shrub stratum. The area is seasonally damp and incorporates a unique floristic composition including two Priority flora populations. For this reason community EdBn are considered significant.	Quadrats: Too06 No impact anticipated on Nature Reserve therefore sampling effort was low. Species richness: 18 species, all native Area: 2.21 ha in Wheatbelt section. Condition was Excellent.	

AECOM vegetation community	Comments	Photograph
Wetlands		
CcAaBj *Corymbia calophylla* mid open woodland over *Astartea affinis*, *Astartea scoparia* and *Acacia saligna* tall shrubland over *Baumea juncea* tall sedgeland. This community is limited to one pocket of Very Good and several smaller pockets of Degraded vegetation. The community represents an ecotone of a Eucalypt woodland and a wetland community, with characteristics of both. For this reason, the community was not grouped with other wetland or woodland communities. One quadrat was completed on loamy clay soils representing a shallow minor drainage channel. Water was present at the time of the survey.	Quadrats: Too57 Restricted in area therefore only one quadrat completed. Species richness: 7 species, all native Area: 0.52 ha Condition ranged from Degraded to Very Good. Located in Main Roads Metro section.	
ErAsOp *Eucalyptus rudis* subsp. *rudis*, *Casuarina obesa* and *Melaleuca rhaphiophylla* low to mid open forest over *Acacia saligna*, *Acacia acuminata* and *Acacia burkittii* low to tall isolated clumps of shrubs over **Oxalis pes-caprae*, **Avena barbata* and **Oxalis corniculata* low mixed herb and tussock grassland. This community is isolated to one area near Toodyay. It represents the Avon River and is considered a Degraded major drainage channel. No water was present at the time of the survey. The understorey is dominated by weed species with no low native shrubs present.	Quadrats: Too25, 26, 74 Species richness: 34 species including 17 native and 16 weed species Area: 4.56 ha in Wheatbelt section. Condition was Degraded.	

AECOM vegetation community	Comments	Photograph
ErMvLd *Eucalyptus rudis* subsp. *rudis* and *Corymbia calophylla* mid open woodland over *Melaleuca viminea* subsp. *viminea*, *Melaleuca preissiana* and *Acacia saligna* tall open shrubland over *Lepidosperma drummondii*, *Ficinia nodosa* and *Juncus pallidus* tall sedgeland. The community was recorded in Degraded to Good condition. This community is associated with shallow wetlands. The tree stratum is only present on the edge of the wetland, with the centre predominantly sedges and rushes. Burnt areas are denoted with a "b" after the code.	Quadrats: Too34, 43, r1 Species richness: 40 species including 25 native and 15 weed species Area: 40.12 ha Metro: 12.01 ha Wheatbelt: 28.11 ha including 4.56 ha burnt vegetation. Condition ranged from Degraded to Excellent.	
ErPlCc *Eucalyptus rudis* subsp. *rudis* and *Melaleuca rhaphiophylla* mid woodland over *Paraserianthes lophantha* subsp. *lophantha*, *Acacia extensa* and *Acacia divergens* tall shrubland over *Chorizema cordata* low isolated heath shrubland. This community is isolated to one wetland within Morangup Nature Reserve and is considered in Very Good to Excellent condition. The unique wetland composition may be attributed to evidence of recent fire. The lower shrub stratum is absent, with a tall shrub thicket providing more than 50% cover. Condition was recorded as Excellent.	Quadrats: Too04, 68, 69 Species richness: 19 species including 17 native and two weed species Area: 2.57 ha in Wheatbelt section. Condition ranged from Very Good to Excellent.	

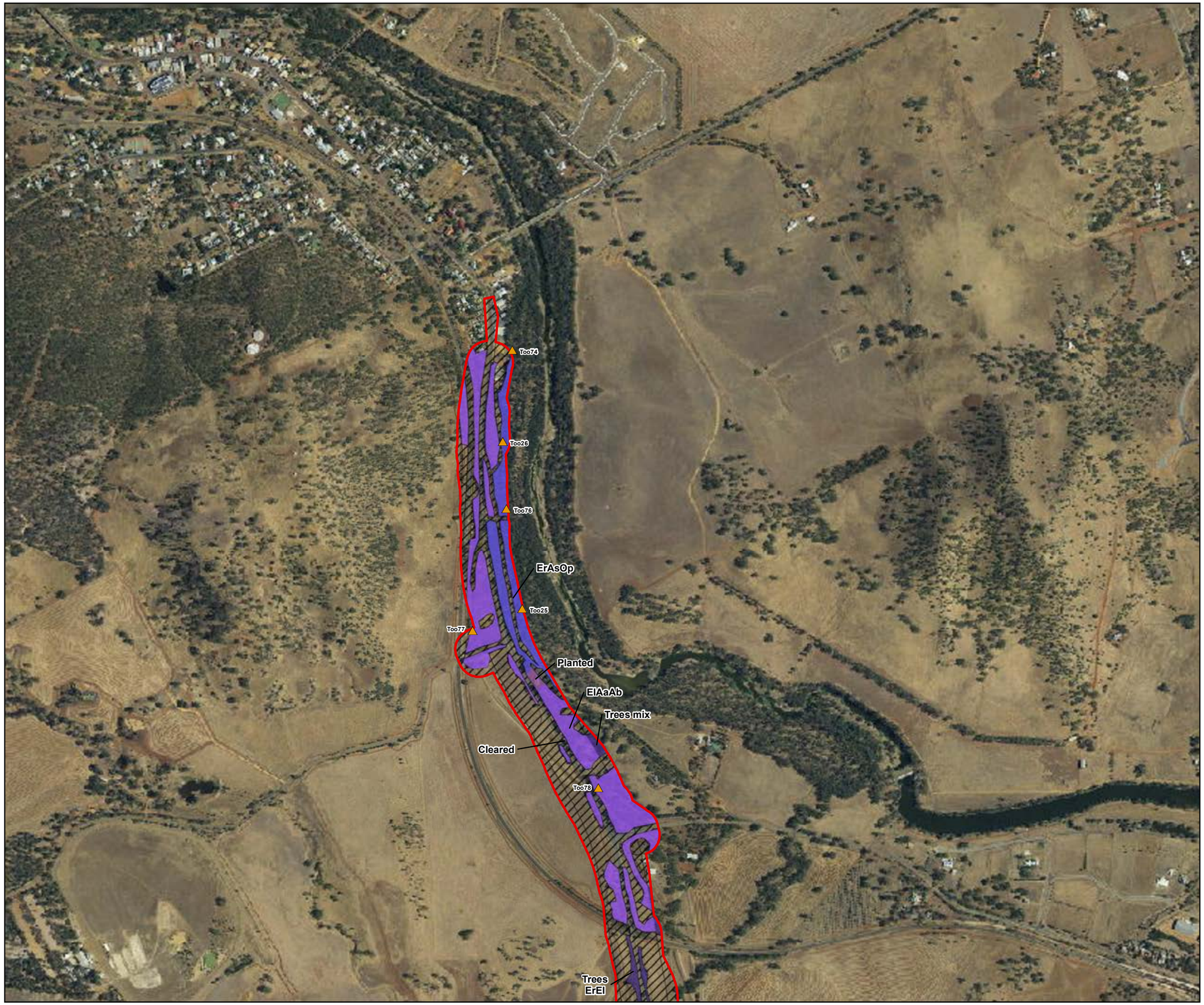
AECOM vegetation community	Comments	Photograph
ErToLm *Eucalyptus rudis* subsp. *rudis* and either *Eucalyptus wandoo* subsp. *wandoo* or *Corymbia calophylla* mid open forest over *Typha orientalis, Melaleuca incana* subsp. *incana,* and *Trymalium odoratissimum* subsp. *odoratissimum* tall open rushland over *Lepyrodia muirii, Alexgeorgea nitens* and **Avena barbata* tall mixed rush and grassland ErToLm was recorded in Degraded to Very Good condition. This community represents a major drainage channel with water present at the time of the survey. The drainage channel is wide and has shallow slopes. Soils include red brown sandy loam. Condition was recorded as Good to Very Good. At some locations, the invasive **Typha orientalis* is present and has displaced native rushes and sedges.	Quadrats: Too02, 39, 44, 66, 75 Species richness: 53 species including 40 native and 13 weed species Area: 10.81 ha Metro: 9.98 ha Wheatbelt: 0.83 ha Condition ranged from Degraded to Very Good.	
EwAbBs *Eucalyptus wandoo* subsp. *wandoo*, *Eucalyptus rudis* subsp. *rudis* and *Allocasuarina huegeliana* low to mid open forest over *Acacia burkittii, Acacia saligna* and *Trymalium odoratissimum* subsp. *odoratissimum* tall open shrubland over *Bossiaea spinescens*, *Acacia pulchella* and *Hibbertia commutata* low to mid heath shrubland. This drainage community represents minor to major drainage channels with steep slopes. The water present has encouraged weed dispersion along the river therefore condition was recorded as Good to Degraded. Dense patches of **Romulea rosea* var. *australis*, **Freesia alba* x *leightlinii*, **Arctotheca calendula*, and **Oxalis pes-caprae* were recorded. These weeds have displaced the majority of native herbs and low shrubs.	Quadrats: Too12, 30, 31 Species richness: 54 species including 38 native and 16 weed species Area: 32.78 ha Metro: 0.28 ha Wheatbelt: 32.50 ha Condition ranged from Degraded to Very Good.	

AECOM vegetation community	Comments	Photograph
EwHuAn *Eucalyptus wandoo* subsp. *wandoo* mid open forest over *Hakea undulata*, *Banksia sessilis* var. *sessilis* and *Banksia squarrosa* subsp. *squarrosa* tall isolated shrubs over *Alexgeorgea nitens*, *Opercularia vaginata* and *Daviesia hakeoides* subsp. *hakeoides* low mixed sedge and herbland. This community was isolated to one area within the Study area and was recorded in Very Good to Excellent condition. It lies adjacent to a drainage channel community and upland Eucalypt woodland, and has a unique composition lacking most of the shrub stratum. The community was recorded on lower slopes on sandy loam gravel and was in Excellent condition with some evidence of tracks.	Quadrats: Too03, 67, 73 Species richness: 77 species including 67 native and ten weed species. Area: 6.2 ha in Wheatbelt section. Condition ranged from Good to Very Good.	
MpHvLl *Melaleuca preissiana* and *Corymbia calophylla* low to mid woodland over *Hakea varia, Xanthorrhoea preissii* and *Kunzea micrantha* subsp. *micrantha* tall open shrubland over *Lepidosperma longitudinale*, *Cyathochaeta avenacea* and *Mesomelaena tetragona* closed sedgeland. Condition was considered Very Good to Excellent. This community is associated with shallow wetlands. No water was present at the time of survey. The community lacks a mid to tall tree stratum with the exception of the edge of the community. Isolated clumps of *Viminaria juncea* were also recorded. The community is located on brown loam clay with soils observed to be moist.	Quadrats: Too51, 52, 53, 61, 62 Species richness: 66 species including 55 native and 11 weed species Area: 19.19 ha Metro: 17.89 ha Wheatbelt: 1.3 ha Condition ranged from Degraded to Excellent.	

AECOM vegetation community	Comments	Photograph
Disturbed		
Calo Calothamnus thicket No quadrats were completed within this community due to restricted size, low environmental value, and difficult access through thicket. The community comprised of *Calothamnus rupestris* species with scattered *Hakea* species.	Area: 0.40 ha Condition was Good. Located in Main Roads Metro section.	
Main Roads Rehabilitation No sites were completed within this vegetation community. Relevés and observations were made as the Study area was traversed.	Area: 18.27 ha in Metro section. Condition ranged from Degraded to Very Good. Located in Main Roads Metro section.	

AECOM vegetation community	Comments	Photograph
Native Trees / Trees Mix Comprised of native trees in paddocks or on roadsides where understorey has been cleared/grazed. Relevés were completed within this community. Cockatoo tree data was also used to identify tree species present. Dominant trees included: · *Corymbia calophylla* · *Eucalyptus accedens* · *Eucalyptus loxophleba* · *Eucalyptus rudis* subsp. *rudis* · *Eucalyptus wandoo* subsp. *wandoo* · *Eucalyptus patens*.	Quadrats: Too54, 55 Many observational data captured in mixed trees with only two represented as a quadrat due to degraded nature of this community. Species richness: 13 species including ten native and three weed species. Area: 141.08 ha Metro: 39.74 ha Wheatbelt: 101.34 ha Condition ranged from Completely Degraded to Degraded.	
EwBsLp *Eucalyptus wandoo* subsp. *wandoo* and *Corymbia calophylla* mid woodland over *Banksia squarrosa* subsp. *squarrosa*, *Leptospermum erubescens* and *Banksia sessilis* var. sessilis tall shrubland over *Leucopogon propinquus*, *Dillwynia laxiflora* and *Hibbertia commutata* low isolated heath shrubland. This community represents cleared areas where native species have returned either as a result of rehabilitation or natural succession. Species diversity is similar to adjacent native vegetation however species composition includes a higher density of disturbance opportunists such as *Banksia squarrosa* subsp. *squarrosa* and *Banksia sessilis*. Geomorphology appears altered and soils are comprised mostly of gravel and sand. This community is significant due to the presence of Priority flora populations.	Quadrats: Too 16, 33, 70, 71 Species richness: 69 species including 62 native and 7 weed species Area: 3.39 ha in Wheatbelt section. Condition was Good.	

AECOM vegetation community	Comments	Photograph
Planted - Planted vegetation on private property.	Area: 24.56 ha Metro: 16.58 ha Wheatbelt: 7.98 ha	



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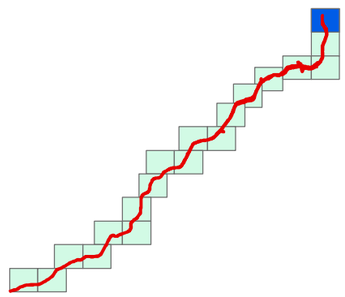
LEGEND

- Quadrat Location
- Study Area

Community

- Calo
- CcAaBj
- CcLeAp
- CcXpHh
- CcXpLb
- CcXpLb b
- Cleared
- EaXpBe
- EaXpBe-b
- EdBn
- ElAaAb
- EmXpBd
- ErAsOp
- ErMvLd
- ErMvLd b
- ErPlCc
- ErToLm
- EwAaAb
- EwAbBs
- EwBsLp
- EwGtAl
- EwHuAn
- EwXpTo
- MRWA Rehab
- MpHvLl
- Planted
- Native Trees
- Water



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Toodyay Biological Assessment

Vegetation Communities

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LAST MODIFIED	fotheringhamd - 15 Nov 2016
VERSION:	2

Figure 5A

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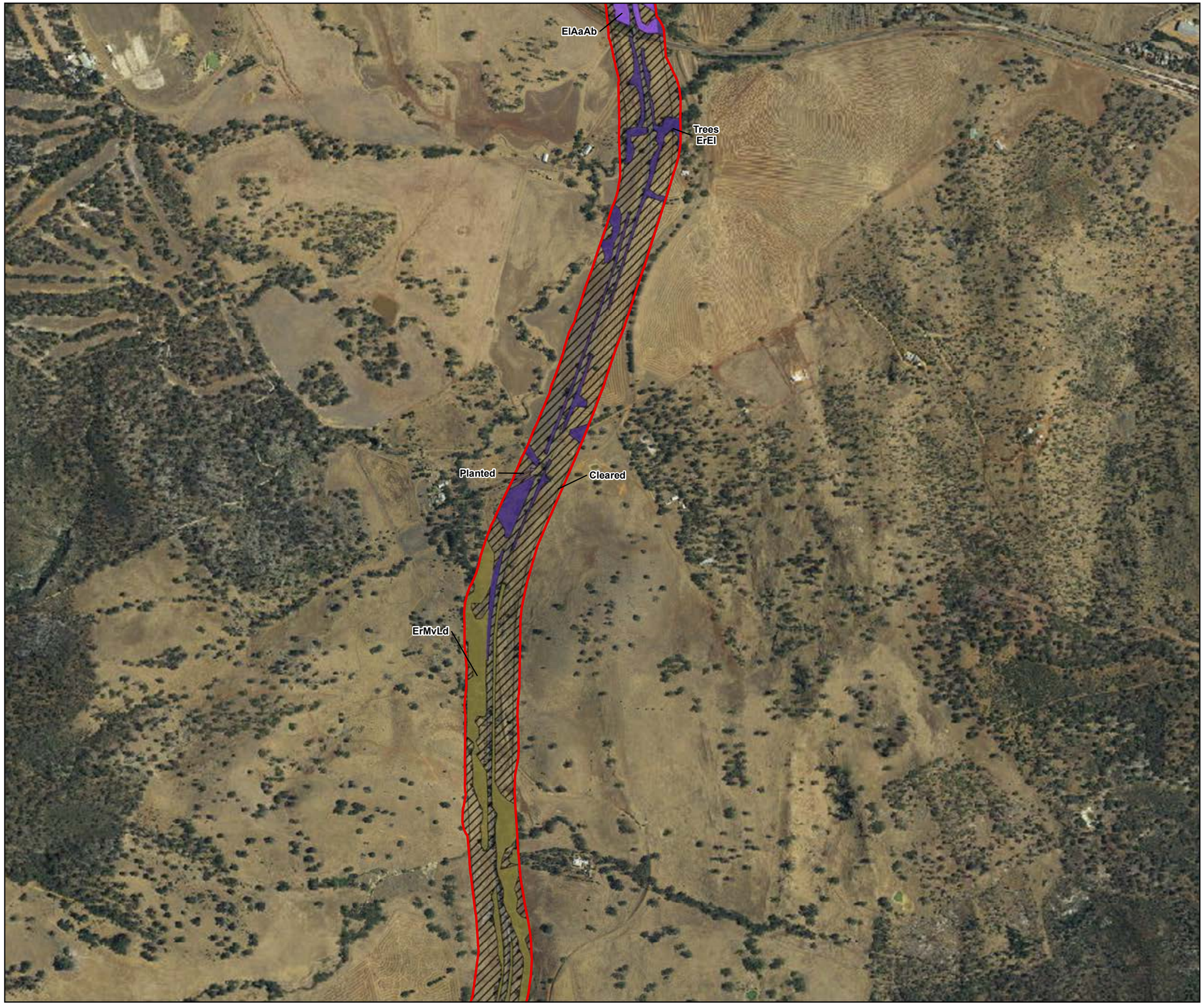

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Metres

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LEGEND

- Quadrat Location
- Study Area

Community

- Calo
- CcAaBj
- CcLeAp
- CcXpHh
- CcXpLb
- CcXpLb b
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- EaXpBe
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- ErMvLd
- ErMvLd b
- ErPlCc
- ErToLm
- EwAaAb
- EwAbBs
- EwBsLp
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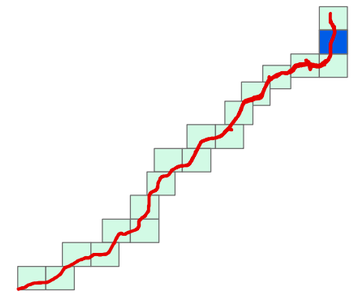
- EwHuAn
- EwXpTo
- MRWA Rehab
- MpHvLl
- Planted
- Native Trees
- Water



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Toodyay Biological Assessment

Vegetation Communities

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Figure 5B

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Metres

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LEGEND

- Quadrat Location
- Study Area

Community

- Calo
- CcAaBj
- CcLeAp
- CcXpHh
- CcXpLb
- CcXpLb b
- Cleared
- EaXpBe
- EaXpBe-b
- EdBn
- ElAaAb
- EmXpBd
- ErAsOp
- ErMvLd
- ErMvLd b
- ErPlCc
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- EwAbBs
- EwBsLp
- EwGtAl
- EwHuAn
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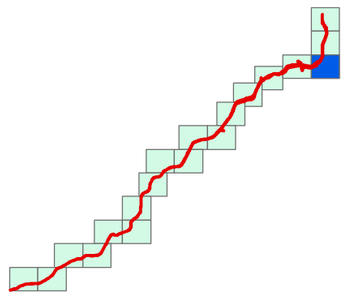
- MRWA Rehab
- MpHvLl
- Planted
- Native Trees
- Water



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Vegetation Communities

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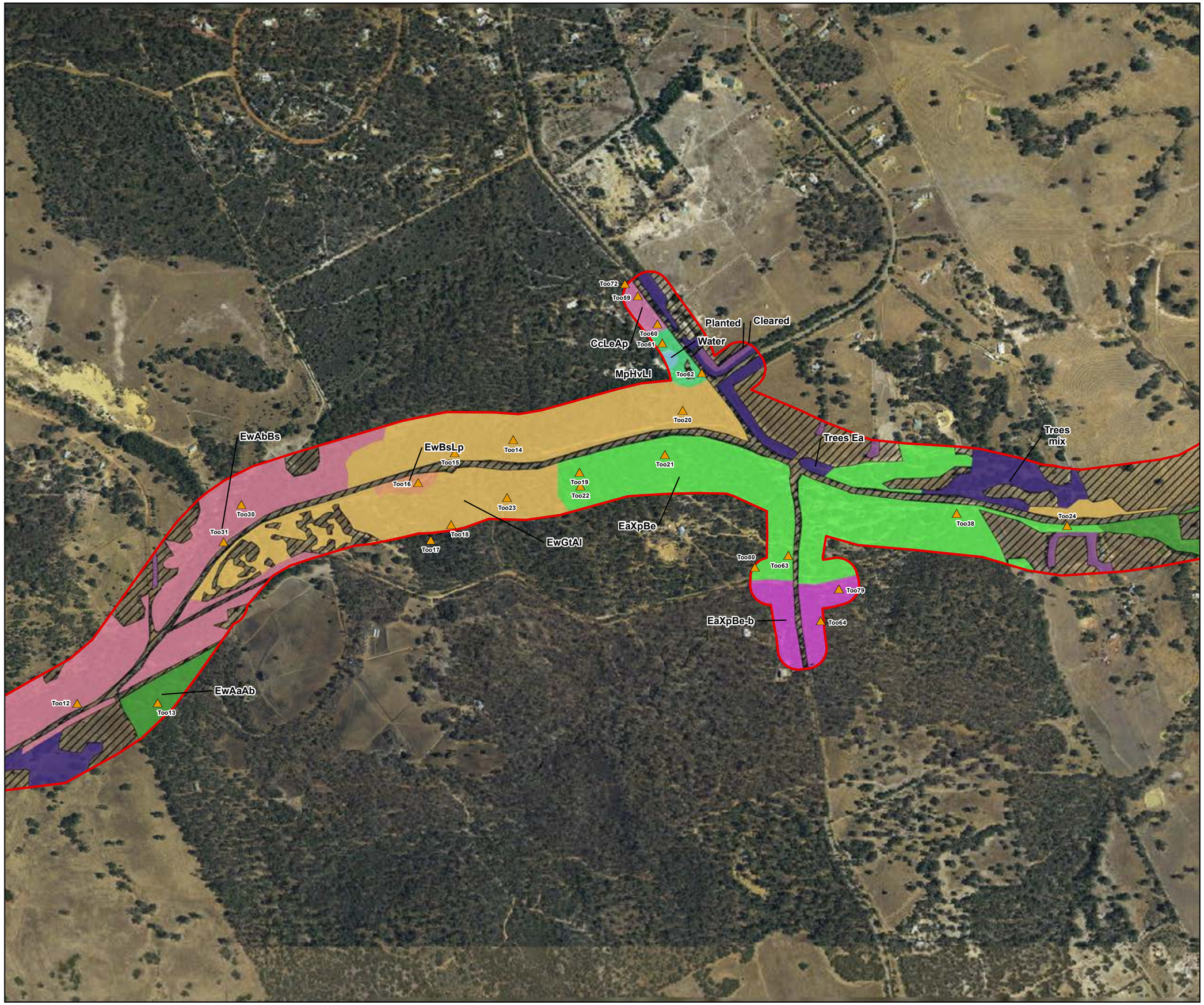

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LEGEND

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Community

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- CcLeAp
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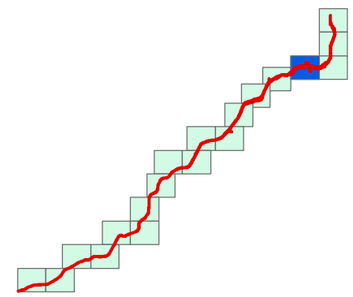
- MRWA Rehab
- MpHvLl
- Planted
- Native Trees
- Water



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Toodyay Biological Assessment

Vegetation Communities

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Figure 5D

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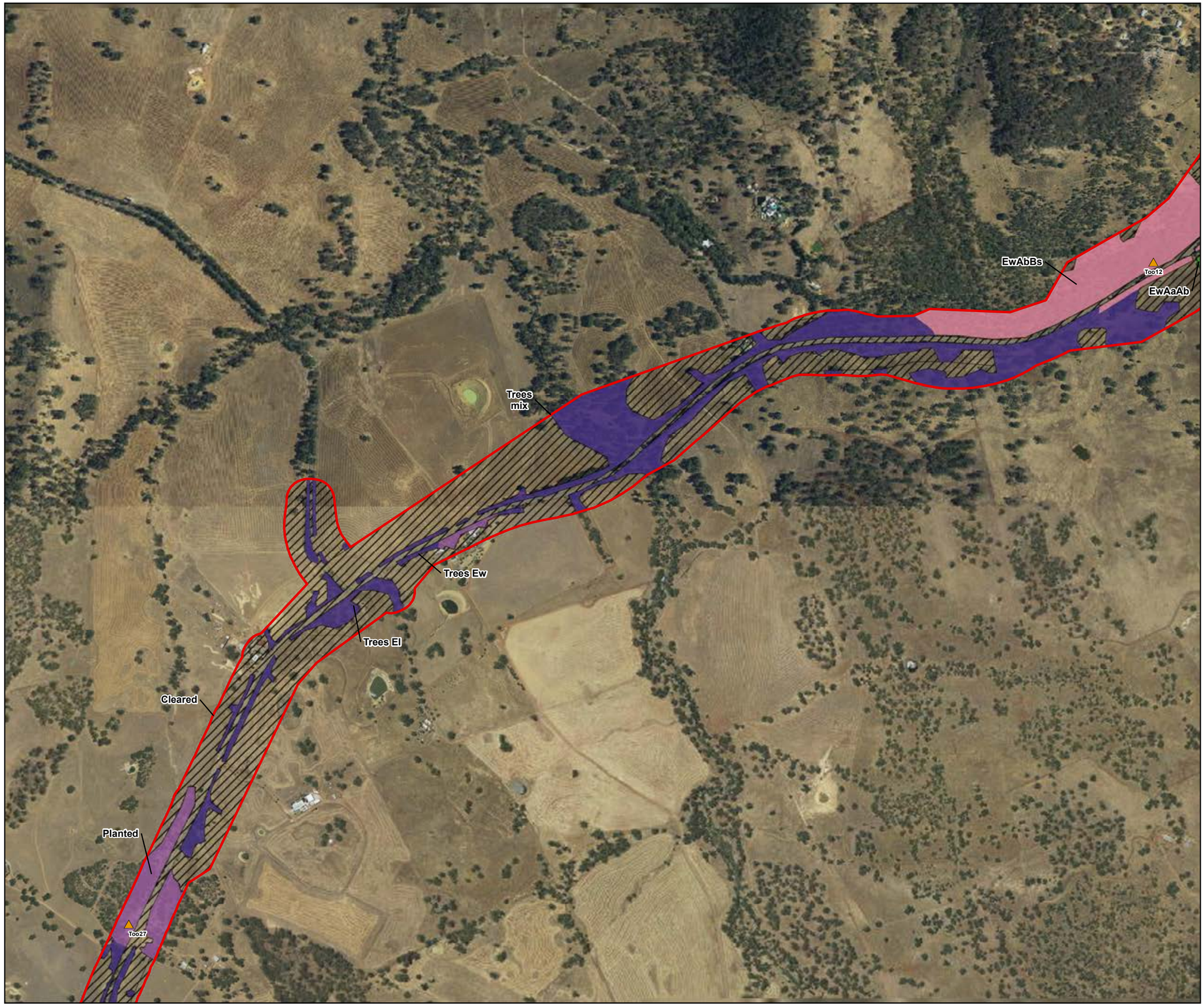

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Metres

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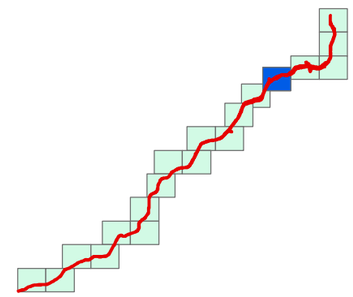
LEGEND

- Quadrat Location
- Study Area

Community

- Calo
- CcAaBj
- CcLeAp
- CcXpHh
- CcXpLb
- CcXpLb b
- Cleared
- EaXpBe
- EaXpBe-b
- EdBn
- ElAaAb
- EmXpBd
- ErAsOp
- ErMvLd
- ErMvLd b
- ErPlCc
- ErToLm
- EwAaAb
- EwAbBs
- EwBsLp
- EwGtAl
- EwHuAn
- EwXpTo
- MRWA Rehab
- MpHvLl
- Planted
- Native Trees
- Water



Data sources:

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Toodyay Biological Assessment

Vegetation Communities

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Figure 5E

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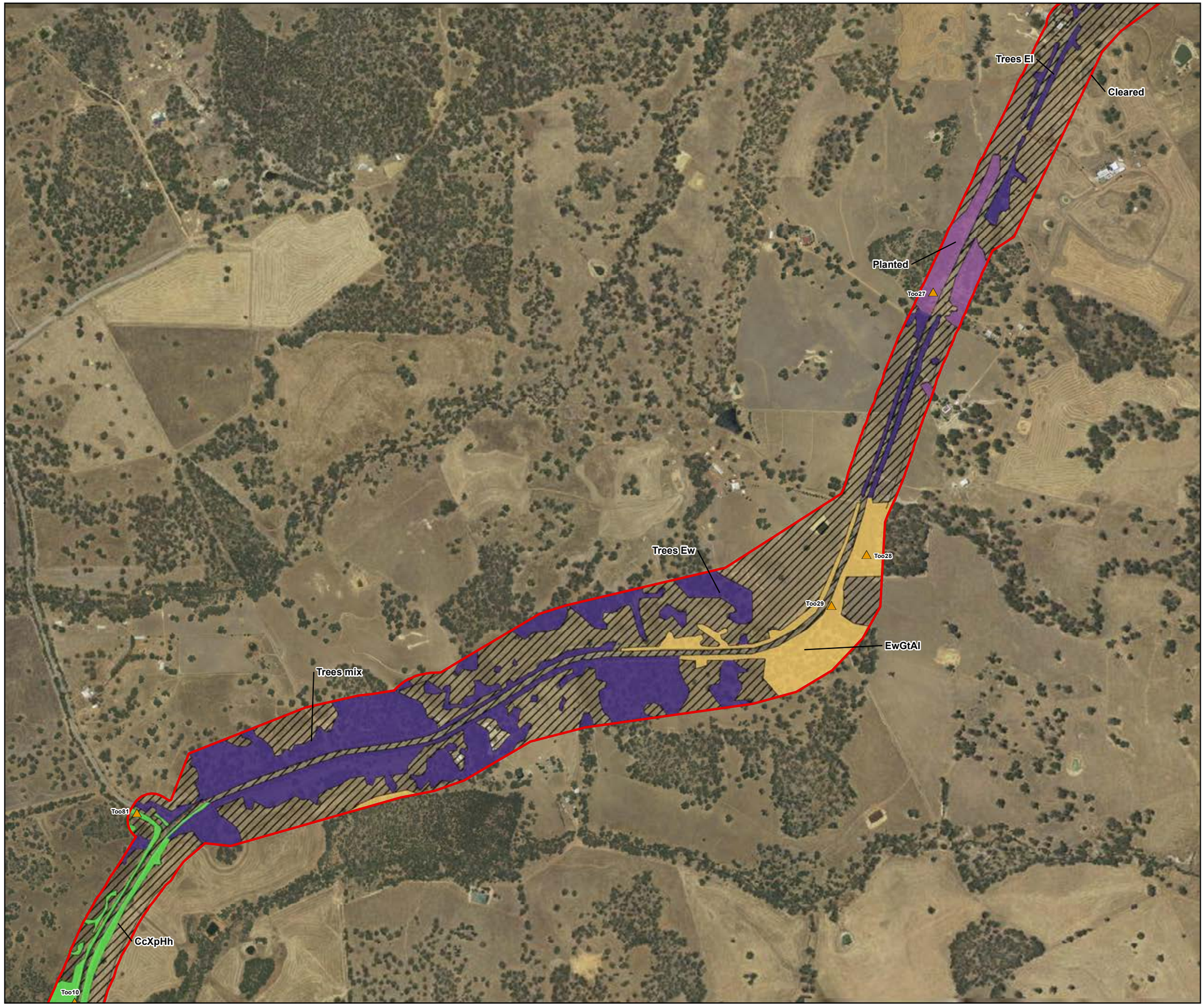

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N

GDA 1994 MGA Zone 50

0 125 250 500
Metres

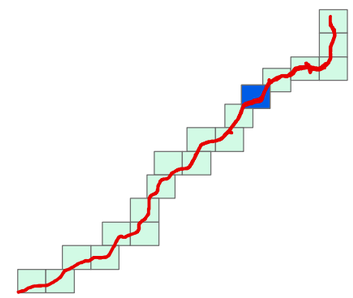
1:10,000 (when printed at A3)

LEGEND

- Quadrat Location
- Study Area

Community

- Calo
- CcAaBj
- CcLeAp
- CcXpHh
- CcXpLb
- CcXpLb b
- Cleared
- EaXpBe
- EaXpBe-b
- EdBn
- ElAaAb
- EmXpBd
- ErAsOp
- ErMvLd
- ErMvLd b
- ErPlCc
- ErToLm
- EwAaAb
- EwAbBs
- EwBsLp
- EwGtAl
- EwHuAn
- EwXpTo
- MRWA Rehab
- MpHvLl
- Planted
- Native Trees
- Water



Data sources:

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Vegetation Communities

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Figure
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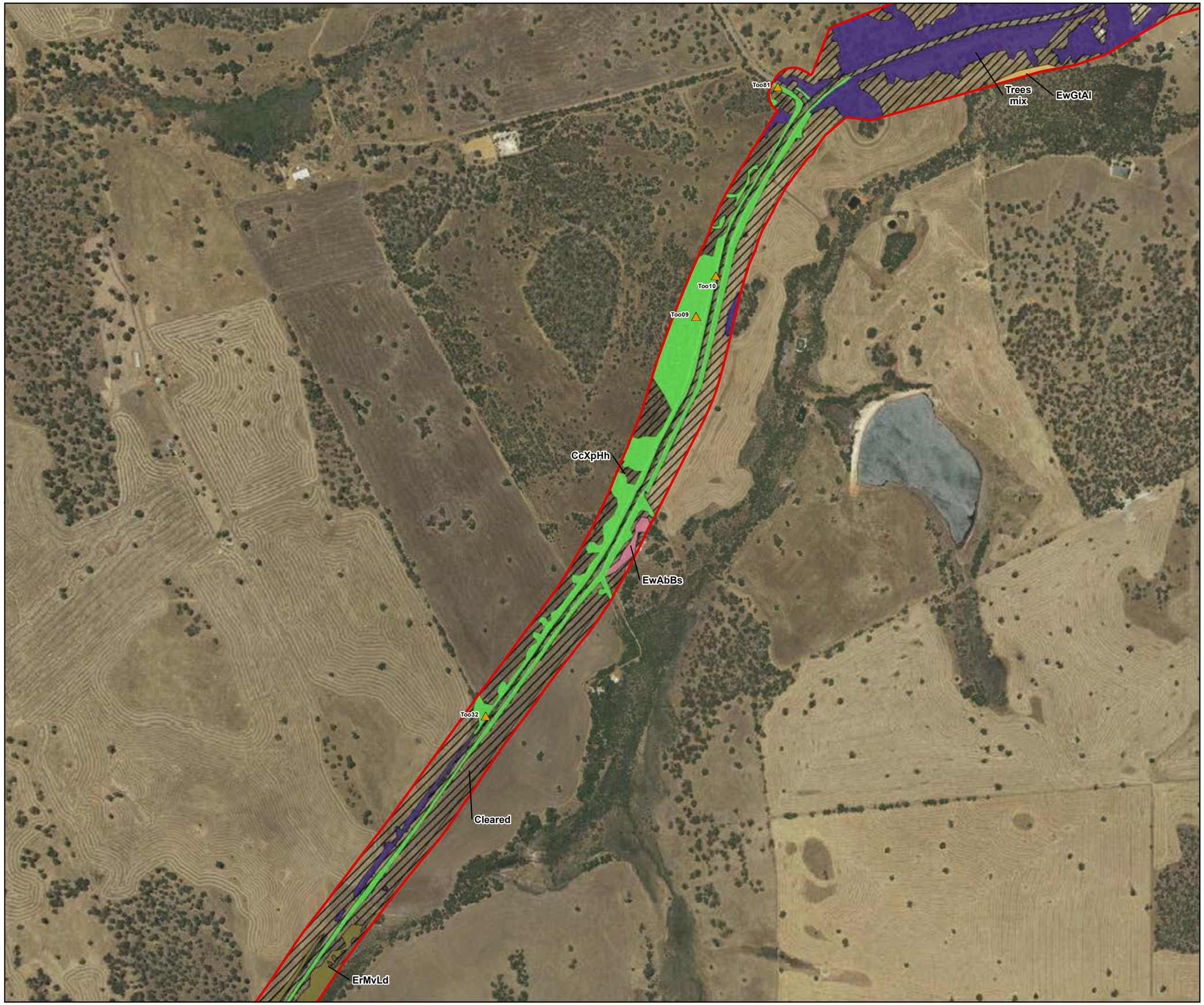

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GDA 1994 MGA Zone 50

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Metres

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LEGEND

- Quadrat Location
- Study Area

Community

- Calo
- CcAaBj
- CcLeAp
- CcXpHh
- CcXpLb
- CcXpLb b
- Cleared
- EaXpBe
- EaXpBe-b
- EdBn
- ElAaAb
- EmXpBd
- ErAsOp
- ErMvLd
- ErMvLd b
- ErPlCc
- ErToLm
- EwAaAb
- EwAbBs
- EwBsLp
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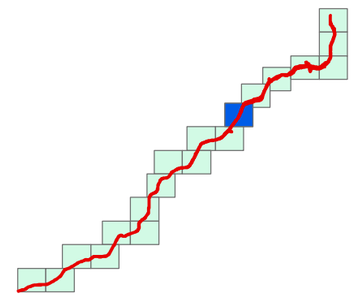
- EwXpTo
- MRWA Rehab
- MpHvLl
- Planted
- Native Trees
- Water



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Vegetation Communities

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Figure 5G

A3 size

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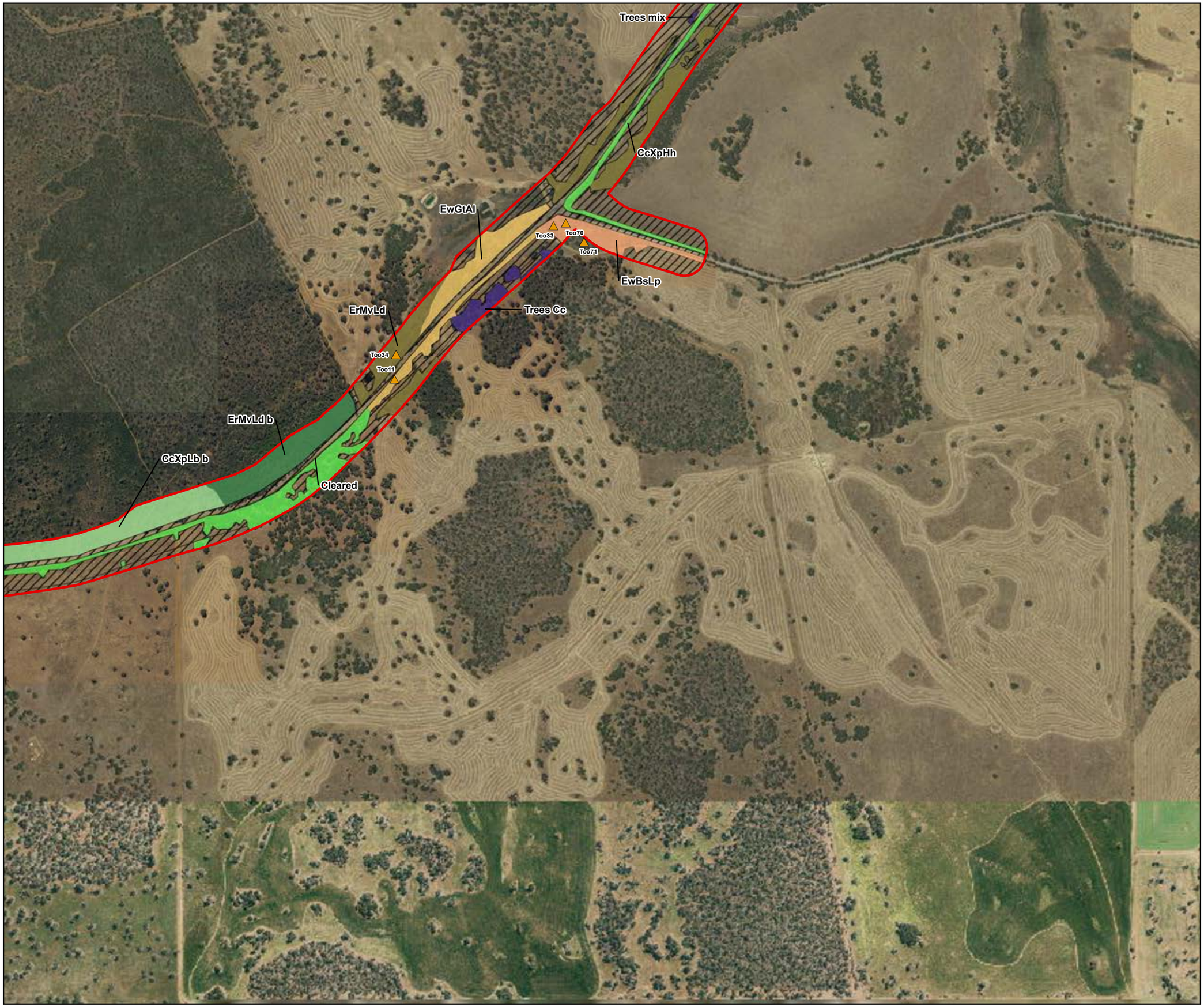

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GDA 1994 MGA Zone 50

0 125 250 500
Metres

1:10,000 (when printed at A3)

LEGEND

- Quadrat Location
- Study Area

Community

- Calo
- CcAaBj
- CcLeAp
- CcXpHh
- CcXpLb
- CcXpLb b
- Cleared
- EaXpBe
- EaXpBe-b
- EdBn
- ElAaAb
- EmXpBd
- ErAsOp
- ErMvLd
- ErMvLd b
- ErPlCc
- ErToLm
- EwAaAb
- EwAbBs
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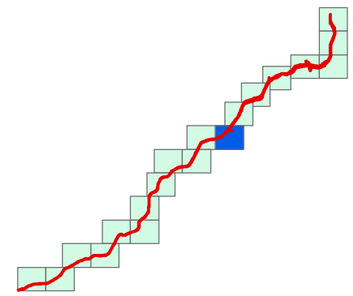
- MRWA Rehab
- MpHvLl
- Planted
- Native Trees
- Water



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Vegetation Communities

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Figure
5H

A3 size

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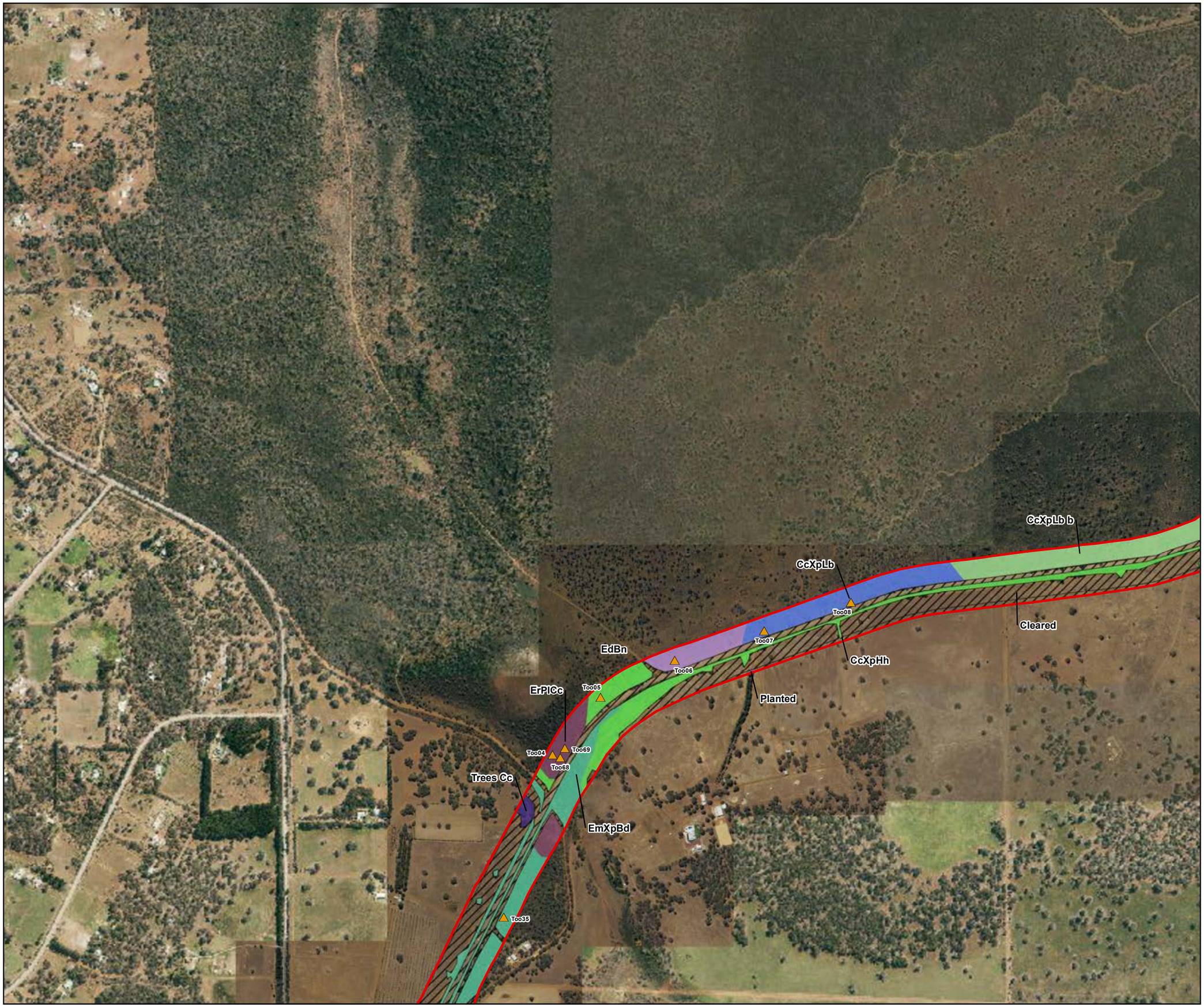

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GDA 1994 MGA Zone 50

0 125 250 500

Metres

1:10,000 (when printed at A3)

LEGEND

- Quadrat Location
- Study Area

Community

- Calo
- CcAaBj
- CcLeAp
- CcXpHh
- CcXpLb
- CcXpLb b
- Cleared
- EaXpBe
- EaXpBe-b
- EdBn
- ElAaAb
- EmXpBd
- ErAsOp
- ErMvLd
- ErMvLd b
- ErPlCc
- ErToLm
- EwAaAb
- EwAbBs
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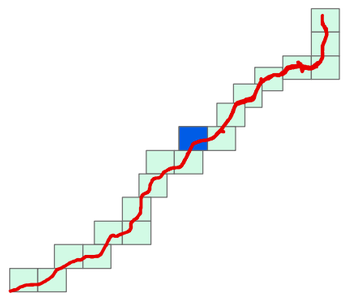
- MpHvLl
- Planted
- Native Trees
- Water



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Vegetation Communities

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N

GDA 1994 MGA Zone 50

0 125 250 500

Metres

1:10,000 (when printed at A3)

LEGEND

- Quadrat Location
- Study Area

Community

- Calo
- CcAaBj
- CcLeAp
- CcXpHh
- CcXpLb
- CcXpLb b
- Cleared
- EaXpBe
- EaXpBe-b
- EdBn
- ElAaAb
- EmXpBd
- ErAsOp
- ErMvLd
- ErMvLd b
- ErPlCc
- ErToLm
- EwAaAb
- EwAbBs
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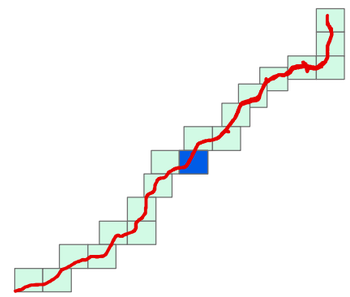
- MpHvLl
- Planted
- Native Trees
- Water



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N

GDA 1994 MGA Zone 50

0 125 250 500
Metres

1:10,000 (when printed at A3)

LEGEND

- Quadrat Location
- Study Area

Community

- Calo
- CcAaBj
- CcLeAp
- CcXpHh
- CcXpLb
- CcXpLb b
- Cleared
- EaXpBe
- EaXpBe-b
- EdBn
- ElAaAb
- EmXpBd
- ErAsOp
- ErMvLd
- ErMvLd b
- ErPlCc
- ErToLm
- EwAaAb
- EwAbBs
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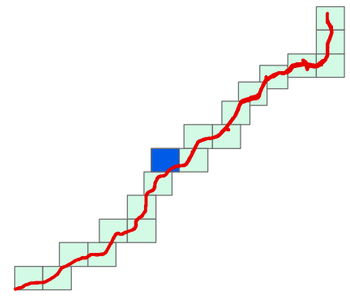
- MpHvLl
- Planted
- Native Trees
- Water



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Vegetation Communities

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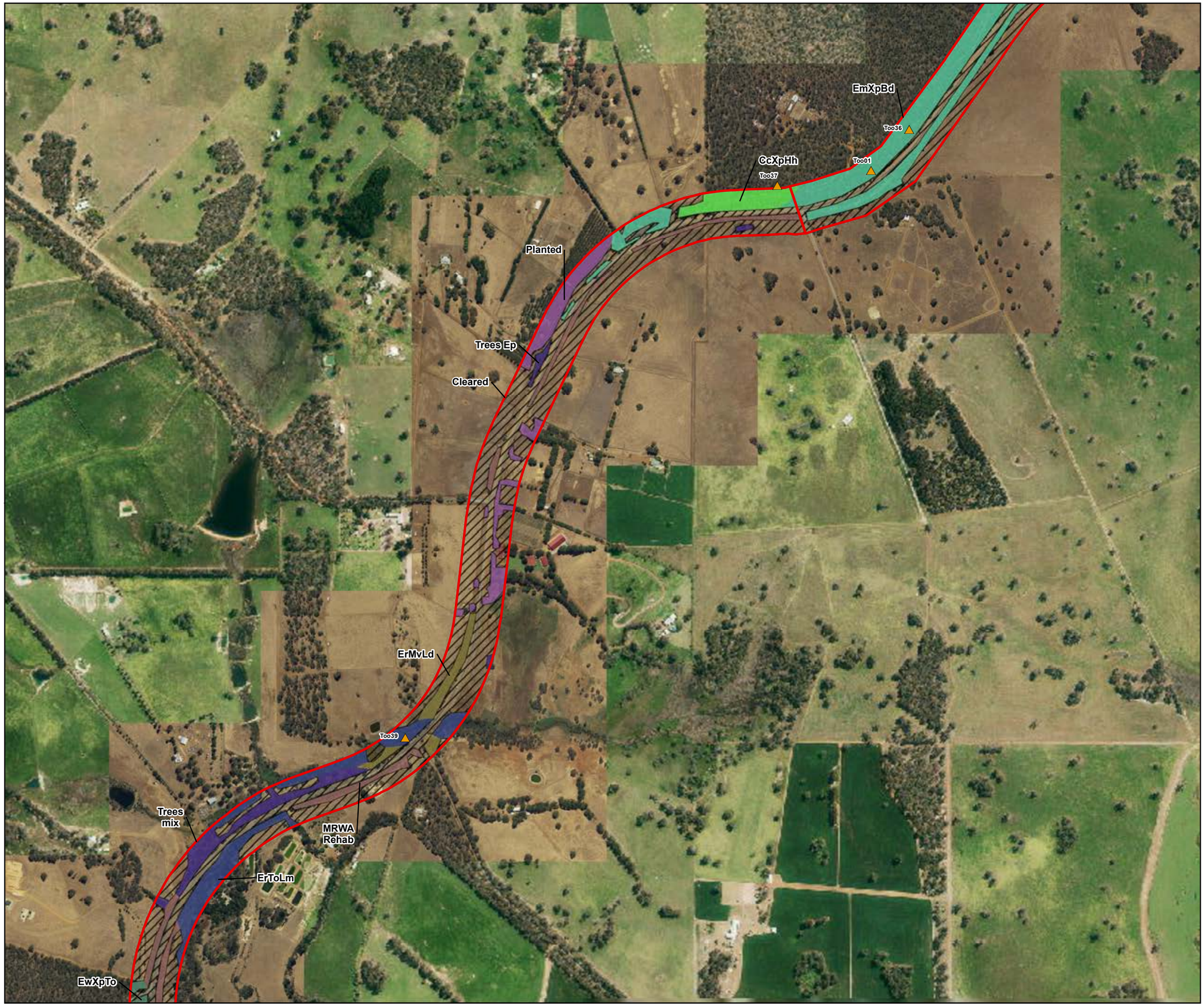

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N

GDA 1994 MGA Zone 50

0 125 250 500
Metres

1:10,000 (when printed at A3)

LEGEND

- Quadrat Location
- Study Area

Community

- Calo
- CcAaBj
- CcLeAp
- CcXpHh
- CcXpLb
- CcXpLb b
- Cleared
- EaXpBe
- EaXpBe-b
- EdBn
- ElAaAb
- EmXpBd
- ErAsOp
- ErMvLd
- ErMvLd b
- ErPlCc
- ErToLm
- EwAaAb
- EwAbBs
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- EwHuAn
- EwXpTo
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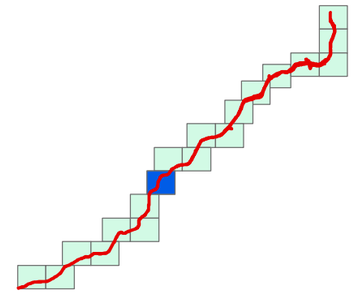
- MpHvLl
- Planted
- Native Trees
- Water



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Vegetation Communities

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GDA 1994 MGA Zone 50

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Metres

1:10,000 (when printed at A3)

LEGEND

- Quadrat Location
- Study Area

Community

- Calo
- CcAaBj
- CcLeAp
- CcXpHh
- CcXpLb
- CcXpLb b
- Cleared
- EaXpBe
- EaXpBe-b
- EdBn
- ElAaAb
- EmXpBd
- ErAsOp
- ErMvLd
- ErMvLd b
- ErPlCc
- ErToLm
- EwAaAb
- EwAbBs
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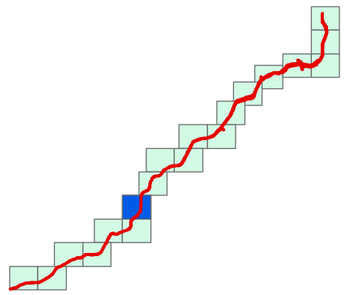
- MpHvLl
- Planted
- Native Trees
- Water



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Vegetation Communities

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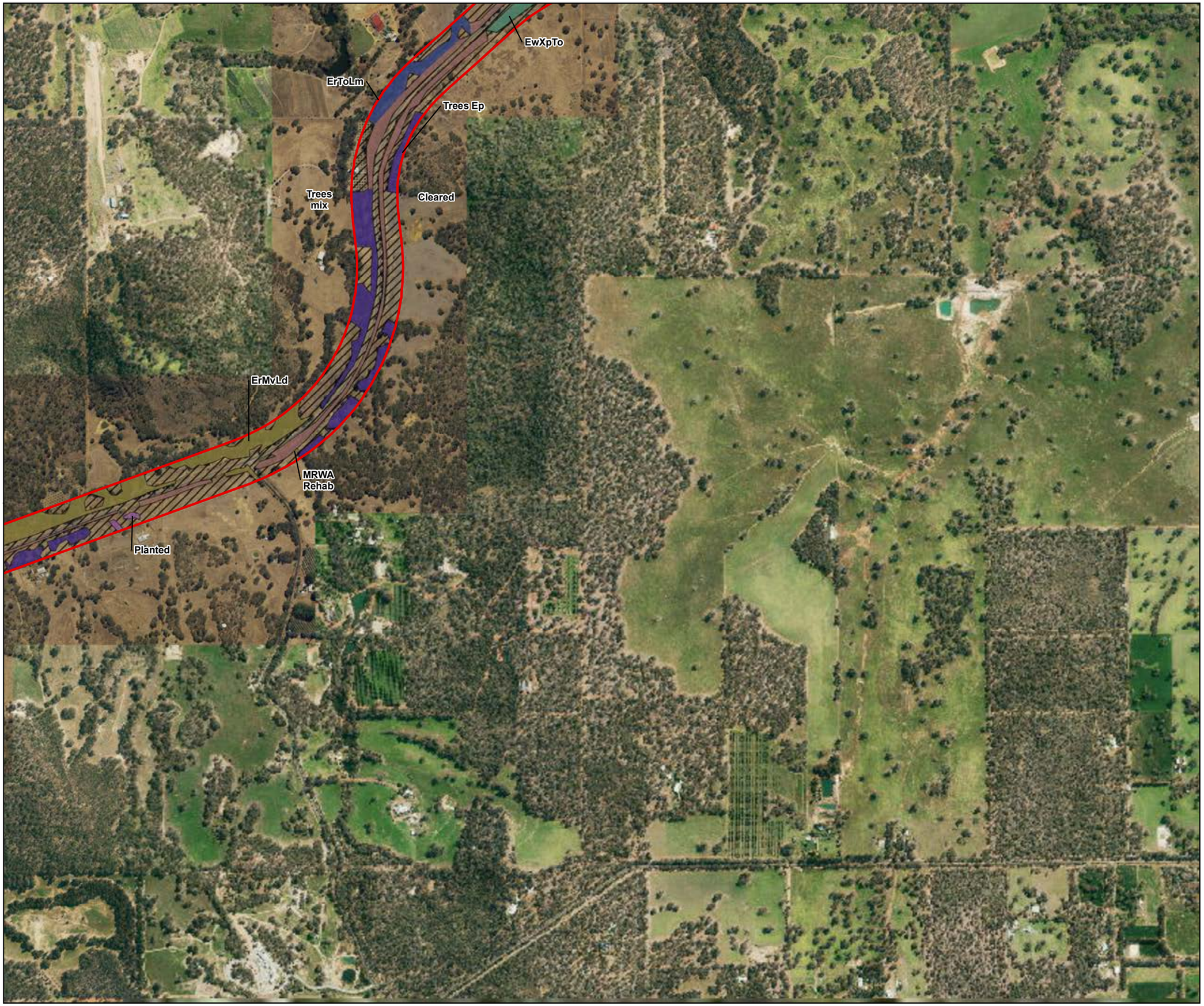

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GDA 1994 MGA Zone 50

0 125 250 500

Metres

1:10,000 (when printed at A3)

LEGEND

- Quadrat Location
- Study Area

Community

- Calo
- CcAaBj
- CcLeAp
- CcXpHh
- CcXpLb
- CcXpLb b
- Cleared
- EaXpBe
- EaXpBe-b
- EdBn
- ElAaAb
- EmXpBd
- ErAsOp
- ErMvLd
- ErMvLd b
- ErPlCc
- ErToLm
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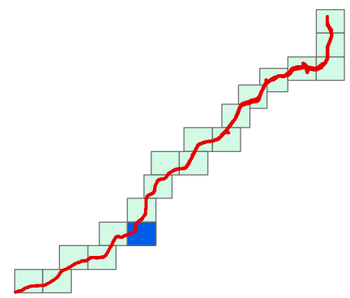
- MpHvLl
- Planted
- Native Trees
- Water



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Vegetation Communities

PROJECT ID	60344161
CREATED BY	DGF
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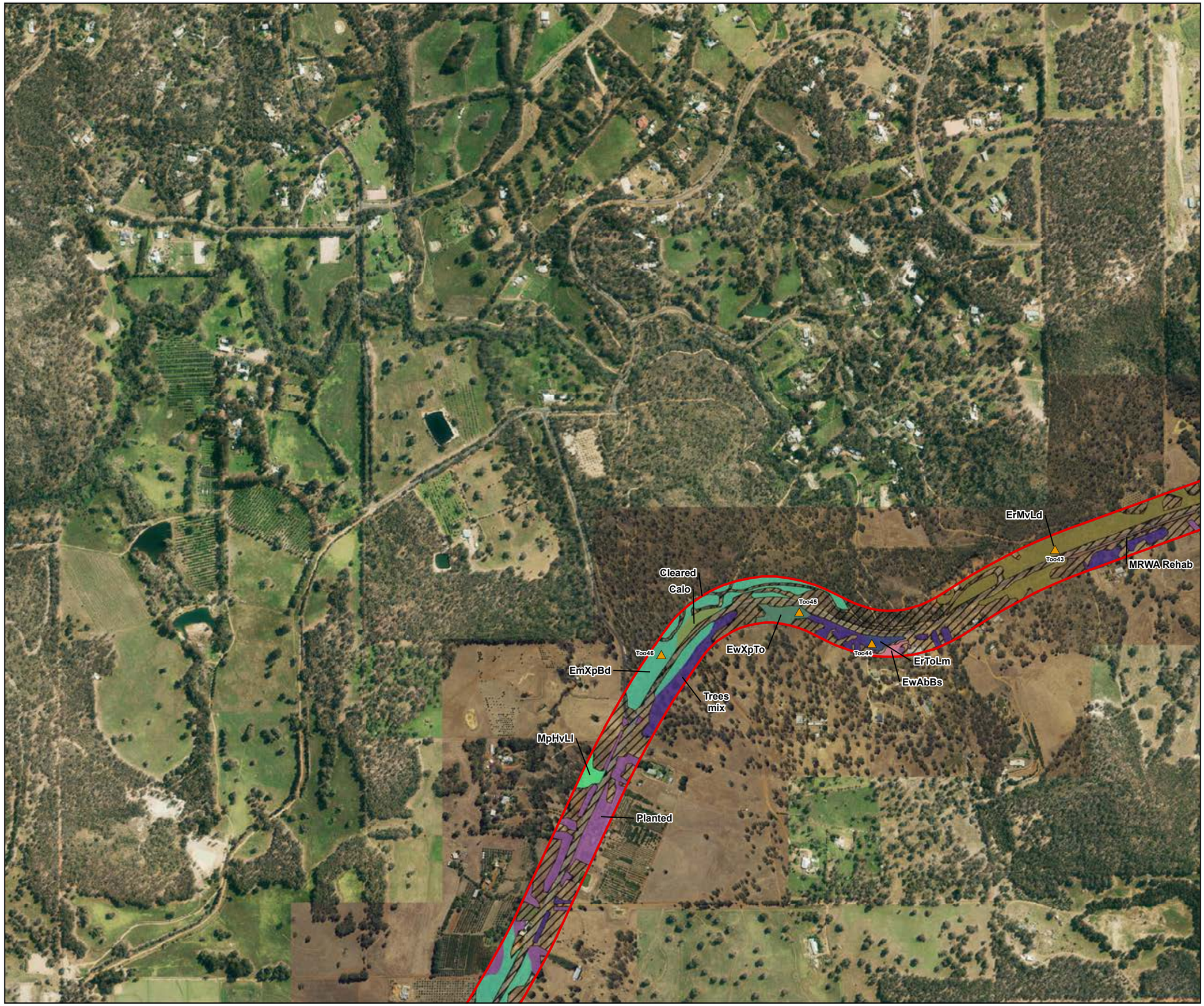

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GDA 1994 MGA Zone 50

0 125 250 500

Metres

1:10,000 (when printed at A3)

LEGEND

- Quadrat Location
- Study Area

Community

- Calo
- CcAaBj
- CcLeAp
- CcXpHh
- CcXpLb
- CcXpLb b
- Cleared
- EaXpBe
- EaXpBe-b
- EdBn
- ElAaAb
- EmXpBd
- ErAsOp
- ErMvLd
- ErMvLd b
- ErPlCc
- ErToLm
- EwAaAb
- EwAbBs
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- Planted
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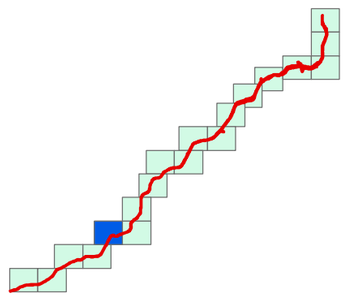
- Water



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Vegetation Communities

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VERSION:	2

Figure

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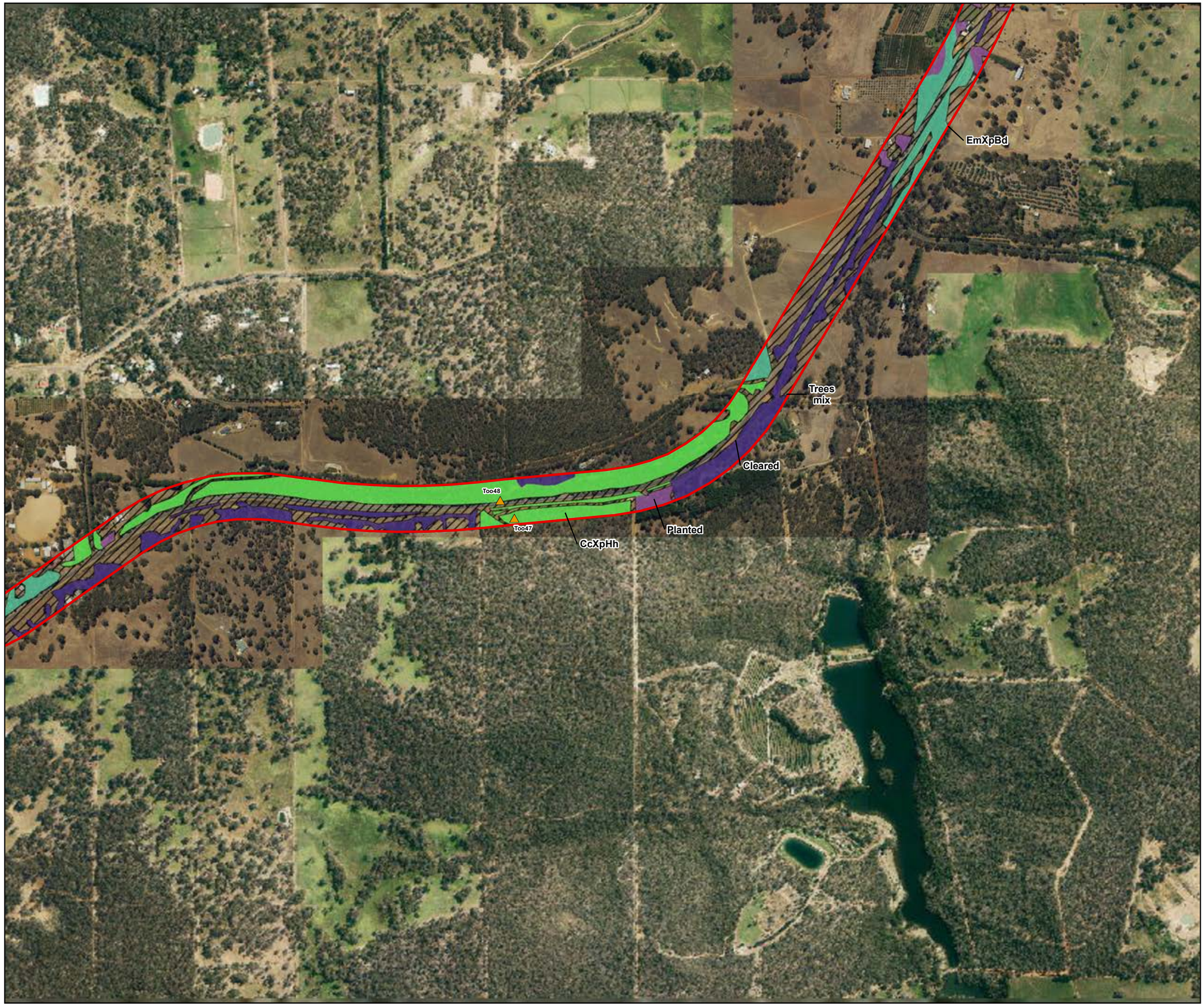

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GDA 1994 MGA Zone 50

0 125 250 500

Metres

1:10,000 (when printed at A3)

LEGEND

- Quadrat Location
- Study Area

Community

- Calo
- CcAaBj
- CcLeAp
- CcXpHh
- CcXpLb
- CcXpLb b
- Cleared
- EaXpBe
- EaXpBe-b
- EdBn
- ElAaAb
- EmXpBd
- ErAsOp
- ErMvLd
- ErMvLd b
- ErPlCc
- ErToLm
- EwAaAb
- EwAbBs
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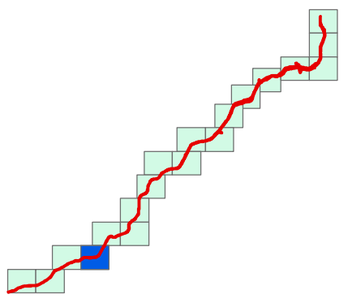
- MpHvLl
- Planted
- Native Trees
- Water



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Vegetation Communities

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Figure 5P

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N

GDA 1994 MGA Zone 50

0 125 250 500
Metres

1:10,000 (when printed at A3)

LEGEND

- Quadrat Location
- Study Area

Community

- Calo
- CcAaBj
- CcLeAp
- CcXpHh
- CcXpLb
- CcXpLb b
- Cleared
- EaXpBe
- EaXpBe-b
- EdBn
- ElAaAb
- EmXpBd
- ErAsOp
- ErMvLd
- ErMvLd b
- ErPlCc
- ErToLm
- EwAaAb
- EwAbBs
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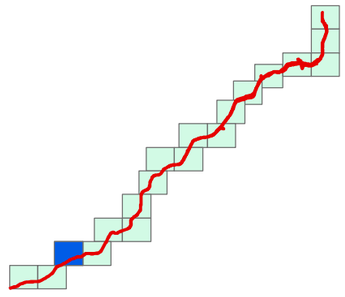
- EwHuAn
- EwXpTo
- MRWA Rehab
- MpHvLl
- Planted
- Native Trees
- Water



Too49
Too50
Too51
Too52
Too53
Too54
Too55
EmXpBd
ErMvLd
Cleared
Trees mix
CcXpHh
MpHvLl
Planted

Data sources:

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Vegetation Communities

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LAST MODIFIED	fotheringhamd - 15 Nov 2016
VERSION:	2

Figure
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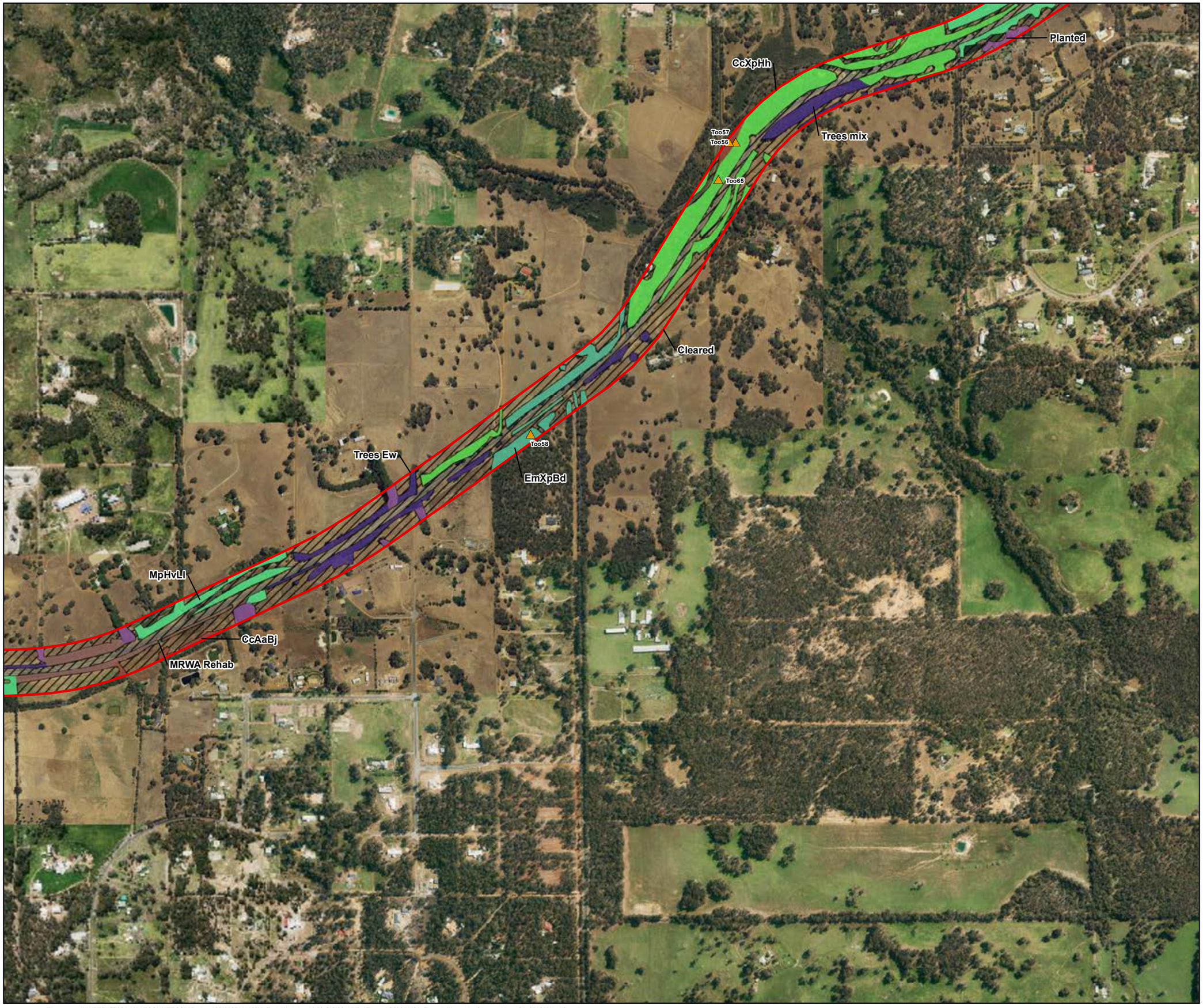

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N

GDA 1994 MGA Zone 50

0 125 250 500

Metres

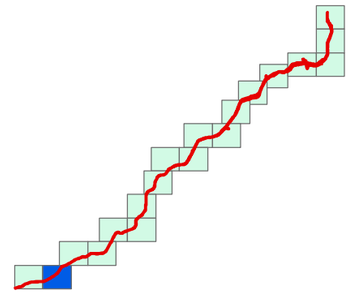
1:10,000 (when printed at A3)

LEGEND

- Quadrat Location
- Study Area

Community

- Calo
- CcAaBj
- CcLeAp
- CcXpHh
- CcXpLb
- CcXpLb b
- Cleared
- EaXpBe
- EaXpBe-b
- EdBn
- ElAaAb
- EmXpBd
- ErAsOp
- ErMvLd
- ErMvLd b
- ErPlCc
- ErToLm
- EwAaAb
- EwAbBs
- EwBsLp
- EwGtAl
- EwHuAn
- EwXpTo
- MRWA Rehab
- MpHvLl
- Planted
- Native Trees
- Water



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Toodyay Biological Assessment

Vegetation Communities

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Figure

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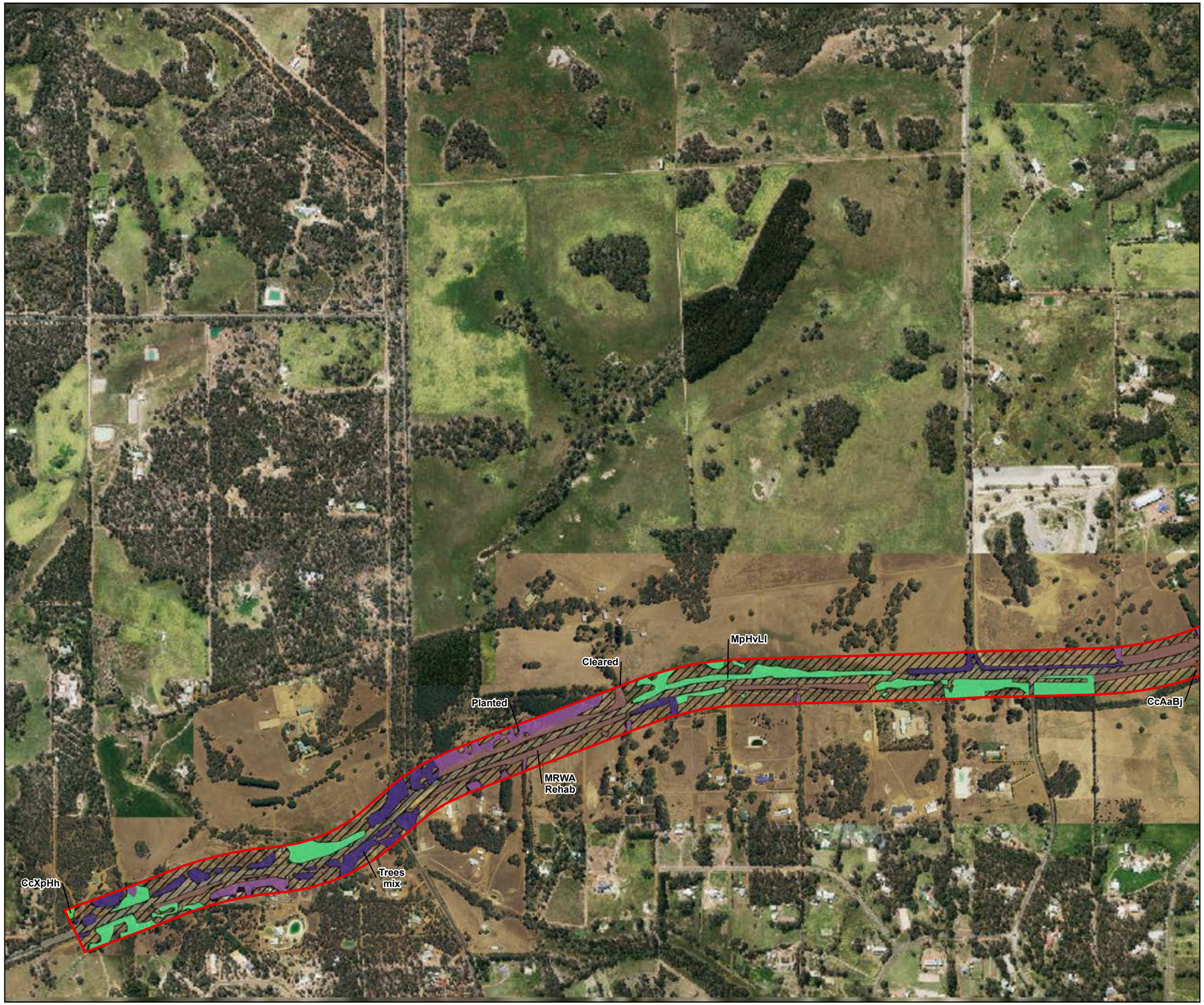

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N

GDA 1994 MGA Zone 50

0 125 250 500
Metres

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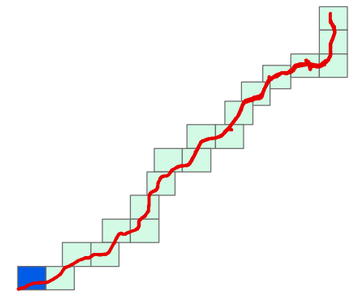
LEGEND

- Quadrat Location
- Study Area

Community

- Calo
- CcAaBj
- CcLeAp
- CcXpHh
- CcXpLb
- CcXpLb b
- Cleared
- EaXpBe
- EaXpBe-b
- EdBn
- ElAaAb
- EmXpBd
- ErAsOp
- ErMvLd
- ErMvLd b
- ErPlCc
- ErToLm
- EwAaAb
- EwAbBs
- EwBsLp
- EwGtAl
- EwHuAn
- EwXpTo
- MRWA Rehab
- MpHvLl
- Planted
- Native Trees
- Water



Data sources:

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Vegetation Communities

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Figure 5S

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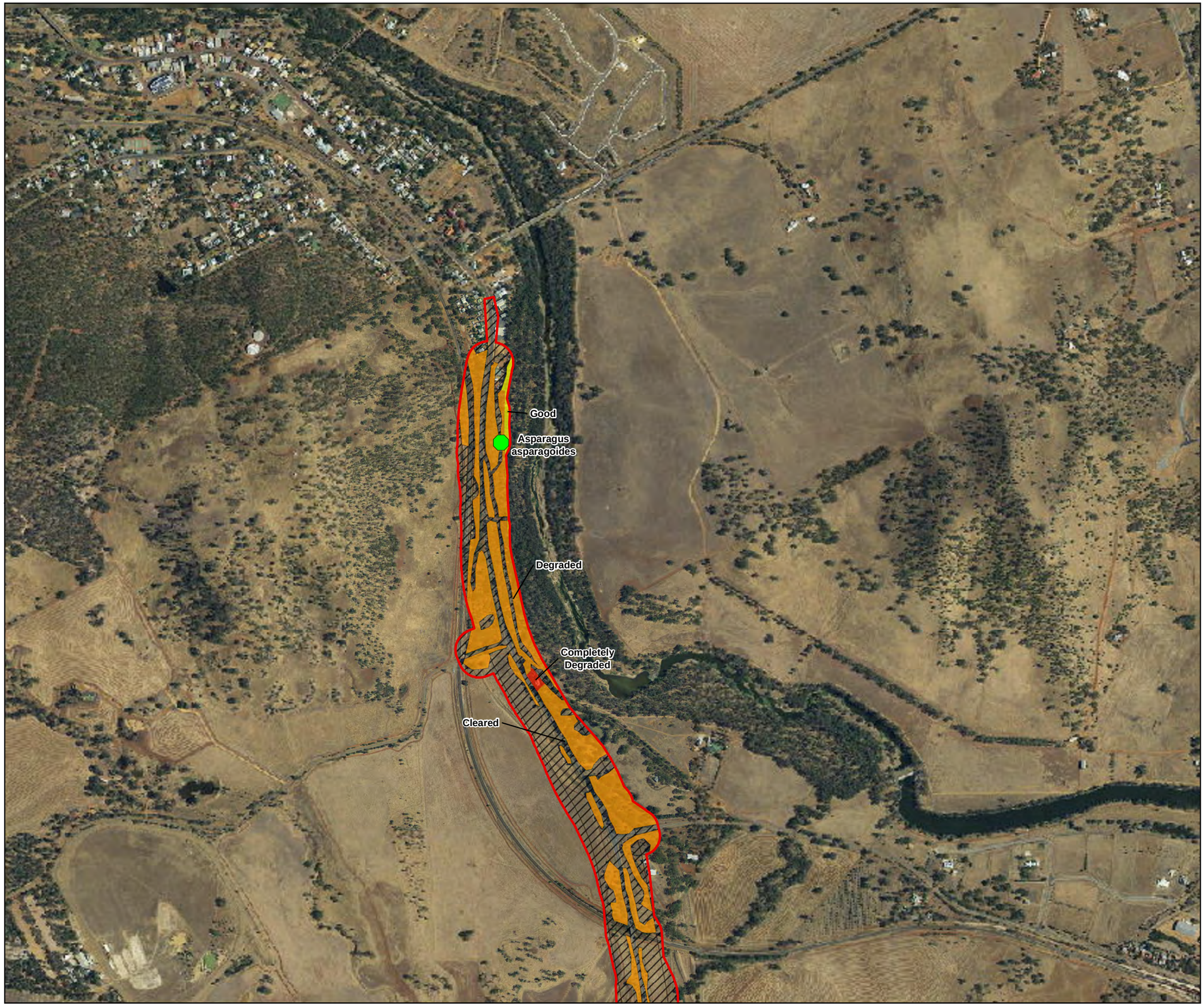
6.2 Vegetation condition mapping

The condition of the vegetation within the Study area ranges from Completely Degraded to Excellent. Vegetation community conditions are noted in Table 16. The major contributing factors were edge effects, historical clearing and grazing. Disturbed areas on gravel soils were often dominated by disturbance opportunists such as *Banksia squarrosa* var. *squarrosa, B. sessilis* var. *sessilis* and *Leptospermum erubescens*. This was particularly evident in narrow roadside vegetation. Degraded vegetation was typically native tree stands in paddocks. These areas were characterised by isolated native shrubs including *Hakea* and *Acacia* species with groundcover consisting of only weeds (paddocks).

The condition of the vegetation is mapped in Figure 6 with total areas provided in Table 17.

Table 17 Vegetation condition in the Study Area

Condition rating	Area (ha)	
	Metro	Wheatbelt
Excellent	14.91	60.27
Very good	42.58	56.82
Good	45.85	76.09
Degraded	77.53	189.08
Completely Degraded	17.10	3.34
Cleared	208.56	366.26
(Water)	0	0.25
Total	**405.63**	**752.12**



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GDA 1994 MGA Zone 50

0 125 250 500

Metres

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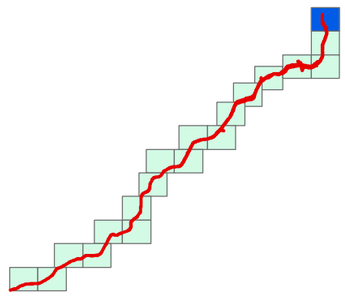
LEGEND

- Declared Pests
- Study Area

Condition

- Excellent
- Very Good
- Good
- Degraded
- Completely Degraded
- Water
- Cleared



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Vegetation Condition

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Figure

6A

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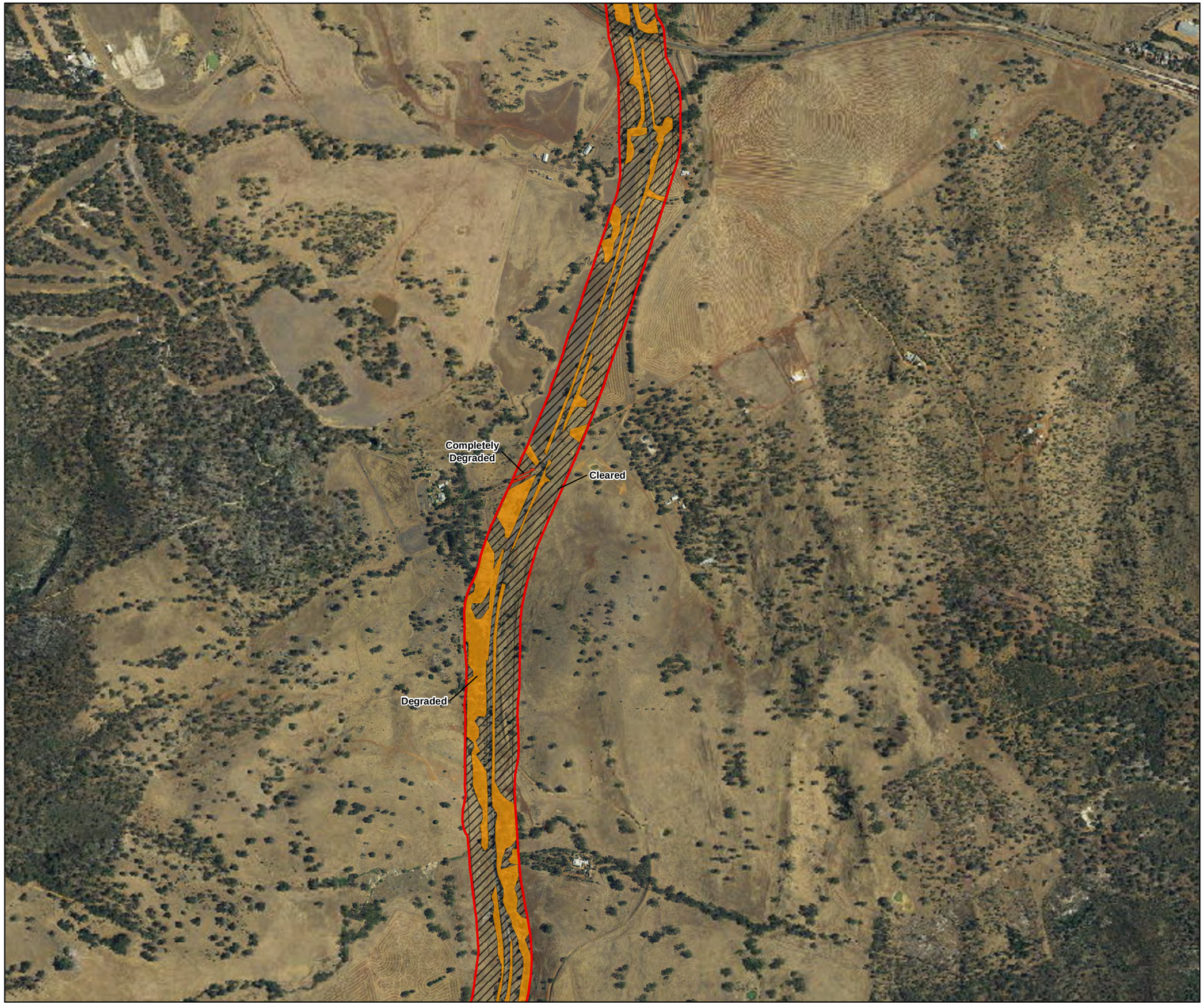

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N

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0 125 250 500

Metres

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LEGEND

Declared Pests

Study Area

Condition

Excellent

Very Good

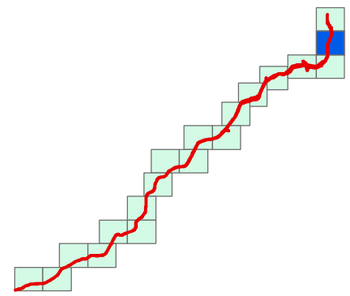
Good

Degraded

Completely Degraded

Water

Cleared



Data sources:

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Vegetation Condition

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Figure

6B

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N

GDA 1994 MGA Zone 50

0 125 250 500

Metres

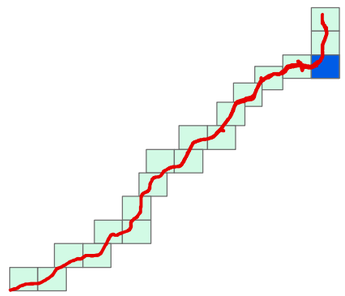
1:10,000 (when printed at A3)

LEGEND

- Declared Pests
- Study Area

Condition

- Excellent
- Very Good
- Good
- Degraded
- Completely Degraded
- Water
- Cleared



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Vegetation Condition

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Figure

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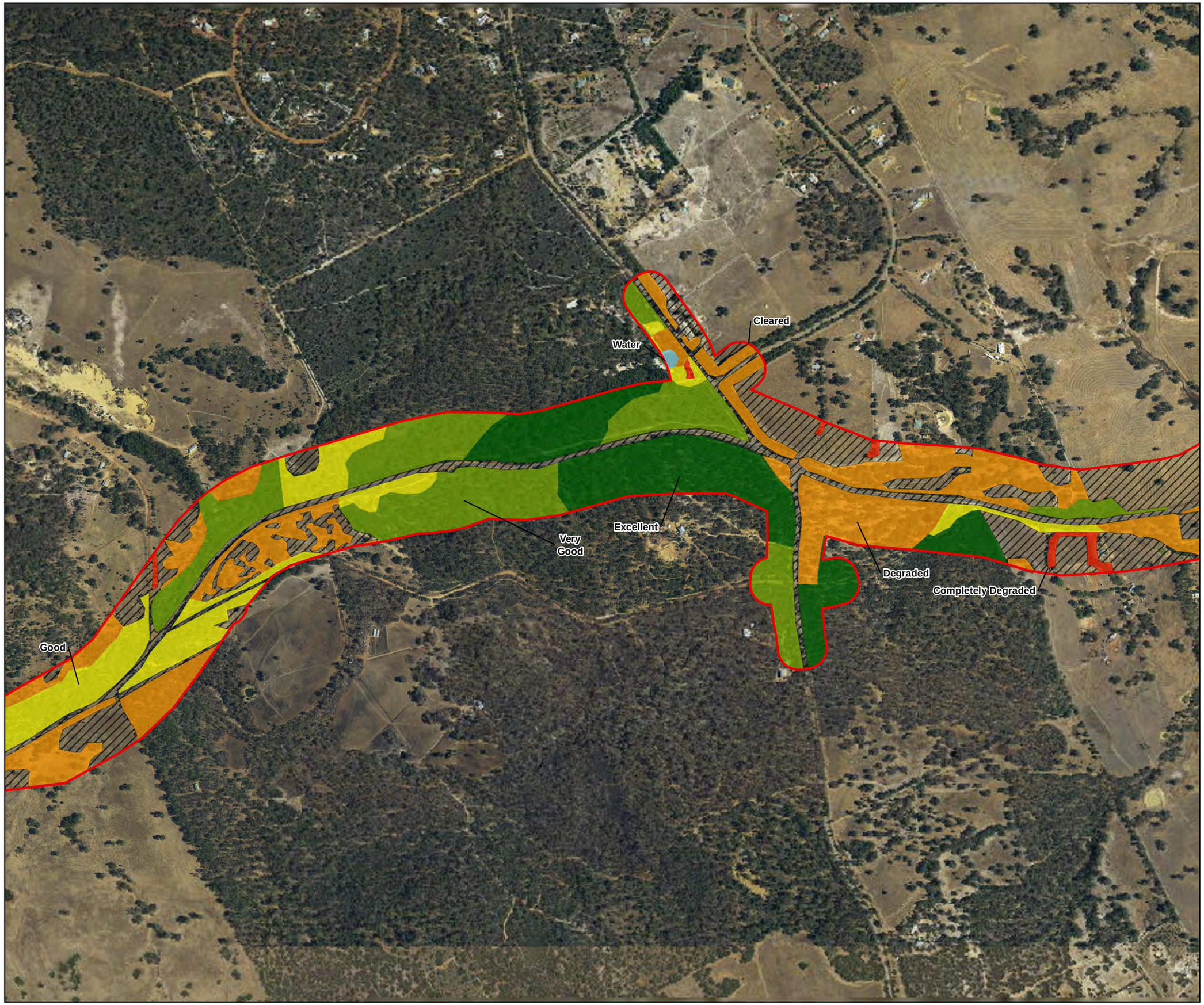

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GDA 1994 MGA Zone 50

0 125 250 500

Metres

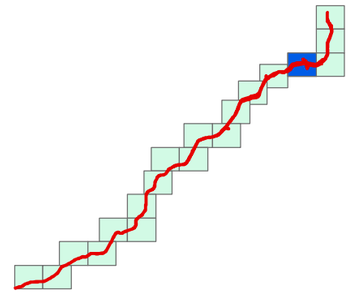
1:10,000 (when printed at A3)

LEGEND

- Declared Pests
- Study Area

Condition

- Excellent
- Very Good
- Good
- Degraded
- Completely Degraded
- Water
- Cleared



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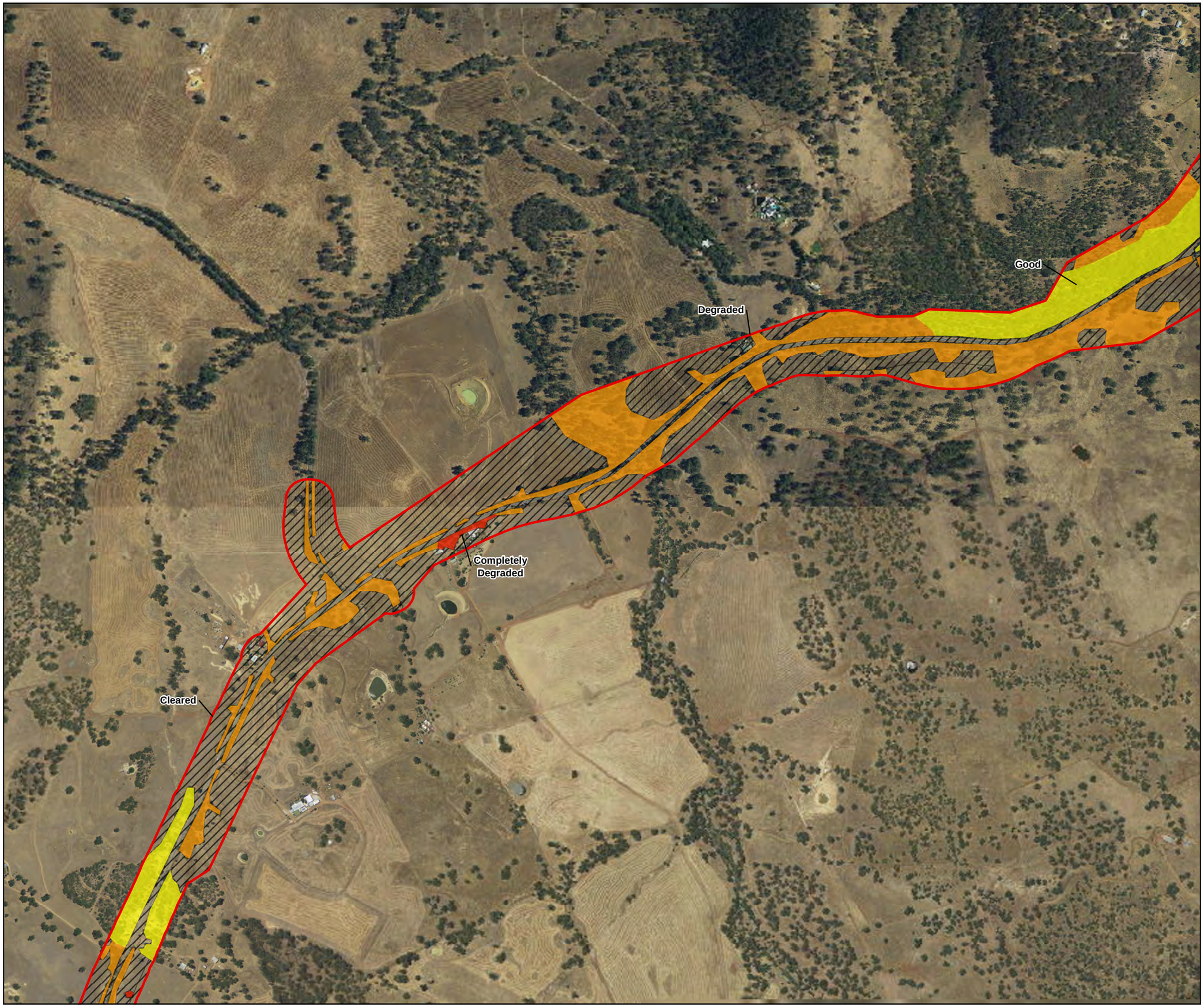

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N

GDA 1994 MGA Zone 50

0 125 250 500

Metres

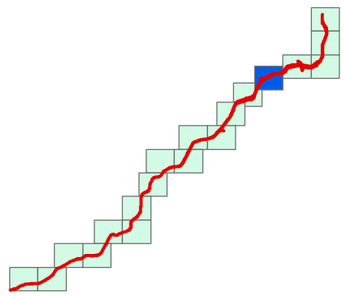
1:10,000 (when printed at A3)

LEGEND

- Declared Pests
- Study Area

Condition

- Excellent
- Very Good
- Good
- Degraded
- Completely Degraded
- Water
- Cleared



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Vegetation Condition

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Figure

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N

GDA 1994 MGA Zone 50

0 125 250 500

Metres

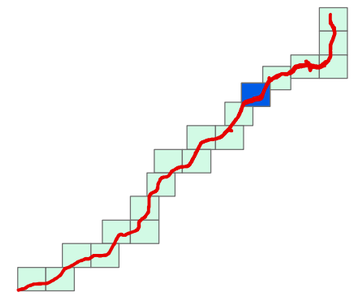
1:10,000 (when printed at A3)

LEGEND

- Declared Pests
- Study Area

Condition

- Excellent
- Very Good
- Good
- Degraded
- Completely Degraded
- Water
- Cleared



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Vegetation Condition

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Metres

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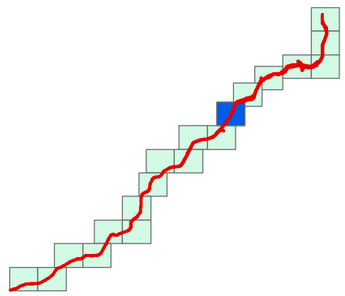
LEGEND

- Declared Pests
- Study Area

Condition

- Excellent
- Very Good
- Good
- Degraded
- Completely Degraded
- Water
- Cleared



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Metres

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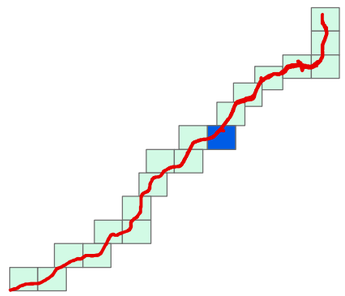
LEGEND

- Declared Pests
- Study Area

Condition

- Excellent
- Very Good
- Good
- Degraded
- Completely Degraded
- Water
- Cleared



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GDA 1994 MGA Zone 50

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Metres

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LEGEND

Declared Pests

Study Area

Condition

Excellent

Very Good

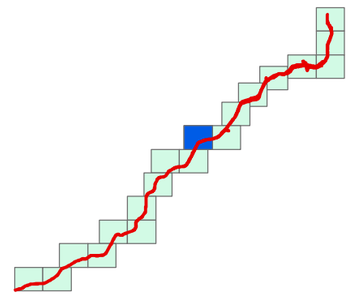
Good

Degraded

Completely Degraded

Water

Cleared



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Vegetation Condition

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VERSION:	1

Figure

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Metres

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LEGEND

- Declared Pests
- Study Area

Condition

- Excellent
- Very Good
- Good
- Degraded
- Completely Degraded
- Water
- Cleared

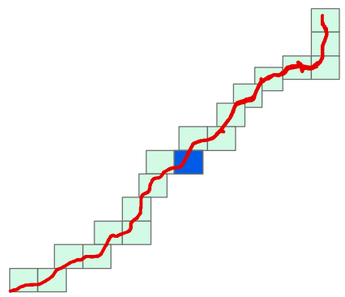

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Figure

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Metres

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LEGEND

- Declared Pests
- Study Area

Condition

- Excellent
- Very Good
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- Degraded
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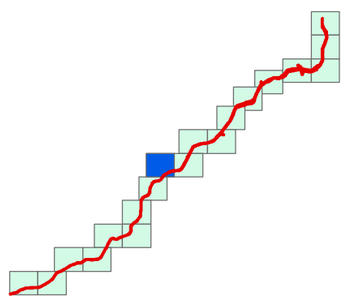
- Water
- Cleared



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Vegetation Condition

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Figure

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N

GDA 1994 MGA Zone 50

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Metres

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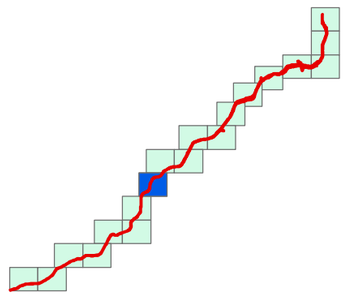
LEGEND

- Declared Pests
- Study Area

Condition

- Excellent
- Very Good
- Good
- Degraded
- Completely Degraded
- Water
- Cleared



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Vegetation Condition

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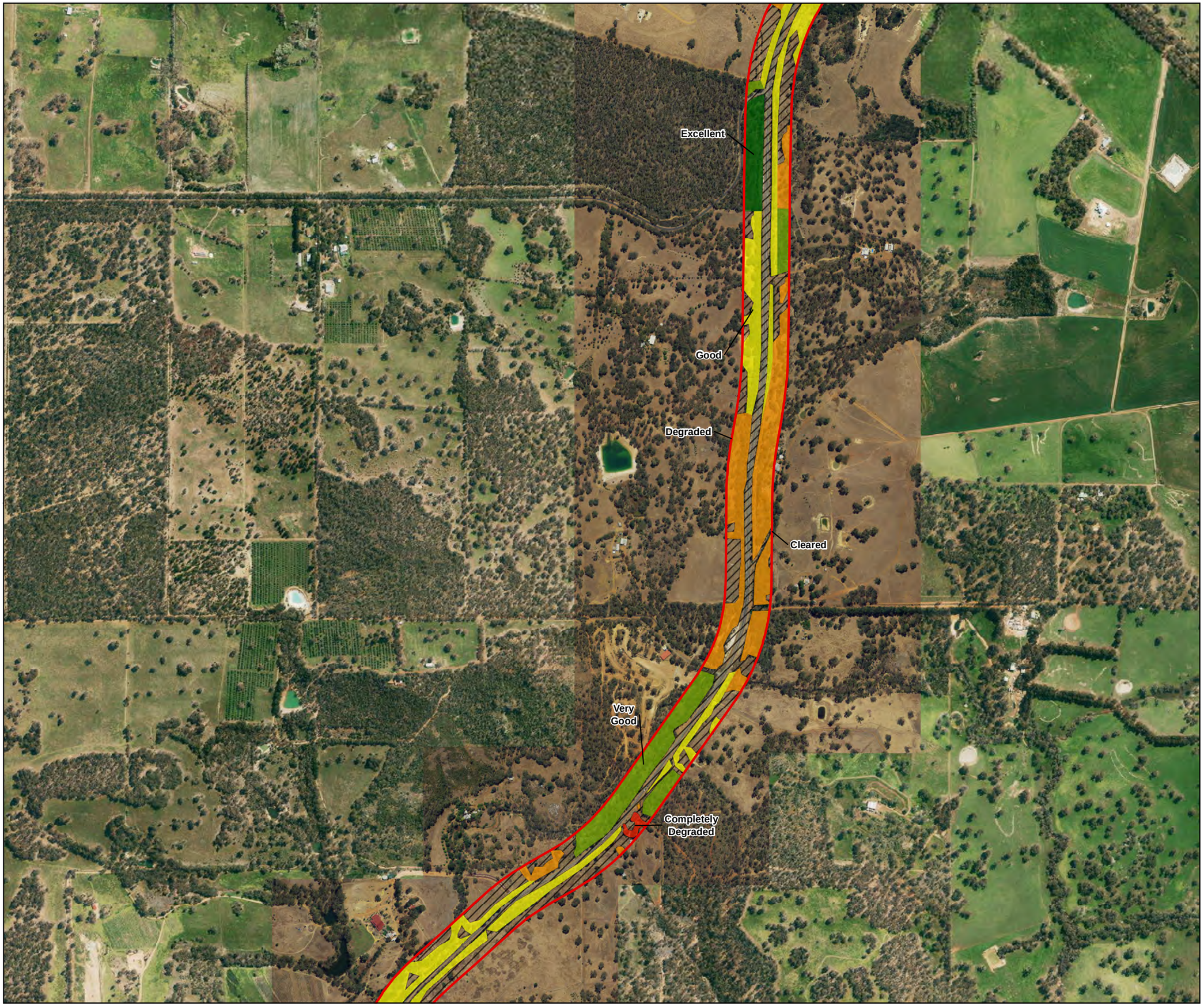

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Metres

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LEGEND

- Declared Pests
- Study Area

Condition

- Excellent
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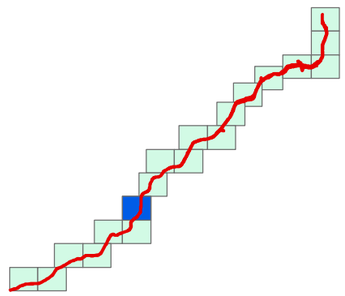
- Water
- Cleared



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Vegetation Condition

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Figure

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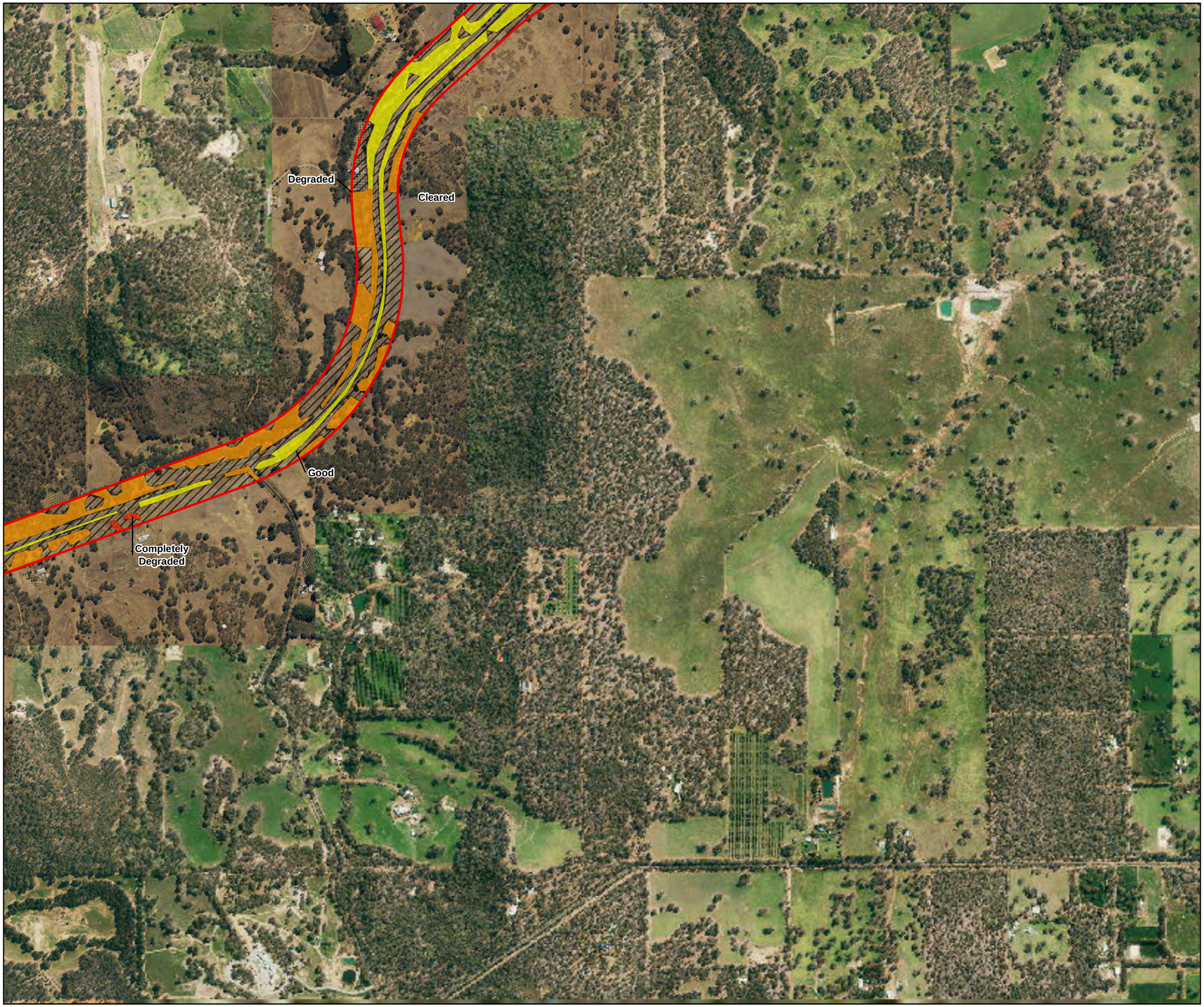

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N

GDA 1994 MGA Zone 50

0 125 250 500

Metres

1:10,000 (when printed at A3)

LEGEND

- Declared Pests
- Study Area

Condition

- Excellent
- Very Good
- Good
- Degraded
- Completely Degraded
- Water
- Cleared

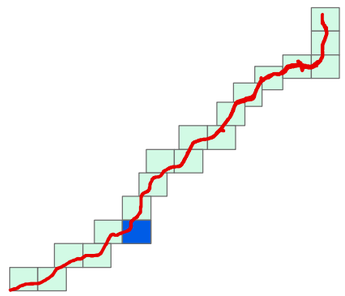

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Figure

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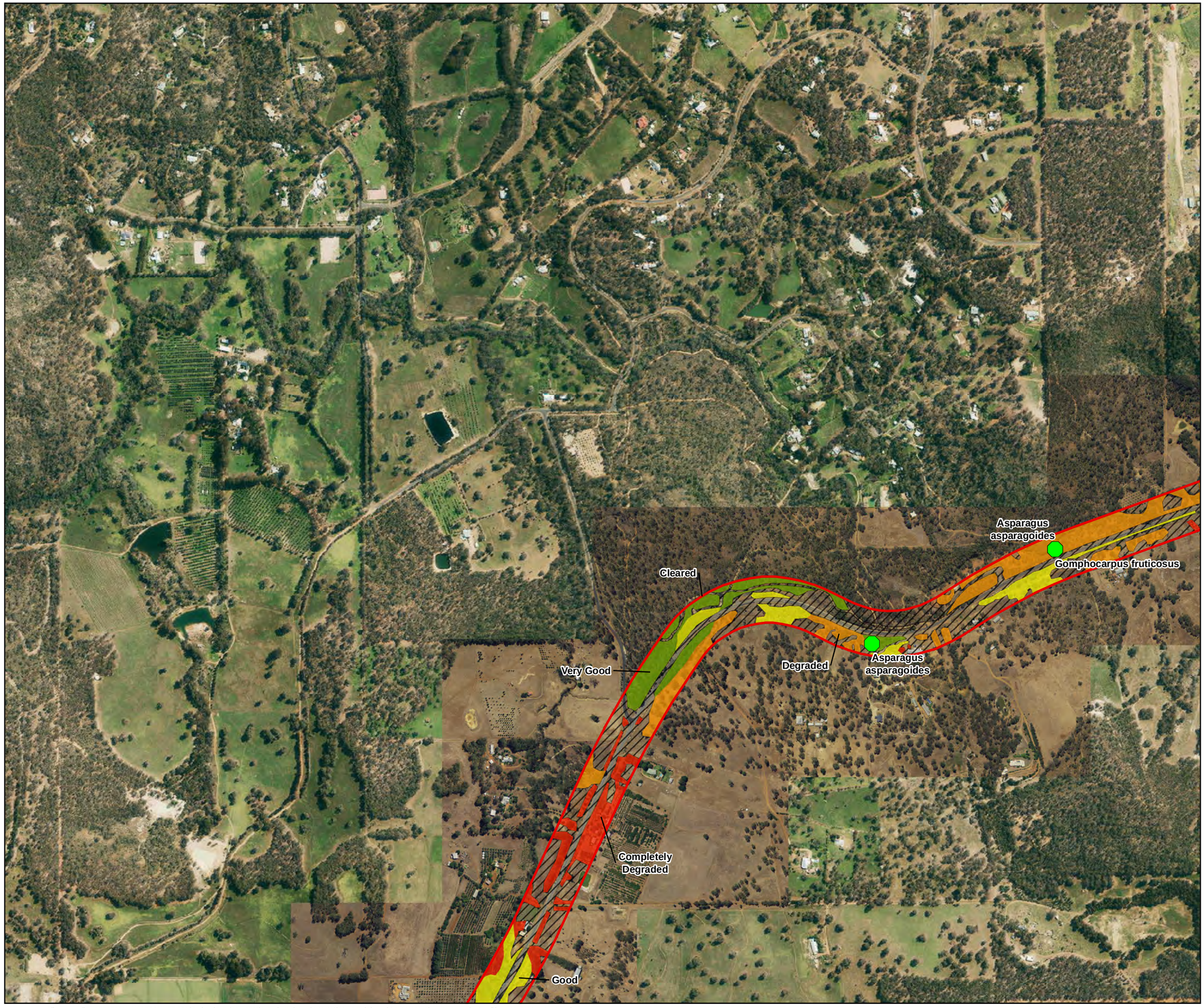

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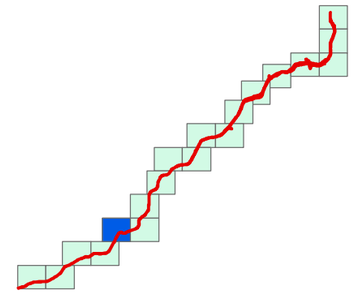
LEGEND

- Declared Pests
- Study Area

Condition

- Excellent
- Very Good
- Good
- Degraded
- Completely Degraded
- Water
- Cleared



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Vegetation Condition

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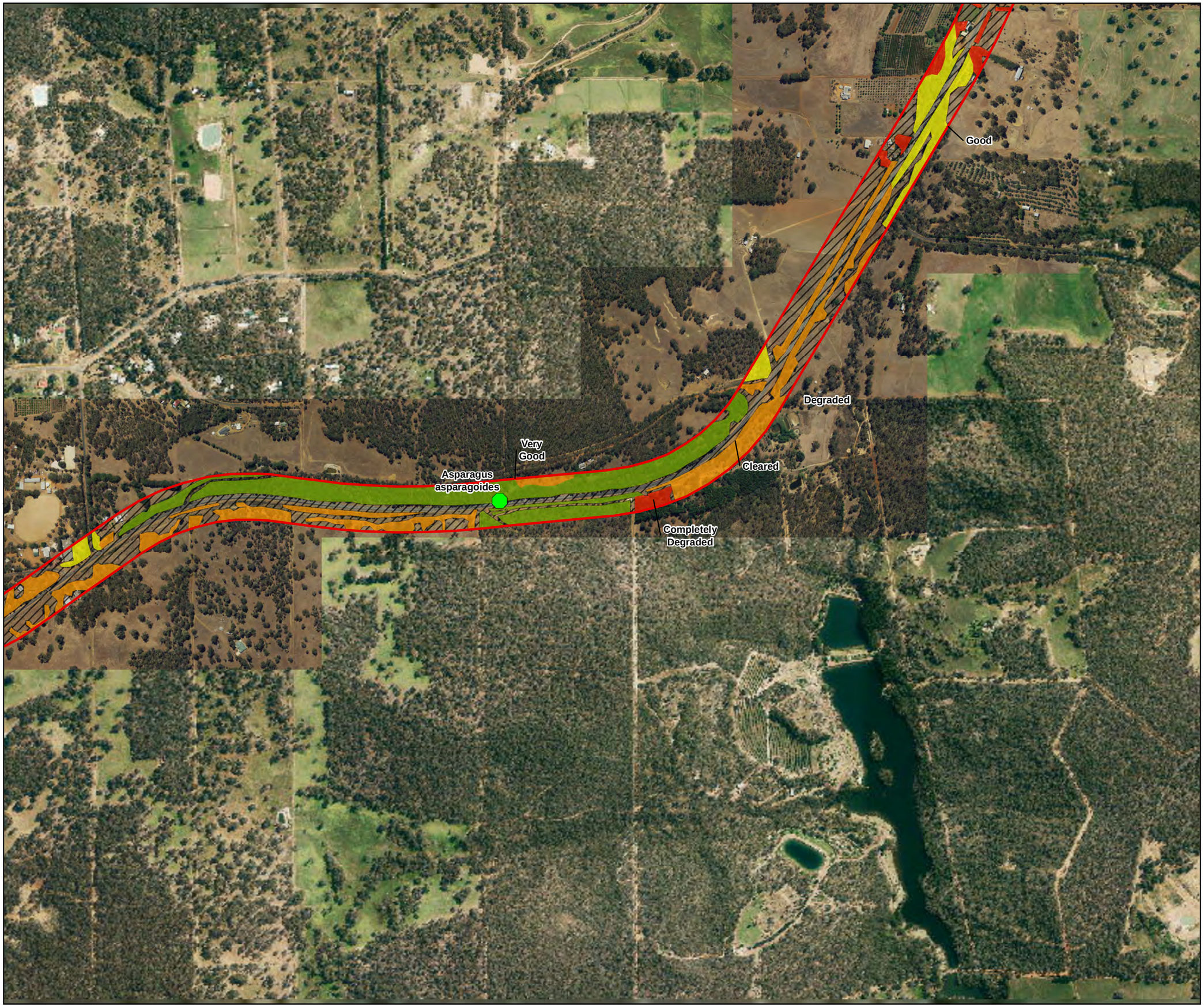

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LEGEND

- Declared Pests
- Study Area

Condition

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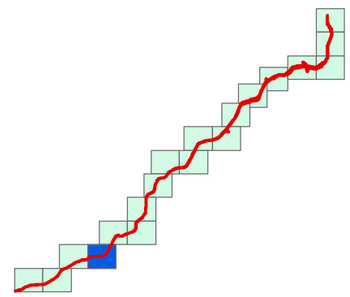
- Water
- Cleared



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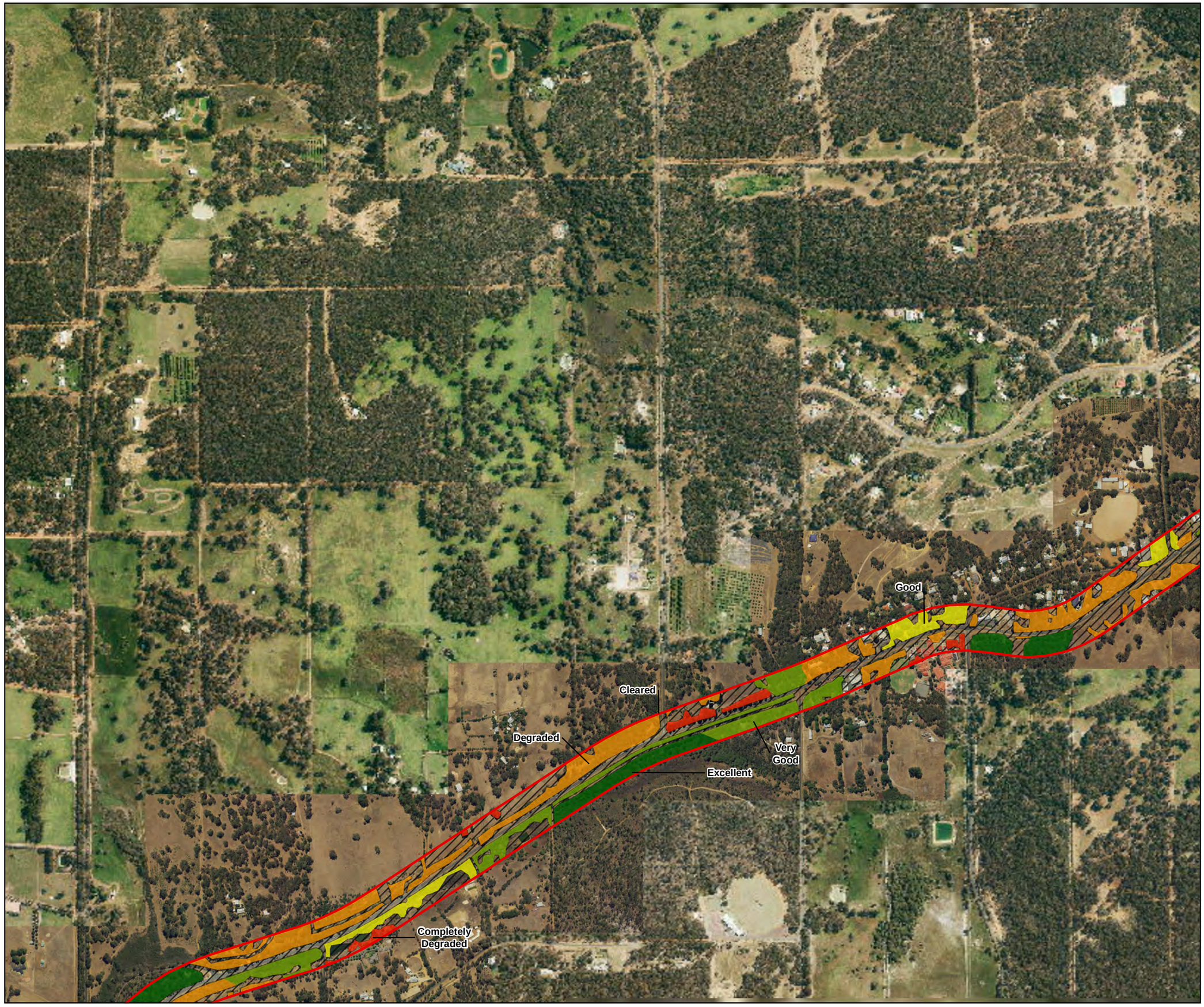

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LEGEND

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- Study Area

Condition

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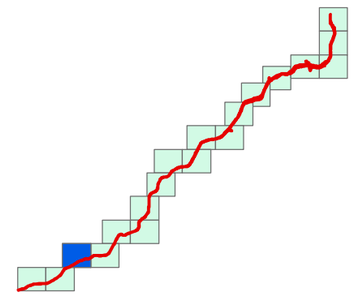
- Cleared



Data sources:

Base Data: © Western Australia Land Information Authority (Landgate) (2016)
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Toodyay Biological Assessment

Vegetation Condition

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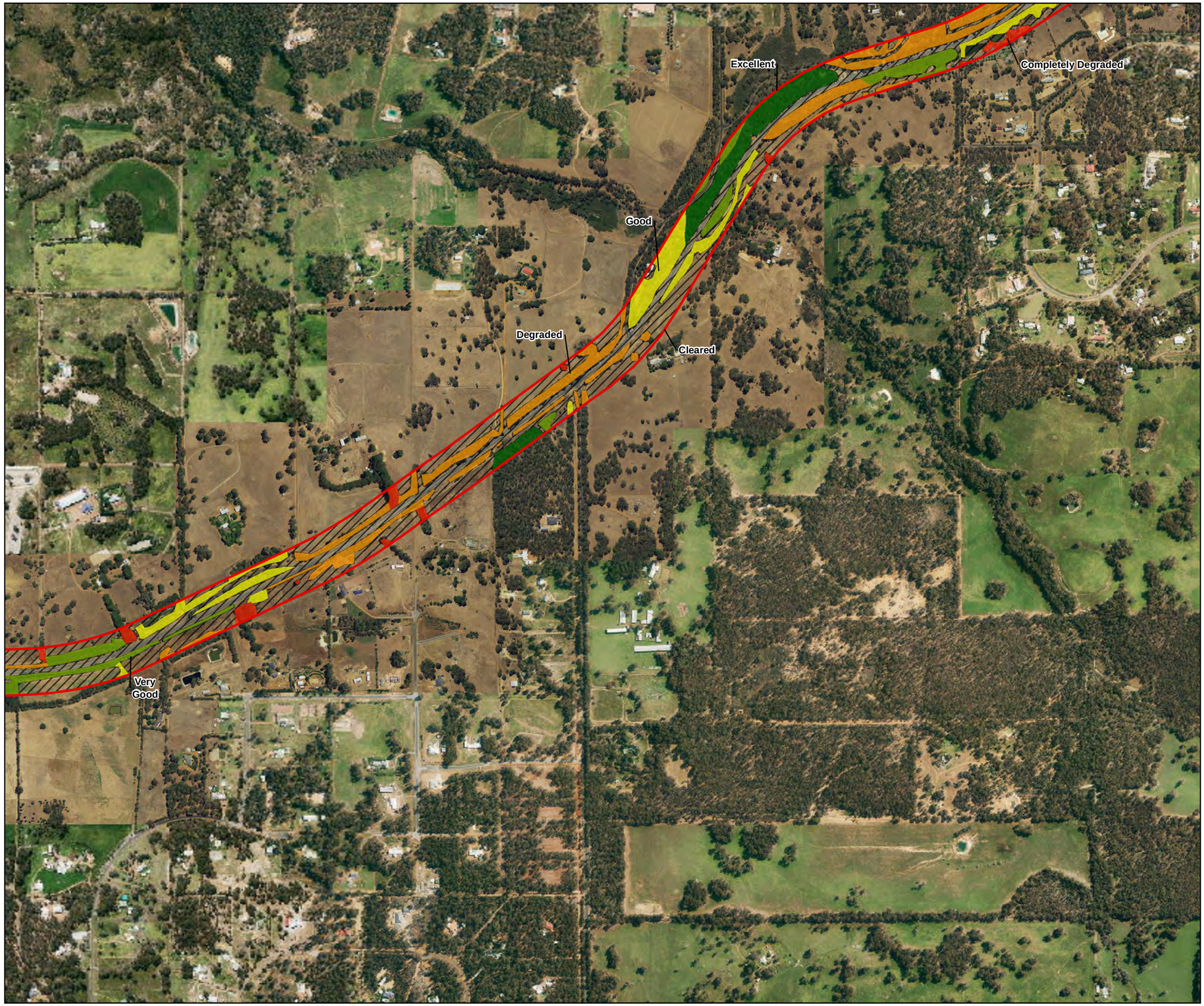

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LEGEND

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- Study Area

Condition

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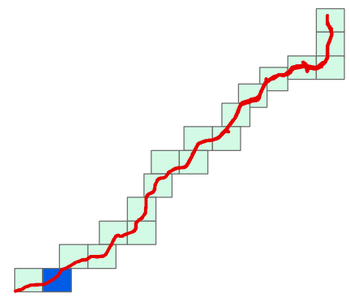
- Cleared



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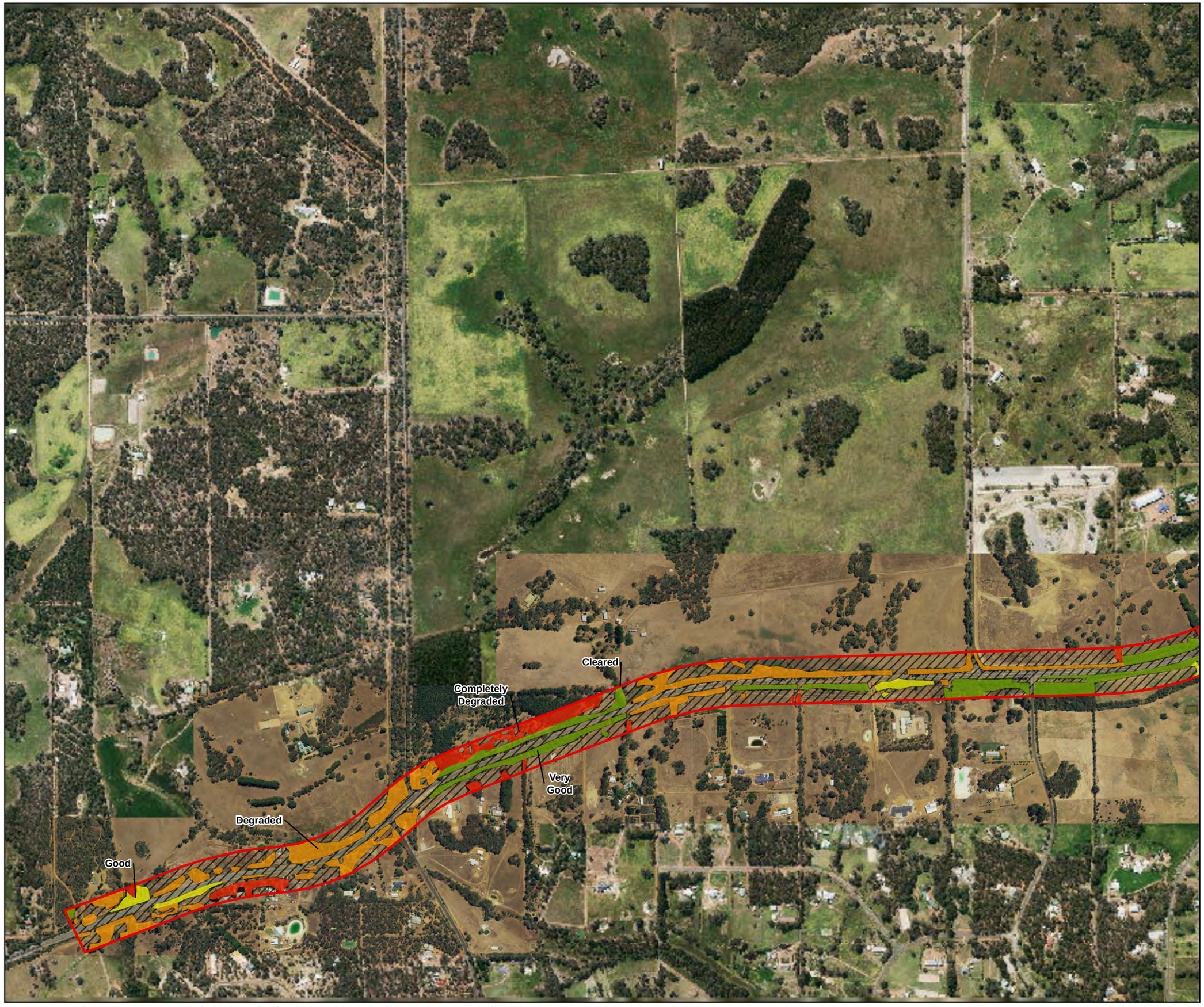

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- Study Area

Condition

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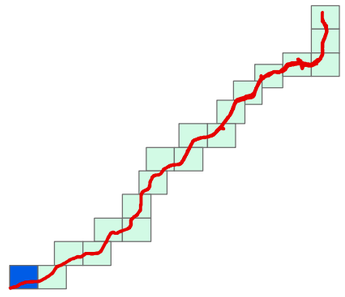
- Water
- Cleared



Data sources:

Base Data: © Western Australia Land Information Authority (Landgate) (2016)
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6.3 Threatened and Priority flora

Seven conservation significant flora species were recorded within the Study area including *Banksia nivea* subsp. Morangup (P2), *Boronia scabra* subsp. *condensata* (P2), *Calytrix oncophylla* (P2), *Grevillea candolleana* (P2), *Verticordia citrella* (P2), *Hibbertia montana* (P4) and *Caladenia integra* (P4). Priority Flora Report Forms are provided in Appendix H, have been submitted to DPaW and each species is discussed below.

6.3.1 *Banksia nivea* subsp. Morangup (M. Pieroni 94/2) – Priority 2

Banksia nivea subsp. Morangup (M. Pieroni 94/2) was recorded in one quadrat within Morangup Nature Reserve (see Figure 7 and Plate 3). The population extended throughout community EdBn and was estimated at 100+ individuals. The extent of the population is shown in Figure 7. Population details are presented in Table 18.

B. nivea subsp. Morangup is known from this single population in WA, comprised of two subpopulations. The latest DPaW survey of this population was undertaken in June 2014, recording approximately 800 mature plants and approximately 150,000 juvenile plants. As there is not anticipated to be any impacts to Morangup Nature Reserve, no further plant counts or population boundary mapping was undertaken for this species.

Table 18 *Banksia nivea* subsp. Morangup population details

AECOM Populations	Database Records[1]	WAH Vouchers[2]
100+	15,800 (800 adults, 15,000 juveniles) / 1 population	100

1. Sourced from Database results and DPaW email dated 1 June 2016
2. Sourced from WAH (1998-)

Plate 3 *Banksia nivea* subsp. Morangup - Priority 2 a) individual b) population

6.3.2 *Beaufortia purpurea* – Priority 3

Beaufortia purpurea grows on lateritic and granitic soils on rocky slopes. There is one database record within the Study area from 1977 in a paddock. This species was not located during the field surveys. This may be attributed to the age of the record, and clearing that has been undertaken in the local area since the record was found.

This species is often recorded in association with granite outcrops and dense heath vegetation, neither of which was recorded in the Study area. It is therefore considered unlikely to occur within the Study area. Spatial distribution of this species is shown in Figure 7 and population details provided in Table 19.

B. purpurea is regionally common, with populations in the Perth Hills district often comprising 100's of individuals.

Table 19 *Beaufortia purpurea* population details

AECOM Populations	Database Records[1]	WAH Vouchers[2]
0	17 populations (no count data provided)	1000+

1. Sourced from Database results and DPaW email dated 1 June 2016
2. Sourced from WAH (1998-).

Plate 4 *Beaufortia purpurea* – Priority 3 flora

6.3.3 *Boronia scabra* subsp. *condensata* – Priority 2

Boronia scabra subsp. *condensata* was recorded in two quadrats (Too17 and 38) in October 2015 and September 2016. Database results show one population near Toodyay more than three kilometres north of the Study area.

Additional targeted searches for this species were undertaken in February 2016 however plants were not found. This species is difficult to identify when not in flower. In September 2016 additional targeted searches were undertaken. A total of 321 plants were recorded from two distinct populations. Spatial distribution of this species is shown in Figure 7 and population details provided in Table 20.

B. scabra subsp. *condensata* is known from five populations (counts not provided), with the closest being 3.4km north of the AECOM populations in the Perth Hills District. Populations in this area are considered locally and regionally significant by DPaW (email correspondence Jessica Donaldson 1 June 2016).

Table 20 *Boronia scabra* subsp. *condensata* population details

AECOM Populations	Database Records[1]	WAH Vouchers[2]
Pop 1: 240 Pop 2: 81 Total: 321	5 populations	15

1. Sourced from Database results and DPaW email dated 1 June 2016
2. Sourced from WAH (1998-).

Plate 5 ***Boronia scabra*** **subsp.** ***condensata*** **– Priority 2 a) individual b) population 1**

6.3.4 *Caladenia integra* – Priority 4

Caladenia integra is known from a wide distribution between Toodyay and Kendenup, and east to Nyabing and Jerramungup. There are two known records within 20 km of the Study area, however DPaW have advised that Toodyay represents the northern extent of the known distribution for this species.

One individual of *C. integra*, the Smooth-lipped Spider Orchid, was recorded at one location in a narrow corridor of roadside vegetation community EwGtEl (see Figure 7 and Plate 6). There are no known database records of this species in the vicinity of the Study area. The location of *C. integra* has been demarcated with DPaW Threatened flora roadside markers (yellow metal markers) along Toodyay Road. This population is the northern-most extent of this species with more populations recorded in the Avon Wheatbelt near Tenterden and Kojonup. This is evident in the lack of known populations from the desktop searches and the distribution map presented in Brown *et al.* (2013).

Targeted surveys undertaken in September 2016 did not locate this species. Brown *et al.* (2013) suggests this species flowers in late September to early November and may therefore have not been flowering at the time of follow-up surveys. Population details of this species are presented in Table 21.

Table 21 ***Caladenia integra*** **population details**

AECOM Populations	Database Records[1]	WAH Vouchers[2]
Pop 1: 1	2 populations (no count data provided)	44

1. Sourced from Database results and DPaW email dated 1 June 2016
2. Sourced from WAH (1998-).

Plate 6 ***Caladenia integra*** **– Priority 4**

6.3.5 *Calytrix oncophylla* – Priority 2

Calytrix oncophylla was recorded within one quadrat (Too18) (see Figure 7 and Plate 7). Several additional collections of potential *C. oncophylla* were made in September 2016 however all were identified as *Calytrix variabilis*.

The verified location of *C. oncophylla* is located within one contiguous area of native vegetation south of Toodyay Road. *C. oncophylla* as recorded on a lateritic outcrop in Wandoo woodland in excellent condition, mapped as EwGtAl. This concurs with existing information for this species as it has previously been recorded on lateritic outcrops in the Shire of Toodyay (WAH, 1998-). Ten individuals were recorded at this location in September 2016 (Table 22).

C. oncophylla is known from only two other populations in Wongamine Nature Reserve in the vicinity of the Study area. This population represents the western extent of this species with other known occurrences found east of Toodyay in the Avon Wheatbelt. This population is therefore considered locally and regionally significant.

Table 22 ***Calytrix oncophylla*** **population details**

AECOM Populations	Database Records[1]	WAH Vouchers[2]
Pop 1: 10	2 populations (no count data provided)	5

1. Sourced from Database results and DPaW email dated 1 June 2016
2. Sourced from WAH (1998-).

Plate 7 ***Calytrix oncophylla***

6.3.6 *Grevillea candolleana* – Priority 2

Grevillea candolleana was recorded in five quadrats (Too10, 11, 15, 20, 38). Three occurrences were in Wandoo woodland, one occurrence in Powderbark Wandoo woodland on a lateritic outcrop, and one occurrence in Marri woodland. Two occurrences were in roadside vegetation and three occurrences were within large expanses of contiguous native vegetation.

Targeted searches identified six distinct *G. candolleana* populations, with a total of 276 individuals recorded. The spatial distribution of this species is shown in Figure 7 and population details are provided in Table 23. Of the six populations, four were located in Wandoo woodland, and two were recorded in Marri woodland in roadside vegetation.

Database records show 257 records from 16 distinct populations. DPaW have advised that this species is known from 16 populations from five locations between Lower Chittering, Toodyay and Clackline.

Plate 8 ***Grevillea candolleana* – Priority 2 a) species b) Marri woodland habitat**

Table 23 *Grevillea candolleana* population details

AECOM Populations	Database Records[1]	WAH Vouchers[2]
Pop 1: 5 Pop 2: 26 Pop 3: 107 Pop 4: 90 Pop 5: 45 Pop 6: 3 Total: 276	257 records / 16 populations	200+

1. Sourced from Database results and DPaW email dated 1 June 2016
2. Sourced from WAH (1998-).

6.3.7 *Hibbertia montana* – Priority 4

Hibbertia montana was recorded in two quadrats (Too09 and 10). This species is part of the *Hibbertia commutata* sens lat group (sens lat describes a group of taxon). The *Hibbertia commutata* group is an informal grouping that includes those species with free stamens all around the carpels, carpels 3-5 and usually with relatively large, soft leaves (Hislop, pers comm, see Plate 9). *Hibbertia montana* also belongs to the *H. commutata* group, and probably also comprises at least two segregate taxa. Mike Hislop commented that other *Hibbertia commutata* plants present in the Study area could be *Hibbertia montana* however it is difficult to determine in sterile specimens. Three collections were made and all were confirmed to be *Hibbertia montana*.

Targeted surveys were undertaken during the flowering period of *H. montana*. Using a hand-lens, species were identified in the field based on carpels and positioning of stamens around the carpels. The survey confirmed a total of 1,909 individuals (minimum). Due to the extensive number of individuals at population 1, not every individual was counted, particularly outside the Study area. Rather, the boundary of the population was mapped (approximately). Population details are provided in Table 24 and location details shown in Figure 7.

The habitat of *H. montana* varies considerably. Population 1 was recorded in degraded *Allocasuarina fraseriana* and *Eucalyptus* woodland over sparse shrubs with no native understorey (ground cover) species present. The population is predominantly located on private property with evidence of grazing. The species in this population were even recorded in the middle of grassy paddocks with no overstorey species. Population 2 and 3 were recorded in 'Excellent' condition Wandoo woodland as part of a larger block of contiguous native vegetation. A total of 1,909 plants were counted and mapped within and extending beyond the Study area. *H. montana* is known from 15 locations over a 200km north-south and 100km east-west range.

Table 24 *Hibbertia montana* population details

AECOM Populations	Database Records[1]	WAH Vouchers[2]
Pop 1: 1777 Pop 2: 83 Pop 3: 49 Total: 1909	200+ records / 15 populations	200+ vouchers

1. Sourced from Database results and DPaW email dated 1 June 2016
2. Sourced from WAH (1998-).

Plate 9 ***Hibbertia montana*** **– Priority 4 a) species b) habitat**

6.3.8 *Tetratheca pilifera* – Priority 3

Tetratheca pilifera was not recorded during the field survey however there is a known population in the Study area according to desktop database results. The species *Tetratheca hirsuta* was collected in the Study area and confirmed as this species therefore it is unlikely to have been misidentified. The record within the Study area is from 1989 and may therefore be invalid due to poor location accuracy at the time.

This species occurs on gravelly soils and is similar in appearance to *Tetratheca hirsuta.* The desktop database location of this species is shown in Figure 7 and population details are presented in Table 25.

Table 25 ***Tetratheca pilifera*** **population details**

AECOM Populations	Database Records[1]	WAH Vouchers[2]
0	585 records	53

1. Sourced from Database results and DPaW email dated 1 June 2016
2. Sourced from WAH (1998-).

Plate 10 ***Tetratheca pilifera*** **– Priority 3 flora**

6.3.9 *Verticordia citrella* – Priority 2

Verticordia citrella was recorded in two quadrats (Too05 and 06) (Plate 11) alongside the other Priority *Banksia nivea* subsp. Morangup population. *Verticordia citrella* is known only from this single locality, confirmed by the desktop results and WA Herbarium records. Records outside the Study area are also from Morangup Nature Reserve. This population is therefore considered locally and regionally significant. Both quadrats are located within the Morangup Nature Reserve in community CcXpLb and EdBn respectively.

The populations were isolated to within the Study area, however desktop results show more populations in the north of Morangup Nature Reserve. See Table 26 for population details and Figure 7 for the spatial distribution.

As there will be no impact on Morangup Nature Reserve, no further population mapping was undertaken in follow-up surveys.

Table 26 *Verticordia citrella* population details

AECOM Populations	Database Records[1]	WAH Vouchers[2]
50 individuals (approximate)	11,244 individuals	200+ vouchers

1. Sourced from Database results and DPaW email dated 1 June 2016
2. Sourced from WAH (1998-).

Plate 11 *Verticordia citrella* – Priority 2 flora

6.3.10 *Verticordia lindleyi* subsp. *lindleyi* – Priority 2

Verticordia lindleyi subsp. *lindleyi* was identified in the desktop assessment as occurring at one location in the Study area. This population was recorded in 1900 in the 'Swan District' and is unlikely to be accurate. However, for assessment purposes it was still considered. This species is known from the Mimegarra-Gillingarra area southwards through Perth to near Serpentine (George, 2002).

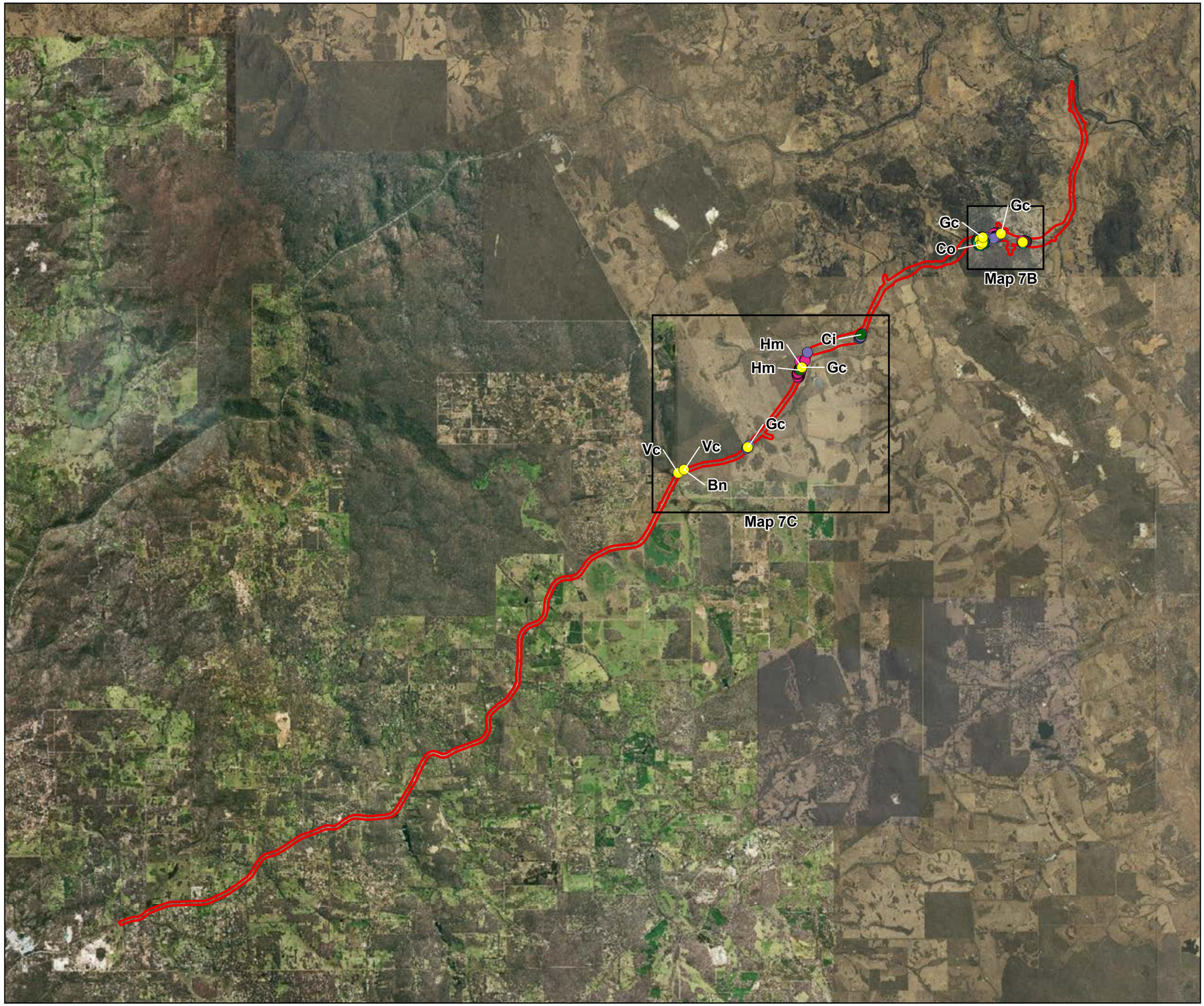
See Table 27 for population details and Figure 7 for the spatial distribution.

Table 27 *Verticordia lindleyi* subsp. *lindley* population details

AECOM Populations	Database Records[1]	WAH Vouchers[2]
0	1 record (no count data)	80

1. Sourced from Database results and DPaW email dated 1 June 2016
2. Sourced from WAH (1998-).

Plate 12 *Verticordia lindleyi* subsp. *lindleyi* – Priority 4 flora



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GDA 1994 MGA Zone 50

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Metres

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LEGEND

Conservation Significant Flora AECOM

- T
- 1
- 2
- 3
- 4

2016 Targeted Search Records

- Boronia scabra subsp. condensata (P2)
- Calytrix oncophylla (P2)
- Grevillea candolleana (P2)
- Hibbertia montana (P4)
- Study Area

Data sources:

Base Data: © Western Australia Land Information Authority (Landgate) (2016)
NearMap Imagery 2016

Toodyay Biological Assessment

Flora Desktop Results

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LAST MODIFIED	fotheringhamd - 16 Nov 2016
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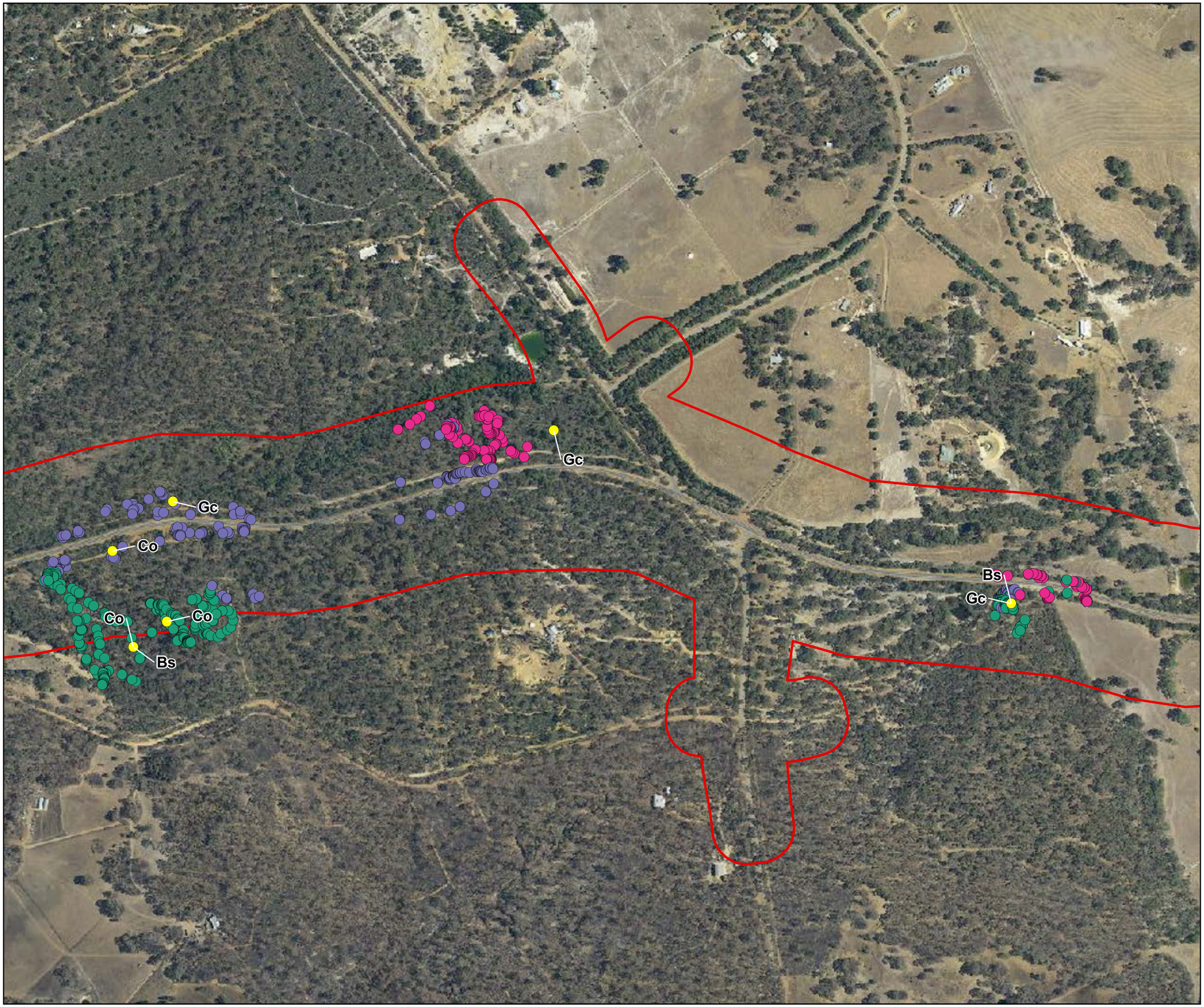

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Metres

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LEGEND

Conservation Significant Flora AECOM

- T
- 1
- 2
- 3
- 4

2016 Targeted Search Records

- Boronia scabra subsp. condensata (P2)
- Calytrix oncophylla (P2)
- Grevillea candolleana (P2)
- Hibbertia montana (P4)
- Study Area

Data sources:

Base Data: © Western Australia Land Information Authority (Landgate) (2016)
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Toodyay Biological Assessment

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Figure 7B

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Metres

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LEGEND

Conservation Significant Flora AECOM

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2016 Targeted Search Records

- Boronia scabra subsp. condensata (P2)
- Calytrix oncophylla (P2)
- Grevillea candolleana (P2)
- Hibbertia montana (P4)
- Study Area

Data sources:

Base Data: © Western Australia Land Information Authority (Landgate) (2016)
NearMap Imagery 2016

Toodyay Biological Assessment

Flora Desktop Results

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Figure 7C

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6.4 Other flora

6.4.1 Species richness

Three hundred and sixty-two native vascular flora taxa were recorded within the Study area, representing 161 genera and 54 families. The most abundant families included Fabaceae (pea family) with 62 species, Myrtaceae with 33 species and Proteaceae with 32 species.

Native species represented 90% of all species collected within the Study area. The Project species list is presented in **Appendix I**. Introduced flora species are discussed in Section 6.4.2.

During the survey, 21 orchid species were recorded including one Priority 4 orchid, *Caladenia integra* (discussed in Section 6.3). Photographs of flowering orchids are shown in Plate 13. This indicates that the Study area was surveyed during a suitable time for capturing flowering orchids.

Plate 13 **Left to right a) Pterostylis recurva b) Pterostylis sargentii c) Calochilus stramenicola d) Thelymitra macrophylla e) Pterostylis sp. Cauline Leaves f) Caladenia falcata g) Diuris corymbosa h) Pterostylis sanguineus i) Cyanicula gemmata j) Caladenia longiclavata j) Thelymitra antennifera**

6.4.2 Introduced flora species

Thirty-eight introduced flora species were recorded within the Study area, including two Declared Pests **Asparagus asparagoides* and **Gomphocarpus fruticosus* (Table 33), as listed under the BAM Act. Pursuant to the BAM Act, these species are subject to restrictions on movement or sale and landholders are obliged to carry out control measures to prevent their spread. **A. asparagoides* is considered a Category 3 pest across the whole of State including Shire of Toodyay and City of Swan. **G. fruticosus* is considered a Category 3 pest in the Shire of Toodyay. More information is provided in Section 6.11.

Of the 38 weeds collected, eight are considered to have a High ecological impact under the environmental weed strategy for WA (CALM, 1999). The rating takes into account species invasiveness, distribution and environmental impacts. The weed species list is provided in **Appendix J**.

6.5 Threatened, Migratory and Priority fauna species

Three conservation significant fauna species were recorded during the field surveys. These included Carnaby's Black Cockatoo (*Calyptorhynchus latirostris* – Endangered under the EPBC Act and WC Act), Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii* subsp. *naso* – Vulnerable under the EPBC Act and WC Act) and the Rainbow Bee-eater (*Merops* ornatus – listed as Marine under the EPBC Act). Their presence was recorded based both on direct sightings and on indirect evidence such as chew markings and a tail feather.

Carnaby's Black Cockatoo was recorded 21 times throughout the Study area during the field survey. This species has also been recorded 190 times within seven kilometres of the Study area (DPaW, 2015). It was recorded flying over the Study area at nine locations. Chew markings suspected to belong to Carnaby's Black Cockatoo were recorded at nine other locations within the Study area. A Carnaby's Black Cockatoo nesting pair was also observed within the Study area (Plate 14 and Table 28).

Plate 14 Carnaby's nesting hollow next to Toodyay Road in the Study area

The Forest Red-tailed Black Cockatoo was recorded flying over the Study area at five locations and indirect evidence such as chew markings and tail feathers belonging to this species were recorded at four locations.

The Rainbow Bee-eater was recorded flying over the Study area at four locations. Note that the Rainbow Bee-eater is listed as Marine under the EPBC Act which means it is only classed as a Threatened species within Commonwealth land. Details are provided in Table 28 and displayed in Figure 8. The Rainbow Bee-eater is a common species which occupies numerous habitats including open woodlands with sandy loamy soil, sand ridges, sandpits, riverbanks, road cuttings, beaches, dunes, cliffs, mangroves and rainforests. The Rainbow Bee-eater avoids heavy forest that would hinder its pursuit of its insect prey (Morcombe, 2003). The Rainbow Bee-eater is a widespread species found all over Australia that has been previously recorded in the area (DPaW, 2015). This species can be expected to occur throughout the majority of the Study area, utilising sandy/loamy soils for breeding and elsewhere for feeding on insects.

Baudin's Black Cockatoo was not recorded during the field survey. Differentiating between Baudin's Black Cockatoo and Carnaby's Black Cockatoo can be difficult in the field, particularly when the birds aren't viewed close up to distinguish between the two. Baudin's Black Cockatoo has been recorded a total of 54 times within seven kilometres of the Study area (DPaW, 2015). As this species is common in the local area, it is likely that some of the Carnaby's Black Cockatoo records may have been Baudin's Black Cockatoo. Baudin's Black Cockatoo remains likely to occur within the Study area.

Table 28 Conservation significant fauna species recorded within the Study area during the survey

Species	Evidence	Latitude	Longitude
Carnaby's Black Cockatoo	Nesting Pair	-31.6071	116.4400
Calyptorhynchus latirostris	Chew markings	-31.6058	116.4420
		-31.6064	116.4370
		-31.6564	116.3690
		-31.6612	116.3650
		-31.6556	116.3710
		-31.6032	116.4490
		-31.6036	116.4496
		-31.6046	116.4505
		-31.6865	116.3250
	Direct sighting	-31.6071	116.4400
		-31.6425	116.3780
		-31.6476	116.3749
		-31.7135	116.2890
		-31.6715	116.3550
		-31.6831	116.3280
		-31.6865	116.3250
		-31.7107	116.2930
		-31.7046	116.3020
		-31.7180	116.2810
		-31.7859	116.2230

Species	Evidence	Latitude	Longitude
Forest Red-tailed Black Cockatoo *Calyptorhynchus banksii* subsp. *naso*	Chew markings	-31.7701	116.2350
		-31.7708	116.2330
		-31.7721	116.2330
	Tail-feather	-31.7712	116.2340
	Direct sighting	-31.7431	116.2680
		-31.7858	116.2240
		-31.7903	116.2080
		-31.7894	116.2070
		-31.6800	116.3300
Rainbow Bee-eater *Merops* ornatus	Direct sighting	-31.7294	116.2710
		-31.7894	116.2180
		-31.7987	116.1810
		-31.6774	116.3390

Based on the desktop assessment, the following conservation significant species were also considered likely to occur or to utilise habitat within the Study area:

- Chuditch (*Dasyurus geoffroii*) - Vulnerable under the EPBC Act and WC Act
- Common Sandpiper (*Actitis hypoleucos*) - Migratory under the EPBC Act and IA under the WC Act
- Fork-tailed Swift (*Apus pacificus*) - Migratory under the EPBC Act and IA under the WC Act
- Eastern Great Egret (*Ardea modesta*) - Migratory under the EPBC Act and IA under the WC Act
- Western Brush Wallaby (*Macropus irma*) - Priority 4 on the DPaW Priority species list
- Blue-billed Duck (*Oxyura australis)* - Priority 4 on the DPaW Priority species list
- Peregrine Falcon (*Falco peregrinus)* – OS under the WC Act.

None of the above species were recorded during the survey.

The Chuditch currently only occurs in areas dominated by sclerophyll forest or drier woodland, heath and mallee shrubland (Van Dyck & Strahan, 2008). The majority of records are found in the contiguous Jarrah forests of south-western Australia (DotE, 2015). The species is known to exist in the local area from four records within seven kilometres of the Study area, the most recent in 2009 with the three most recent records adjacent to a road or intersection (DPaW, 2015). This species is likely to occur in the Eucalypt Woodlands fauna habitat of the Study area. This comprises 219 ha or 25.3 % of the Study area. A targeted Chuditch survey is being undertaken in areas of the Eucalypt Woodland fauna habitat in October / November 2016.

The Common Sandpiper (Migratory and IA) is widespread throughout Australia, with few important sites on the continent. These birds visit Australia during the non-breeding season (July to February). Preferred habitat is coastal wetlands with muddy margins or rocky shores but it has also been recorded in inland wetlands and dams (DotE, 2015). The Common Sandpiper has been recorded nine times within seven kilometres of the Study area, most recently in 2011 (DPaW, 2015). This species may be expected to occur within the Study area in the River and in the Wetland fauna habitats of the Study area. This comprises 52 ha or 6 % of the Study area. These habitats are considered to be significant

The Fork-tailed Swift (Migratory and IA) is a regular summer migrant to Australia, arriving in October and leaving by mid-April. It is generally observed flying high overhead, over open country, semi-arid deserts to coasts and forests (Pizzey & Knight, 2007). The Fork-tailed Swift was last recorded in 2000 within seven kilometres of the Study area (DPaW, 2015).The Fork-tailed Swift is almost exclusively aerial and is likely to fly over the fauna habitats of the Study area.

The Great Egret (formerly Migratory and now Marine and IA) occupies a wide variety of wet habitats including freshwater wetlands, dams, flooded pastures, estuarine mudflats, mangroves and reefs (Morcombe, 2003). The species is also known to visit shallows of rivers, sewage ponds and irrigation areas (Pizzey & Knight, 2007). Based on numerous recent records from 2013 within seven kilometres of the Study area (DPaW, 2015), this species is likely to occur in the River and in the Wetland fauna habitats of the Study area. This comprises 52 ha or 6 % of the Study area. The species is widespread across Australia and utilises a wide range of wetland habitats. As such, the habitat within the Study area is not considered significant for the species.

The Western Brush-wallaby is a Priority 4 species and only occurs in the south-west of Western Australia. Preferred habitat consists of open sclerophyll forest or woodland and favours open flats over scrub thickets. It is also found in larger areas of mallee and heathland in the Wheatbelt and is uncommon in wet sclerophyll forest (Van Dyck & Strahan, 2008). It has been recorded as recently as 2010 in the local area, with a total of six records within seven kilometres of the Study area (DPaW, 2015). It is likely to occur within the Study area in the Eucalypt Woodlands, Native Shrublands and the Heath fauna habitats of the Study area. This comprises 236 ha or 27 % of the Study area. The habitats of the Study area are well represented in the surrounding landscape although it is a highly fragmented setting. For this reason, the habitats of the Study area are not considered to represent significant habitat for the species.

The Blue-billed Duck (Priority 4) is endemic to south-eastern and south-western Australia. It prefers deep water in large permanent wetlands and swamps with aquatic vegetation. This species of duck is fully aquatic and rarely comes onto land (NSW Government, 2015). This species has been recorded within seven kilometres of the Study area four times, most recently in 2012 (DPaW, 2015). It is considered unlikely to occur within the Study area based on the fauna habitats present.

The Peregrine Falcon (OS) occurs across much of mainland Australia occupying diverse habitats, from rainforest to arid scrubland. It relies on abundant prey, secure nest sites and a lack of human interference (Pizzey & Knight, 2007). This species was not recorded during the survey; however it still may be an infrequent visitor to the area.

6.6 Other fauna

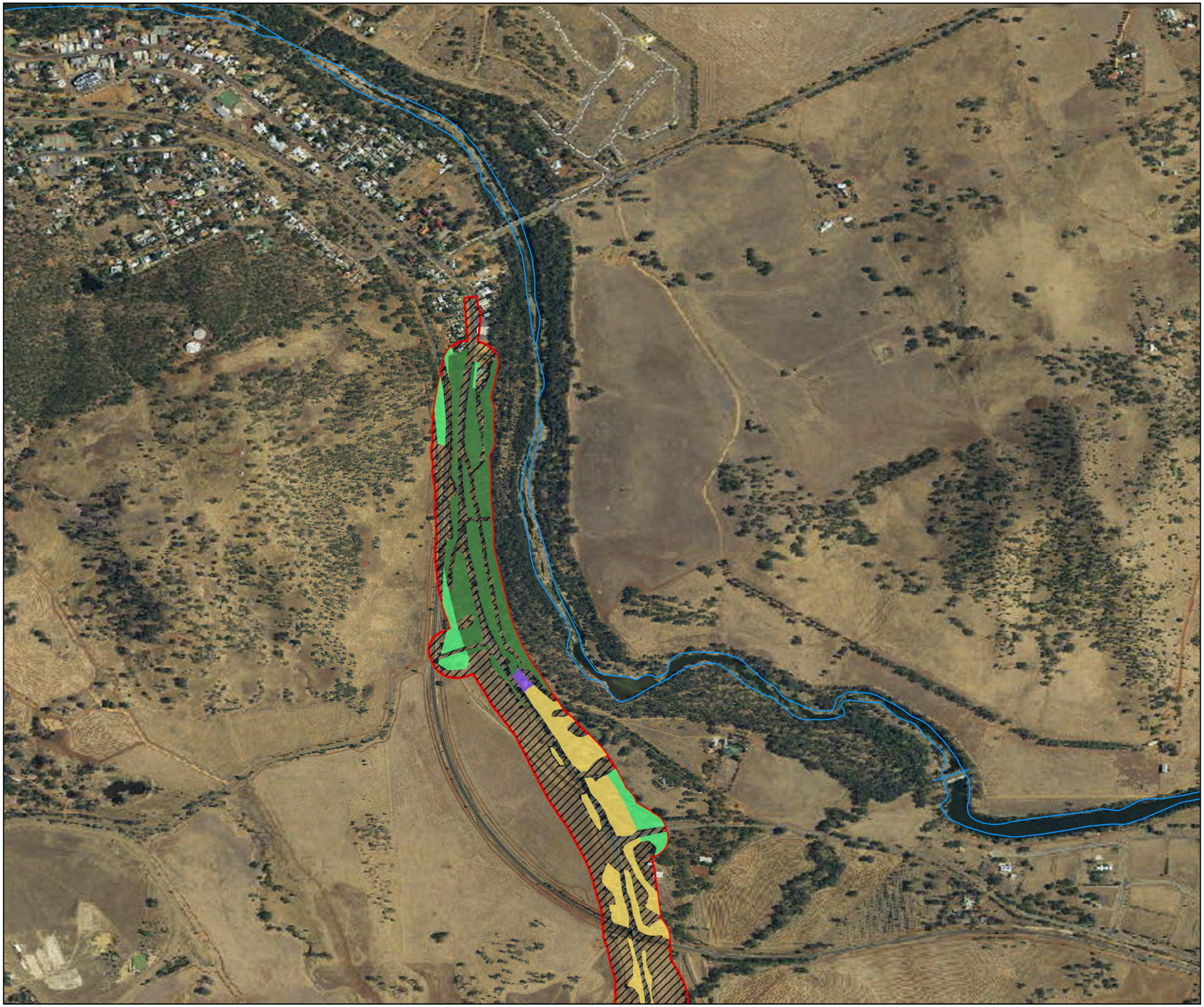
6.6.1 Inventory of fauna species

Fifty eight vertebrate fauna species were recorded during the field survey and comprises 43 bird species, five amphibian species, six mammal species and four reptile species. A complete inventory of fauna species recorded within the Study area is provided in **Appendix K**.

6.6.2 Introduced species

Five introduced species were recorded within the Study area during the field survey and their legal status under the BAM Act are listed below:

- Laughing Kookaburra (*Dacelo novaeguineae*) – Permitted – s11
- European Cattle (*Bos Taurus*) – Permitted – s11
- Dog (*Canis lupus* subsp. *familiaris*) Domestic – Permitted – s11; Feral - Declared Pest – s22(2)
- Cat (*Felis catus)* – Permitted – s11
- Red Fox (*Vulpes vulpes*) (Feral) – Declared Pest – s22(2)
- Rabbit (*Oryctolagus cuniculus*) (Feral) – Declared Pest – s22(2).



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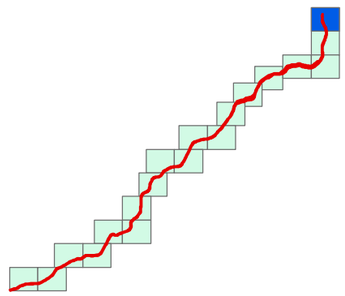
LEGEND

- Field Observations
- Watercourses

Fauna Habitats

- Wetland
- Planted Vegetation
- Native Shrubland
- MRWA Rehabilitation
- Isolated Eucalypts
- Heath
- Eucalypt Woodland
- River / Drainage channels
- Cleared
- Study Area



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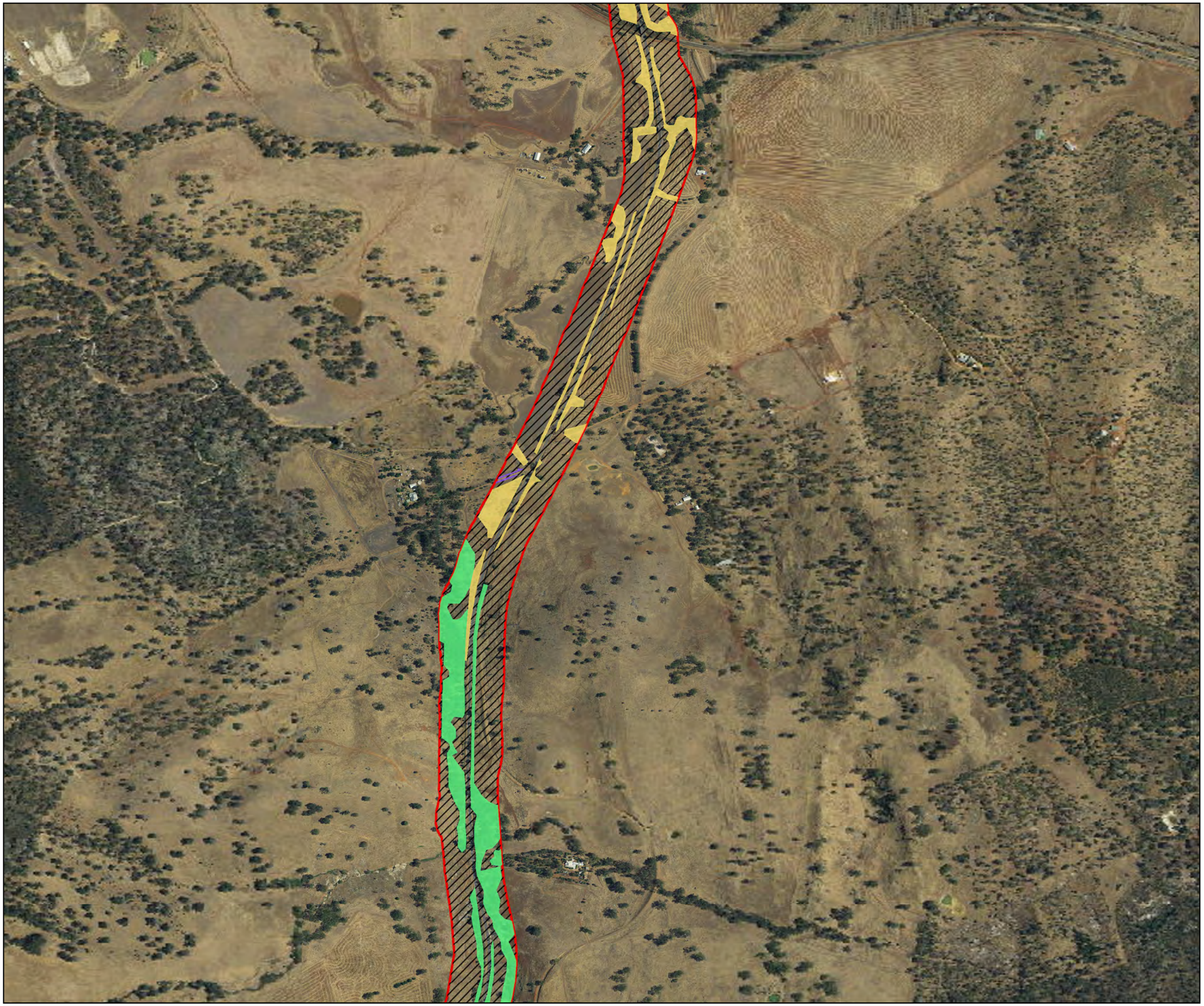

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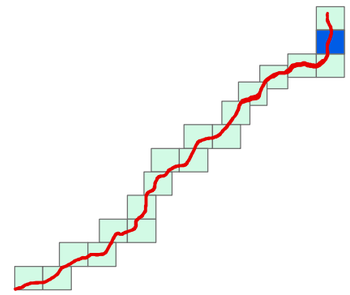

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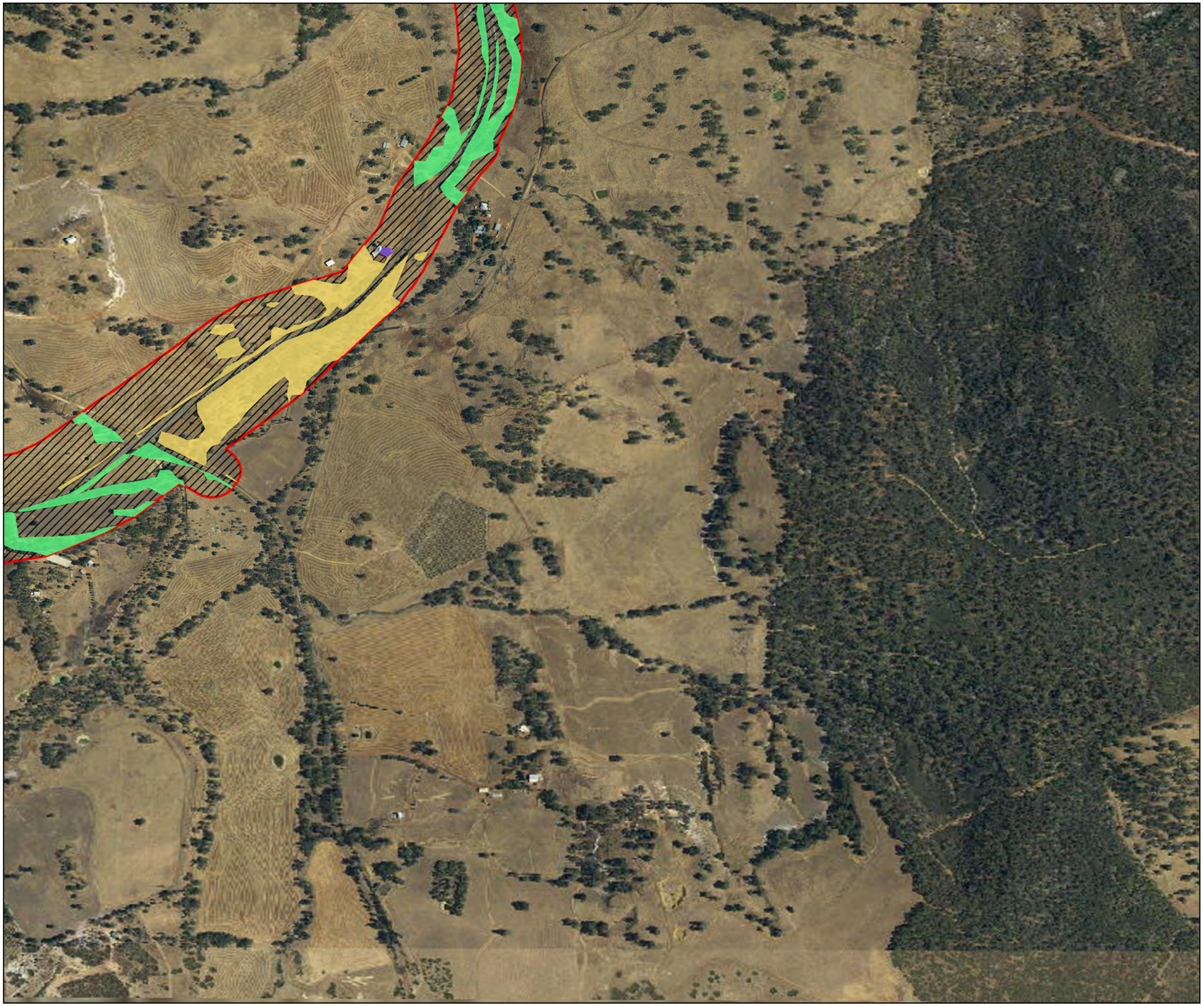

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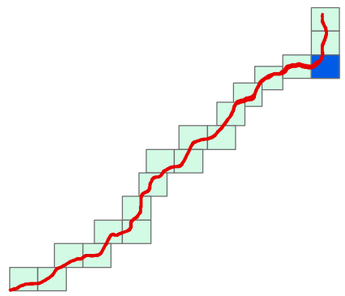

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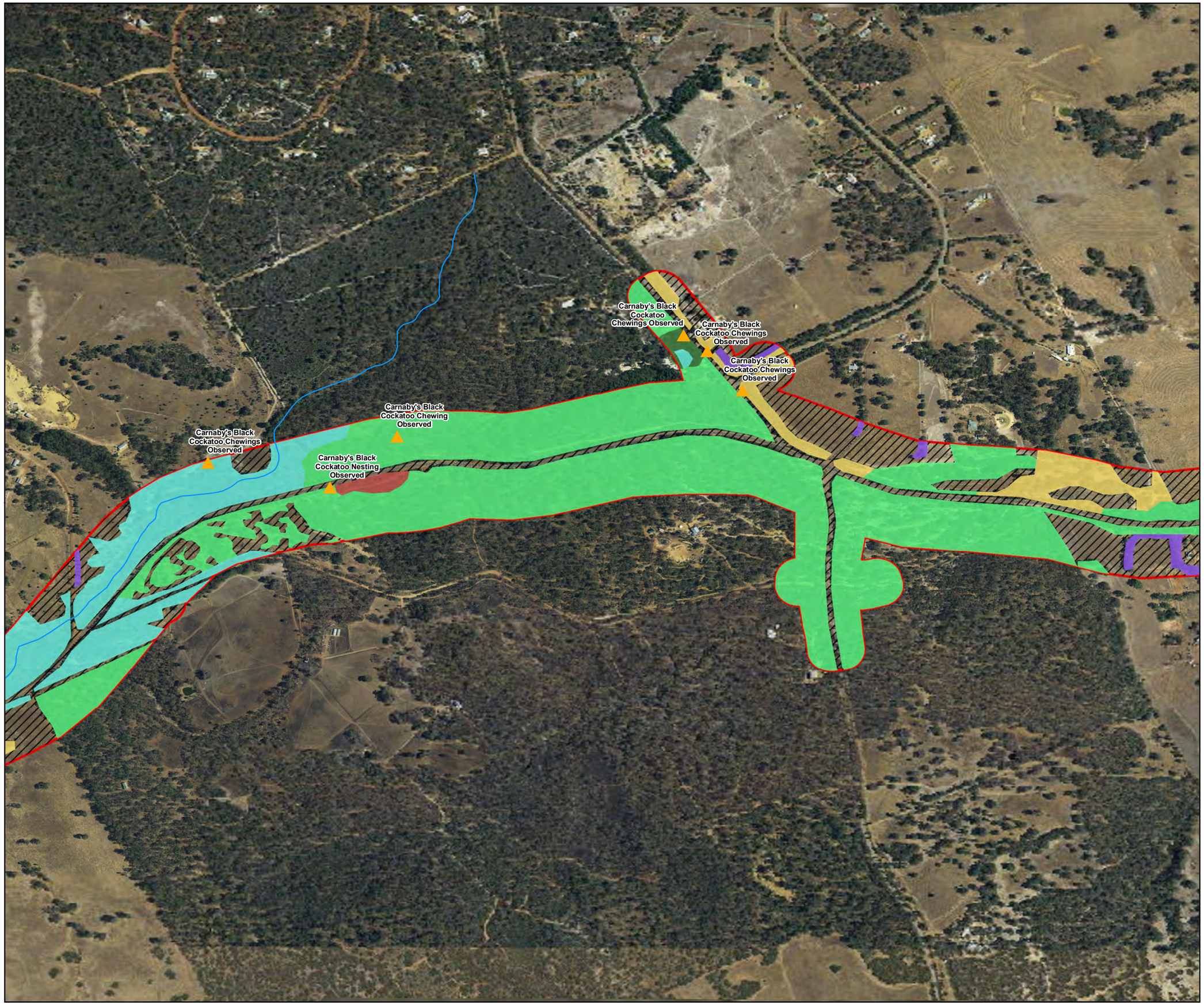

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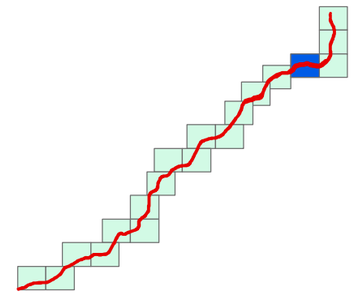

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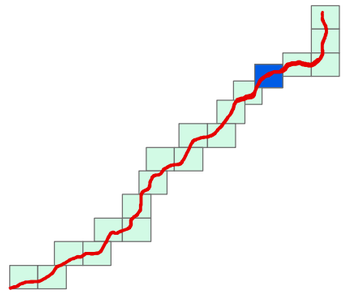

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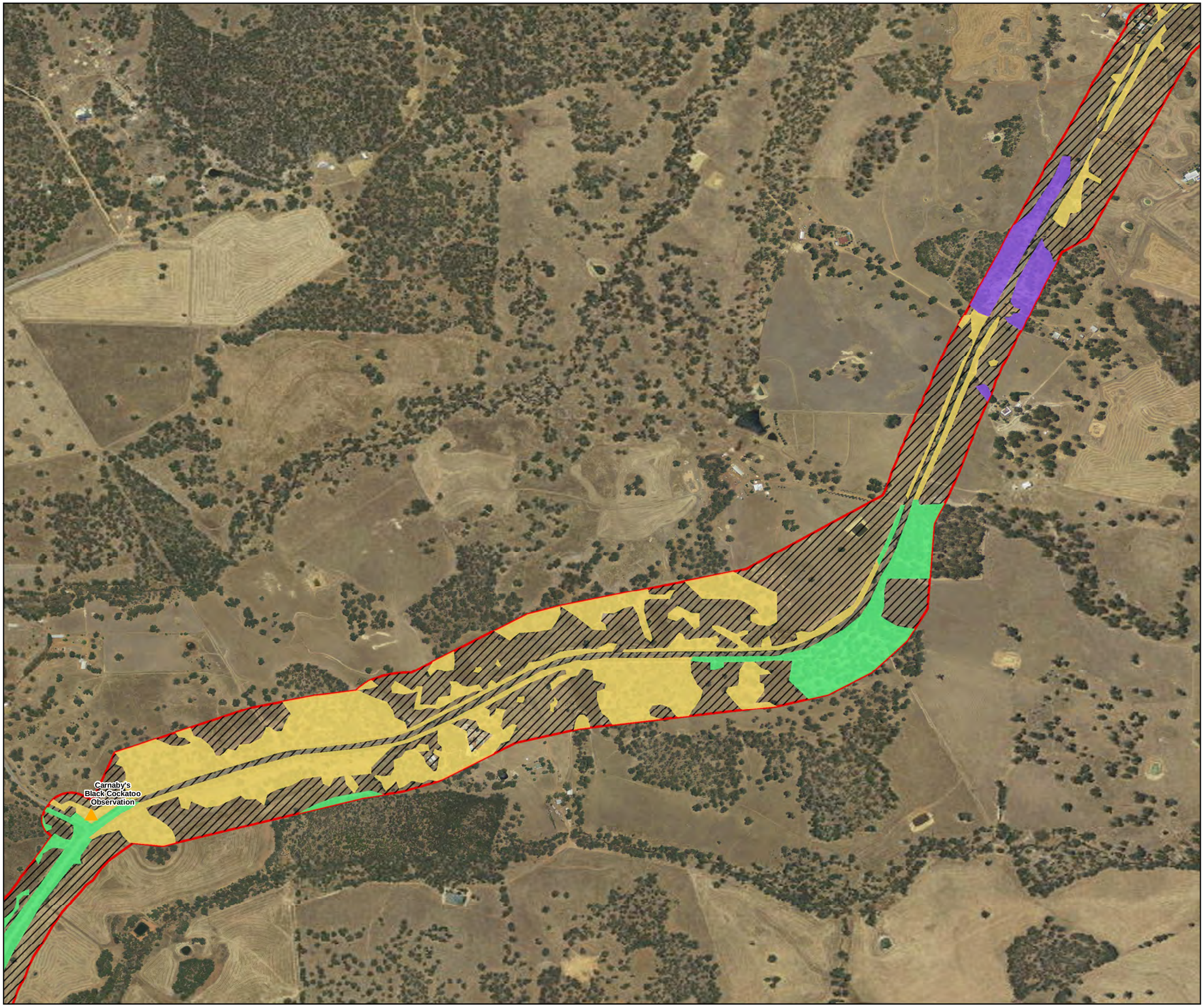

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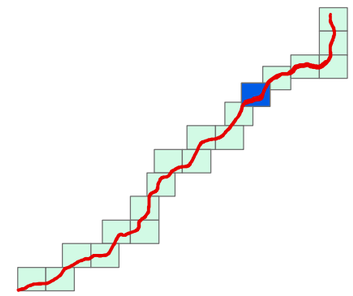

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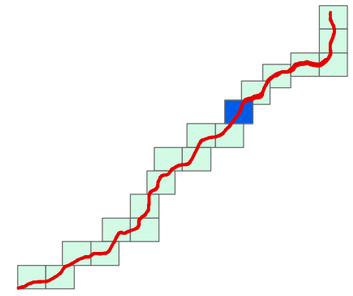

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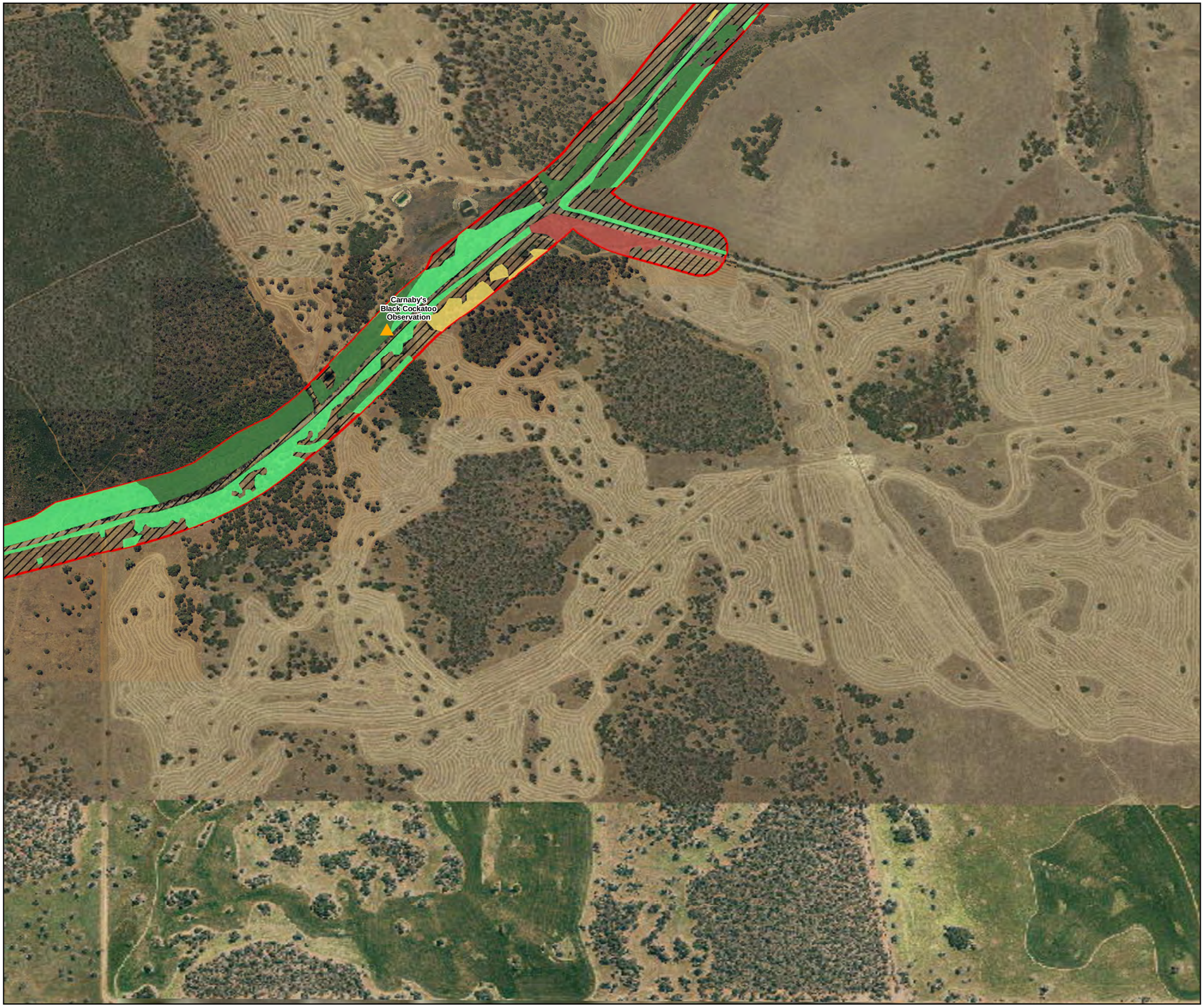

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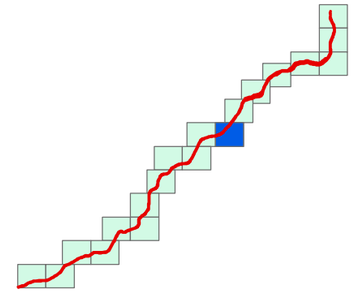

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Fauna Values of the Project Area

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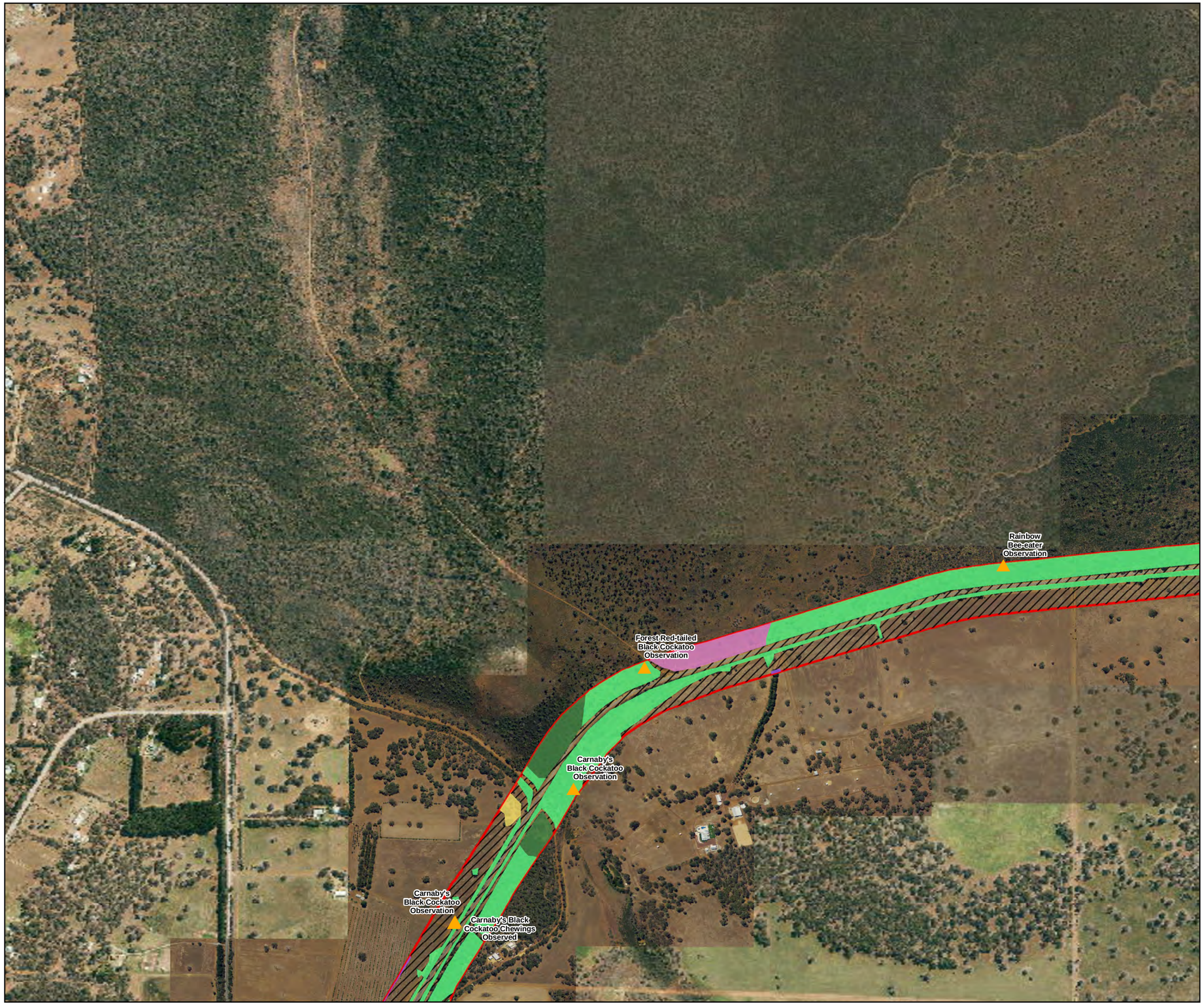

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LEGEND

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- Watercourses

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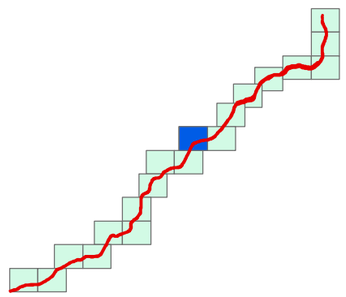
- Study Area



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Fauna Values of the Project Area

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VERSION:	2

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LEGEND

- Field Observations
- Watercourses

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- Isolated Eucalypts
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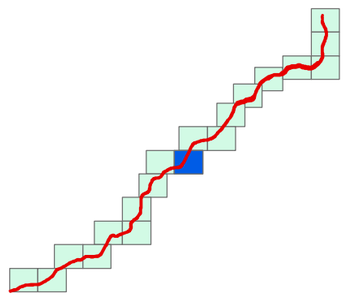

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Fauna Values of the Project Area

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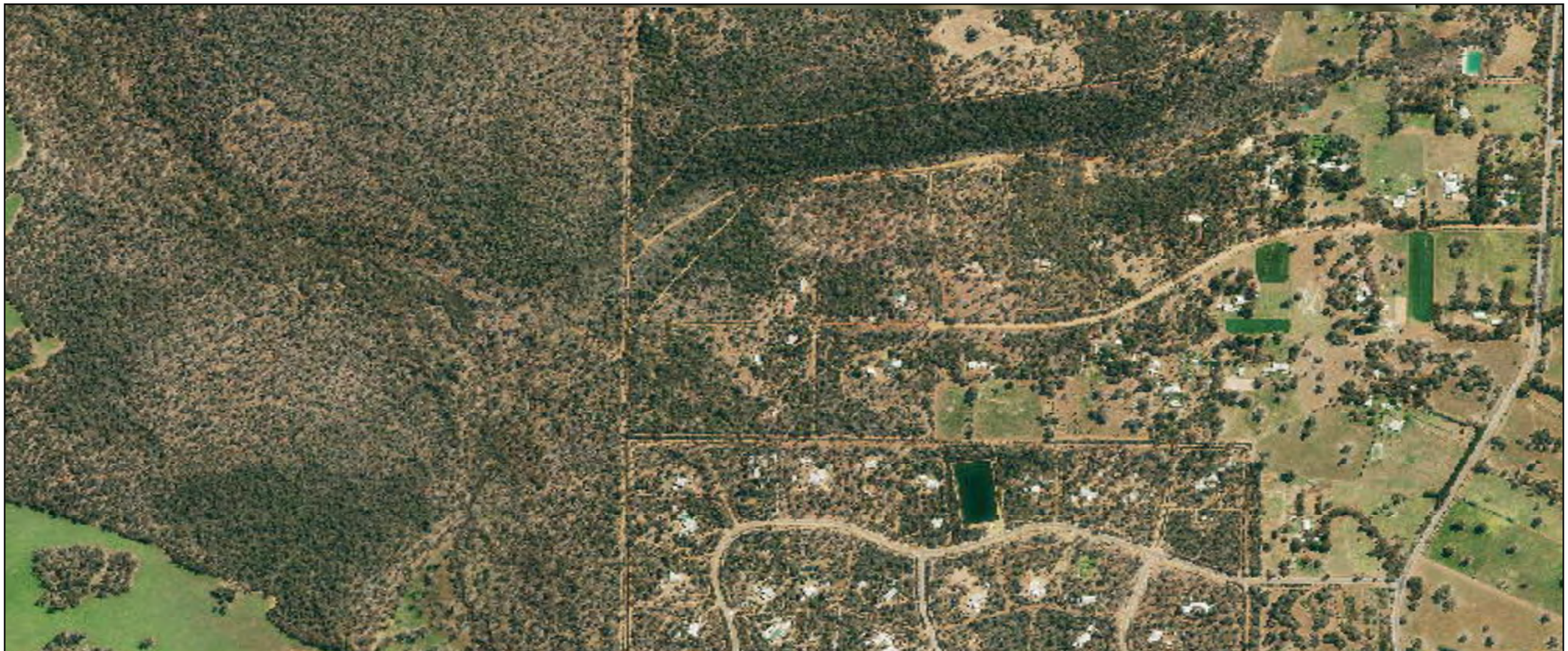

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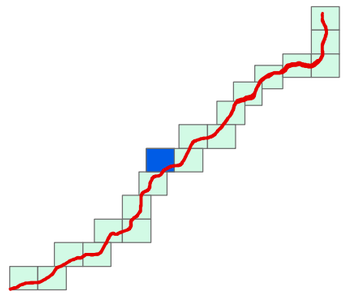
LEGEND

- Field Observations
- Watercourses

Fauna Habitats

- Wetland
- Planted Vegetation
- Native Shrubland
- MRWA Rehabilitation
- Isolated Eucalypts
- Heath
- Eucalypt Woodland
- River / Drainage channels
- Cleared
- Study Area



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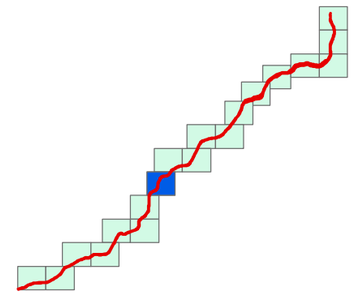

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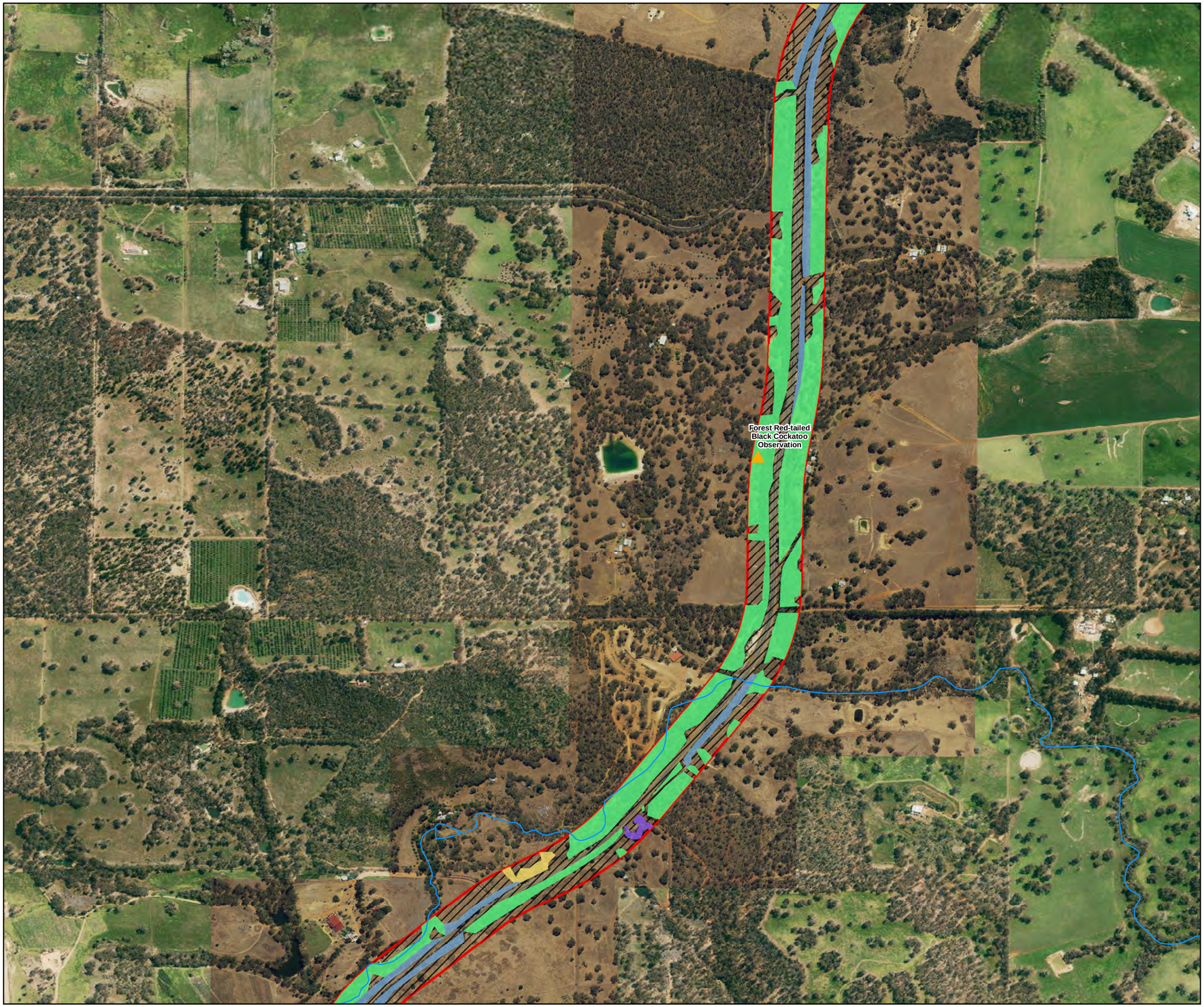

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- Field Observations
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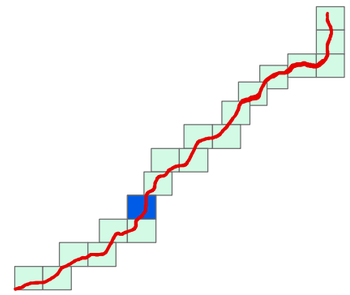

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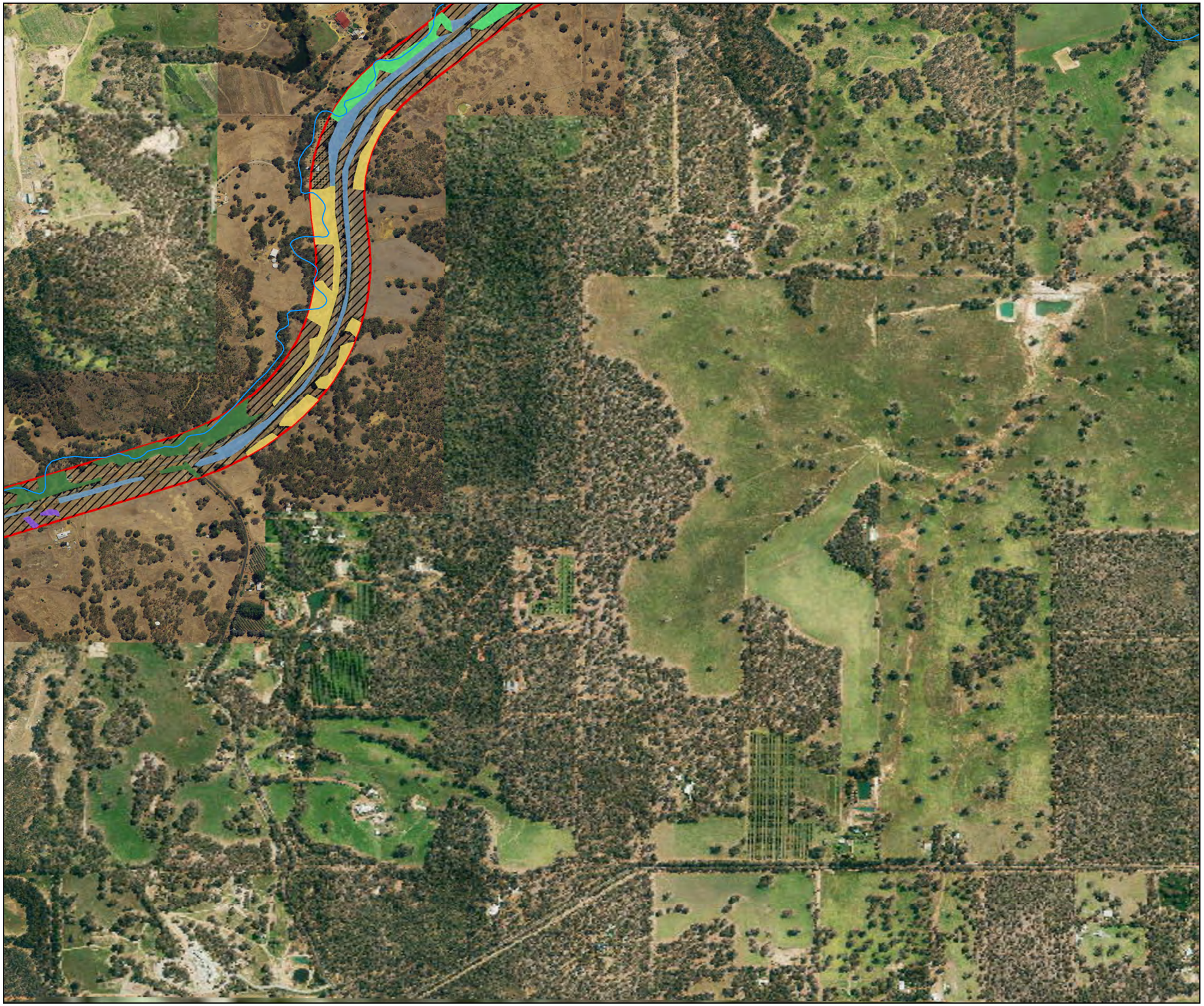

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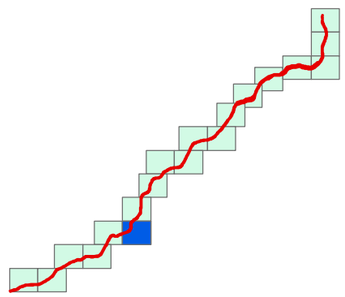

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Forest Red-tailed Black Cockatoo Chewing

Forest Red-tailed Black Cockatoo Chewing

Forest Red-tailed Black Cockatoo Feather observed

Forest Red-tailed Black Cockatoo Chewing

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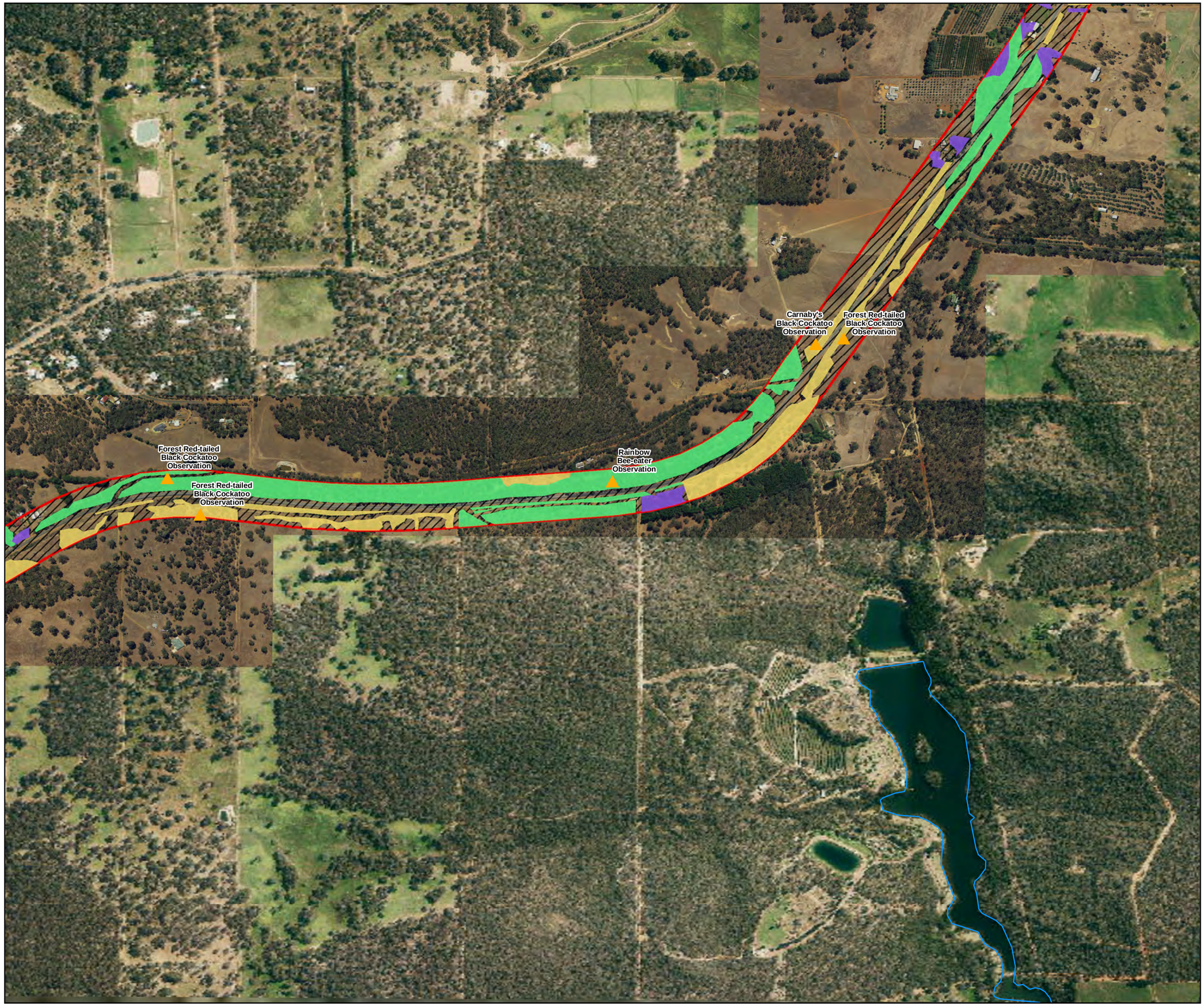

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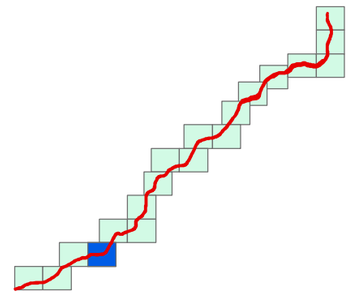

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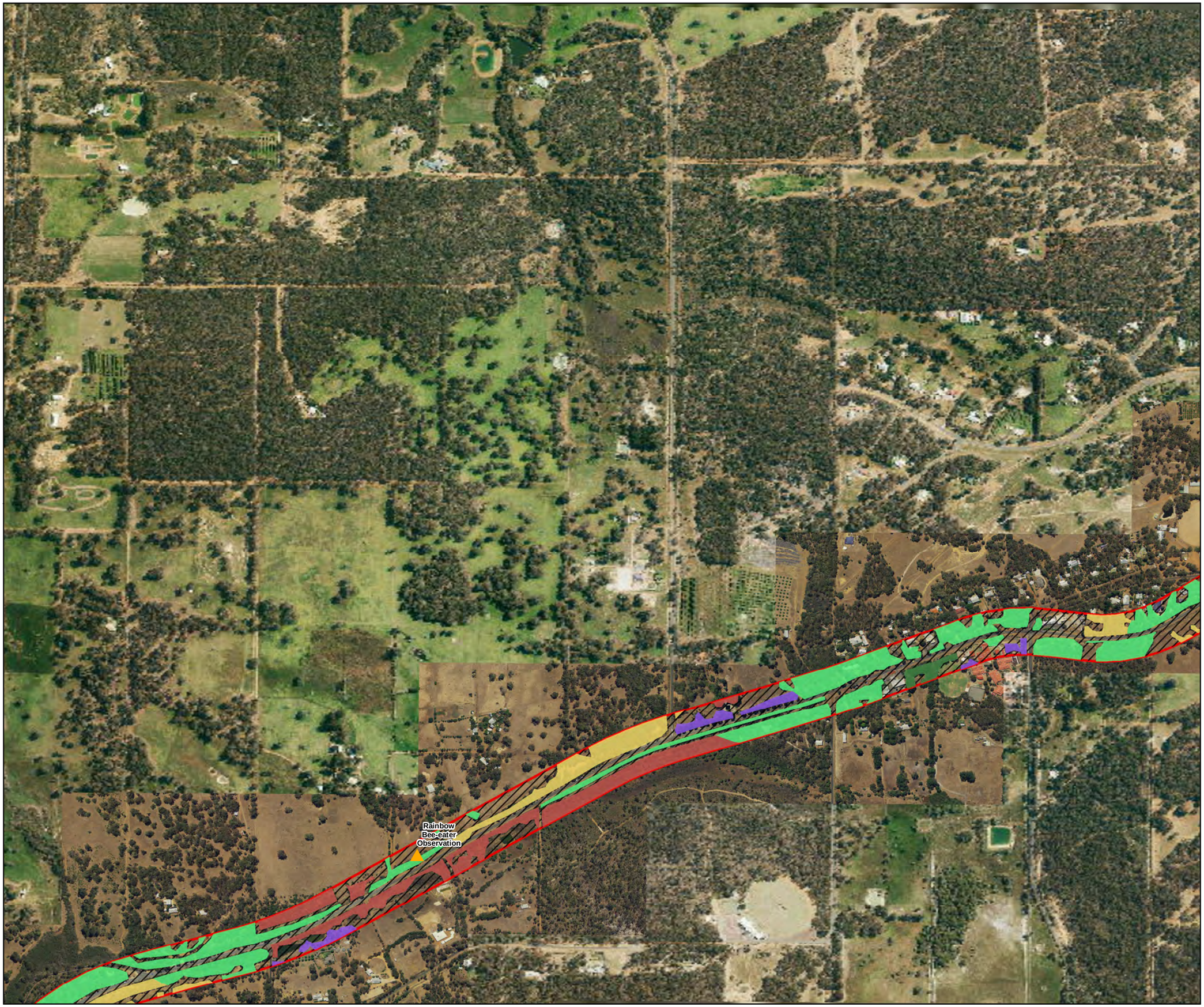

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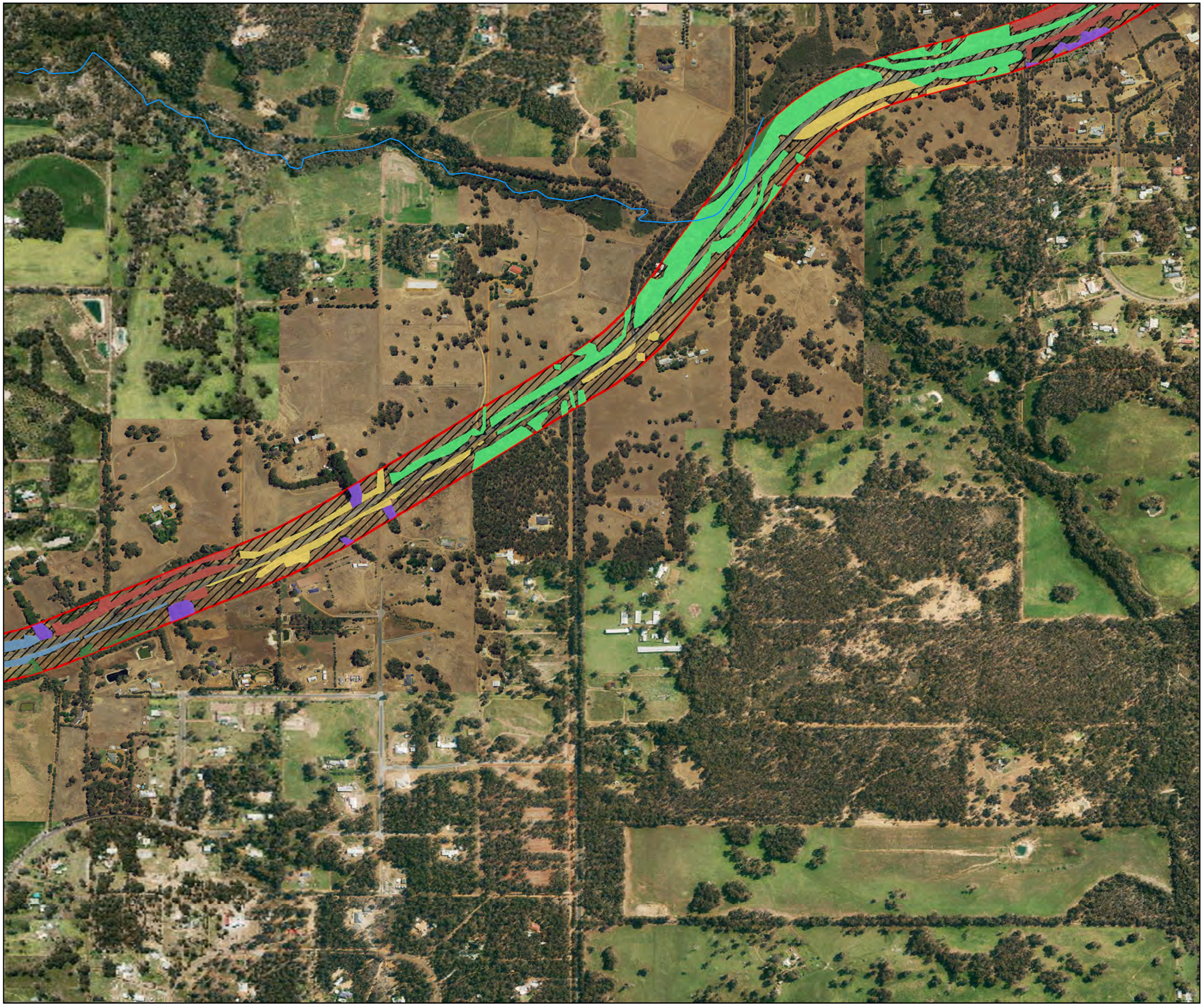

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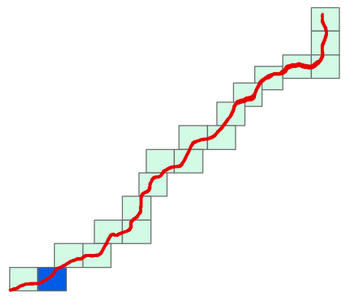

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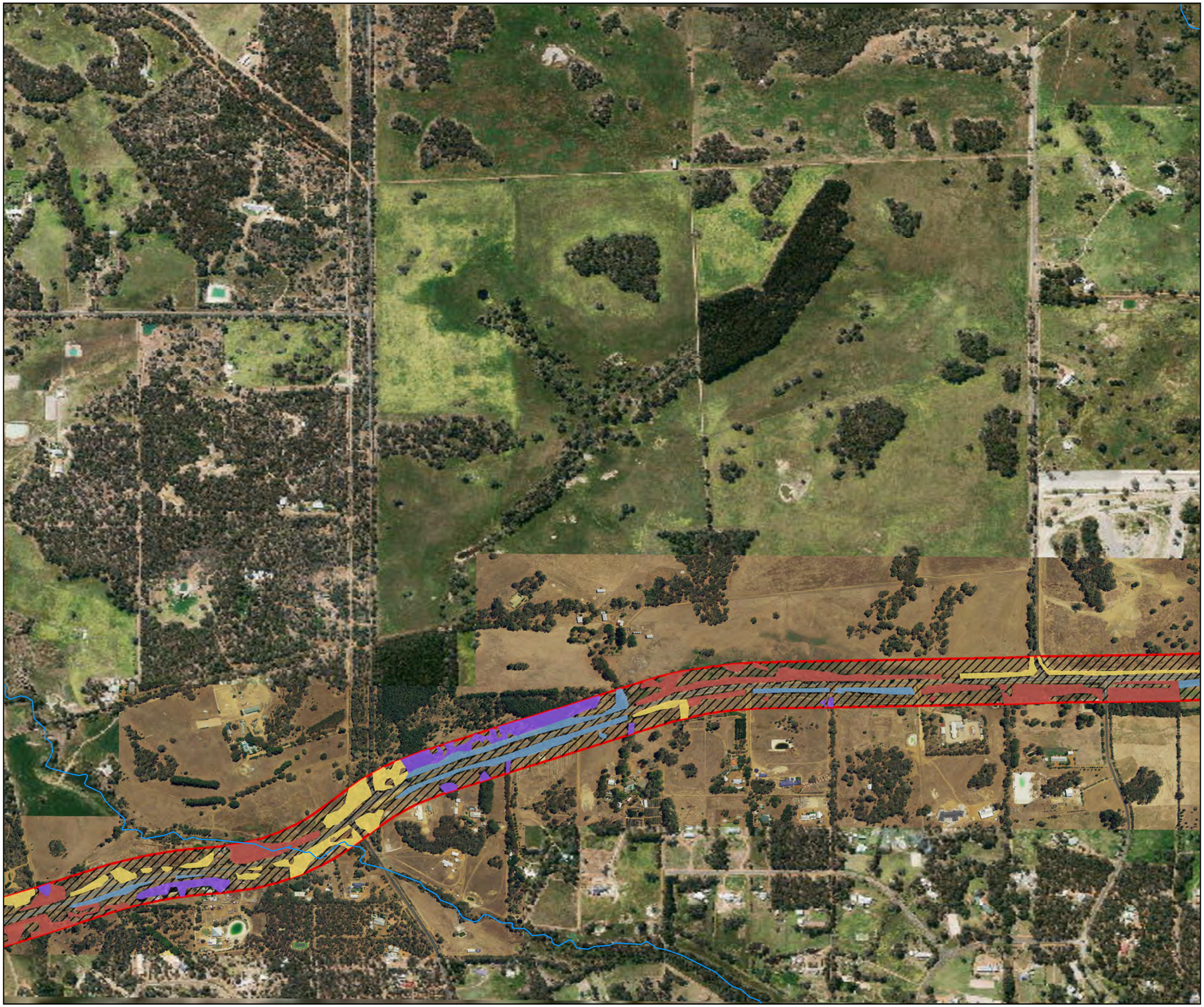

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6.7 Black Cockatoos

6.7.1 Breeding habitat

Within the Study area, 7,235 trees are considered to be potential Black Cockatoo breeding habitat trees, in accordance with the Commonwealth guidelines (DSEWPaC, 2012a) (Figure 9 and Table 31). Four hundred and sixty one of these trees had 935 potential hollows. These are defined as appearing to look like a hollow. From the ground it is not always possible to determine if a hollow is present. Of these 935 potential hollows, 278 had diameters deemed large enough (greater than 20 cm) and were potentially suitable for use by Black Cockatoo. One hollow contained a nesting Carnaby's Black Cockatoo (Plate 14 and Table 31). This confirms breeding occurs in the local area.

6.7.2 Roosting habitat

Black Cockatoo roosting habitat is generally found in or near riparian vegetation, close to fresh water and typically is comprised of the tallest trees in these areas (DSEWPaC, 2012a). There is 90 ha that contains large trees found within 50 m of freshwater wetlands and rivers and within the Study area (Figure 9). No confirmed roosting trees were observed in the Study area.

6.7.3 Foraging habitat

6.7.3.1 Carnaby's Black Cockatoo

Carnaby's Black Cockatoo is endemic to the southwest of Western Australia, extending from the Murchison River to Esperance, and inland to Coorow, Kellerberrin and Lake Cronin (DotEE, 2016). This black cockatoo has a white patch on its cheek, white bands on its tail, and a strong curved bill.

Carnaby's Black Cockatoo feed on seeds, nuts and flowers of a variety of native and exotic plants. Feed plants include the various proteaceous species (e.g. *Banksia, Grevillea* and *Hakea*), *Corymbia calophylla* (Marri*), Eucalyptus* (e.g. Jarrah [*Eucalyptus marginata*]), and seeds from the cones of Pine trees (*Pinus* sp.).

Carnaby's Black Cockatoo display strong pair bonds and nest in the hollows of live or dead mature eucalypts including Salmon Gum (*Eucalyptus salmonophloia*), York Gum (*Eucalyptus loxophleba* subsp. *loxophleba*), Flooded Gum (*Eucalyptus rudis*), Karri (*Eucalyptus diversicolor*), Marri (*Corymbia calophylla*), Wandoo (*Eucalyptus wandoo*) and Tuart (*Eucalyptus gomphocephala* [DSEWPaC, 2012]). Nest hollows generally range from 2.5-12 m above ground, size of entrance from 23-30 cm and depth of hollows from 1-2.5 m (Johnstone & Storr,1998). The species appears to be expanding its current breeding range westward and south into the Jarrah-Marri forests of the Darling Range and into the Tuart forests of the SCP (Johnstone & Kirkby, 2006). After breeding, Carnaby's Black Cockatoo disperse to the higher rainfall coastal areas of the south-west of Western Australia to feed in late December to July (DEC, 2009). Breeding has been recorded from early July to mid-December.

Carnaby's Black Cockatoo has undergone a dramatic decline of approximately 50 percent in the past 45 years, with the main contributing factors the clearing of core breeding habitat in the Wheatbelt, the deterioration of nesting hollows, and clearing of foraging habitat.

A total of approximately 90 ha of vegetation within the Study area was considered to be of Good foraging value to Carnaby's Black Cockatoo, mapped in Figure 9 and detailed in Table 29. This score takes into account both structure and diversity of the vegetation within each vegetation unit. The score also takes into account relevant habitat features on site such as water sources, breeding habitat and confirmed or modelled species presence at the site.

Table 29 Carnaby's Black Cockatoo foraging habitat quality results

Rating	Area (ha)	Area (%)
Poor: 0-3	652.55	75.4
Moderate: 4-5	122.42	14.2
Good: 6-8	89.53	10.4
Excellent: 9-10	0	0
Total	**864.50**	**100**

6.8 Forest Red-tailed Black Cockatoo

6.8.1 Forest Red-tailed Black Cockatoos

The Forest Red-tailed Black Cockatoo is endemic to the south-west humid and semi-humid zones of Western Australia, where it inhabits dense Jarrah, Karri and Marri forests which receive more than 600 mm average annual rainfall (DSEWPaC, 2012). The species has a pair of black central tail feathers and a bright red, orange or yellow barring on the tail.

This species predominantly feeds in eucalypt forests, preferring Marri (*Corymbia calophylla*) and Jarrah (*Eucalyptus marginata*) seeds, but also feeding in Blackbutt (*Eucalyptus patens*), Albany Blackbutt (*Eucalyptus staeri*), Karri (*Eucalyptus diversicolor*), Sheoak (*Allocasuarina fraseriana*) and Snottygobble (*Persoonia longifolia*) (Johnstone, 2016 pers. comm.). Forest Red-tailed Black Cockatoo are monogamous and pairs nest in tree hollows from 6.5–33 m above ground. Most nests are in very large and very old, mature Marri (*Corymbia calophylla*) Johnstone, Kirkby & Sarti, 2013), though they will nest in other eucalypts such as Tuart (Johnstone, 2016 pers. comm.).

The modelled distribution of Forest Red-Tailed black Cockatoos in the *Referral Guidelines for three threatened black cockatoo species* (DSEWPaC, 2012) ranges from Perth to Albany encompassing the south west of the state. Formerly common, but now rare to uncommon and patchily distributed, the Forest Red-tailed Black Cockatoo has disappeared from about 30% of its former range. It has suffered a marked decline in numbers over the past 60 years because of the destruction and fragmentation of habitat (especially Jarrah-Marri forest), the apparent decline in Marri along the eastern side of the Darling Scarp (possibly due to climate change), logging, the impact of competitors for nest hollows, and fire (Chapman, 2008).

According to Johnstone *et al.* (2013) the foraging ecology of the Forest Red-tail is changing as their range is expanding. New foraging species, including introduced species, are being added to their diet. Lack of food and the discovery of new food sources is leading this change in foraging range. Sedentary flocks are now becoming regular visitors to the Swan coastal Plain, particularly for breeding. Principal foods are Marri and Jarrah with less important foods including Blackbutt, Sheoak, Hakea, introduced eucalypts and cape lilac.

A total of approximately 82 ha of vegetation within the Study area was considered to be of Good foraging value for the Forest Red-tailed Black Cockatoo, mapped in Figure 10 and detailed in Table 30.

Table 30 Forest Red-tailed Black Cockatoo foraging habitat quality results

Rating	Area (ha)	Area (%)
Poor: 0-3	644.21	74.5
Moderate: 4-5	138.12	16.0
Good: 6-8	82.17	9.5
Excellent: 9-10	0	0
Total	**864.50**	**100**

6.9 Baudin's Black Cockatoo

Baudin's Black Cockatoo is distributed throughout the south-western humid and subhumid zones, from the northern Darling Range and adjacent far east of the SCP (south of the Swan River), south to Bunbury and across to Albany (Johnstone & Storr, 1998). It is a large black cockatoo with rectangular white patches in the tail. Males have a pink eye ring, the female a dark eye ring.

Baudin's Black Cockatoo forages primarily in eucalypt forest, where it feeds on seeds, flowers, nectar and buds from Marri (*Corymbia calophylla*), and seeds of *Eucalyptus* and proteaceous species (e.g. *Banksia* and *Hakea*), as well as orchard fruits and Pines (*Pinus* sp.). It also takes insect larvae and insects (including beetle, wasp and moth larvae) from under bark and in wood of live and dead trees, from galls and from flower spikes of *Xanthorrhoea* and the pith of *Anigozanthos flavidus* (Johnstone & Kirkby, 2008).

This black cockatoo primarily nests in tree hollows in live or dead Karri (*Eucalyptus diversicolor*), Marri (*Corymbia calophylla*), Wandoo (*Eucalyptus wandoo* subsp. *wandoo*) and Tuart (*Eucalyptus gomphocephala* [DSEWPaC, 2012]). Baudin's Black Cockatoo nests in spring in the deep southwest of Western Australia. It has suffered a substantial decline in numbers in the past 50 years. Direct causes of population decline include large numbers shot by orchardists, fragmentation of habitat and the impact of hollow competitors.

Approximately 26 ha of vegetation within the Study area was considered to be of Good foraging value to Baudin's Black Cockatoo, mapped in Figure 11 and detailed in Table 31.

Table 31 Baudins Black Cockatoo foraging habitat quality results

Rating	Area (ha)	Area (%)
Poor: 0-3	610.29	70.6
Moderate: 4-5	168.30	19.4
Good: 6-8	25.69	3.0
Excellent: 9-10	0	0
Total	**864.50**	**100**

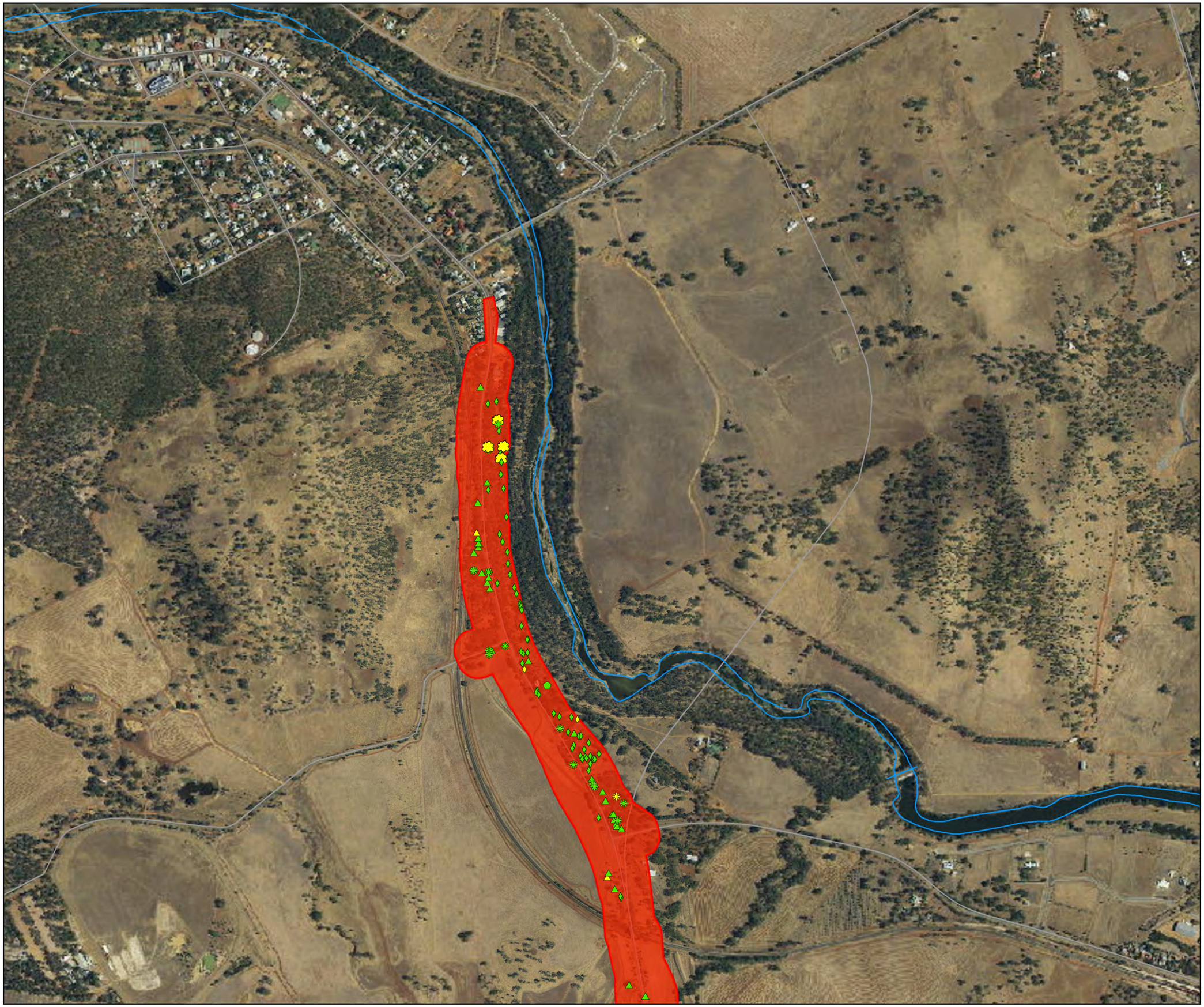
No areas within the Study area were considered to be of Excellent foraging value for any of the three Black Cockatoo species. This is to be expected as the majority of the Study area occupies roadside vegetation and vegetation either within of adjacent paddocks.

6.10 Other fauna habitat

Nine fauna habitats were defined and mapped (Figure 8) within the Study area based on the results of the field survey. Cleared habitat occupies the largest area within the Study area, covering just over 50% of the Study area. In terms of native vegetated habitats, the Eucalypt Woodland is the most common fauna habitat, covering 219 ha or 25% of the Study area. Table 32 describes the nine fauna habitats identified, includes the area and percentage these cover within the Study area, and the conservation significant fauna species that may utilise these habitats.

Table 32 Fauna habitats of the Study area

Habitat	Description	Conservation significant fauna species that may utilise habitat	Area (ha)	
			Metro	Wheatbelt
Eucalypt Woodland	Mixed eucalypts native shrublands and grasslands of varying condition and structure. Soils varied between sandy, loam, laterite and emergent granite.	Forest Red-tailed Black Cockatoo, Baudin's Black Cockatoo, Carnaby's Black Cockatoo, Western Brush Wallaby, Rainbow Bee-eater, Chuditch.	91.0	212.26
Native Shrublands	Mix of native shrubs. Good quality habitat has good structure but poor quality habitat has an introduced grassland understory	Forest Red-tailed Black Cockatoo, Baudin's Black Cockatoo, Carnaby's Black Cockatoo, Western Brush Wallaby, Rainbow Bee-eater.	17.89	3.39
Heath	This habitat was located in the Morangup Nature Reserve. Species present included *Banksia nivea* subsp. Morangup (P2), *Kunzea micrantha* subsp. *micrantha* and *Lepidosperma drummondii*.	Forest Red-tailed Black Cockatoo, Baudin's Black Cockatoo, Carnaby's Black Cockatoo, Western Brush Wallaby, Rainbow Bee-eater.	0	2.21
Wetland	This habitat was associated with lower drainage lines in the Study area and often found near the river habitat. It consisted of Marri, Flooded Gum and *Melaleuca* species over mixed and introduced shrubs and grasses.	Forest Red-tailed Black Cockatoo, Baudin's Black Cockatoo, Carnaby's Black Cockatoo, Western Brush Wallaby, Eastern Great Egret.	12.74	26.64
Planted Vegetation	Planted vegetation including gardens and parks.	Rainbow Bee-eater.	16.58	7.98
Main Roads Rehabilitation	Rehabilitation sections undertaken by Main Roads of western Australia around the late 1980's and early 1990's. Mixture of native shrubs.	Rainbow Bee-eater.	18.83	0
Isolated Trees	Isolated trees of varying species including Marri, Jarrah, Powderbark, Wandoo, Flooded Gum and York Gum over introduced grasses.	Forest Red-tailed Black Cockatoo, Baudin's Black Cockatoo, Carnaby's Black Cockatoo.	39.74	108.01
River and Drainage Channels	This habitat consisted of freshwater streams, creeks and minor drainage channels that bisected the Study area.	Eastern Great Egret.	0.28	32.49
Cleared	Cleared habitats consisted of introduced grassland, roads, tracks, houses and other human-related infrastructure.	Rainbow Bee-eater.	208.56	399.46
Total			**405.63**	**792.63**



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Metres

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LEGEND

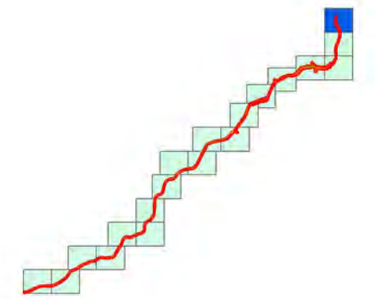
- Study Area

Toodyay Trees

- Eucalyptus loxophleba, No Hollows
- Eucalyptus loxophleba, Hollows
- Eucalyptus marginata, No Hollows
- Eucalyptus rudis, No Hollows
- Eucalyptus rudis, Hollows
- Eucalyptus wandoo, No Hollows
- Eucalyptus wandoo, Hollows
- Stag, Hollows

Carnaby's Black Cockatoo Foraging Habitat Quality

- Poor (0 - 3)
- Moderate (4 - 5)
- Good (6 - 8)
- Excellent (9 - 10)



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Toodyay Biological Assessment

Carnaby's Black-Cockatoo Habitat Assessment

PROJECT ID	60344161
CREATED BY	DGF
LAST MODIFIED	fotheringhamd - 20 Oct 2016
VERSION:	2

Figure 9A

A3 size

Filename: \\AUPER1FP001.AU.AECOMNET.COM\Projects\605X\6051588\4. Tech Work Area\4.99 GIS\02_MXDs\Figures\G60344161_Figure9_CarnabysBlackCockatooHabitatAssessment_v02_20161019_A3.mxd

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N

GDA 1994 MGA Zone 50

0 125 250 500

Metres

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LEGEND

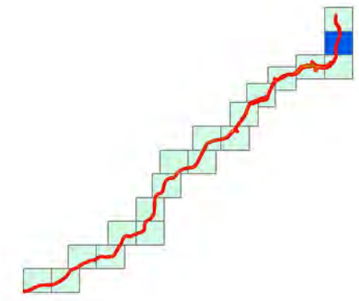
Study Area

Toodyay Trees

- Corymbia calophylla, No Hollows
- Eucalyptus loxophleba, No Hollows
- Eucalyptus rudis, No Hollows
- Eucalyptus rudis, Hollows
- Eucalyptus wandoo, No Hollows
- Stag, No Hollows
- Stag, Hollows

Carnaby's Black Cockatoo Foraging Habitat Quality

- Poor (0 - 3)
- Moderate (4 - 5)
- Good (6 - 8)
- Excellent (9 - 10)



Data sources:

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Toodyay Biological Assessment

Carnaby's Black-Cockatoo Habitat Assessment

PROJECT ID	60344161
CREATED BY	DGF
LAST MODIFIED	fotheringhamd - 20 Oct 2016
VERSION:	2

Figure 9B

A3 size

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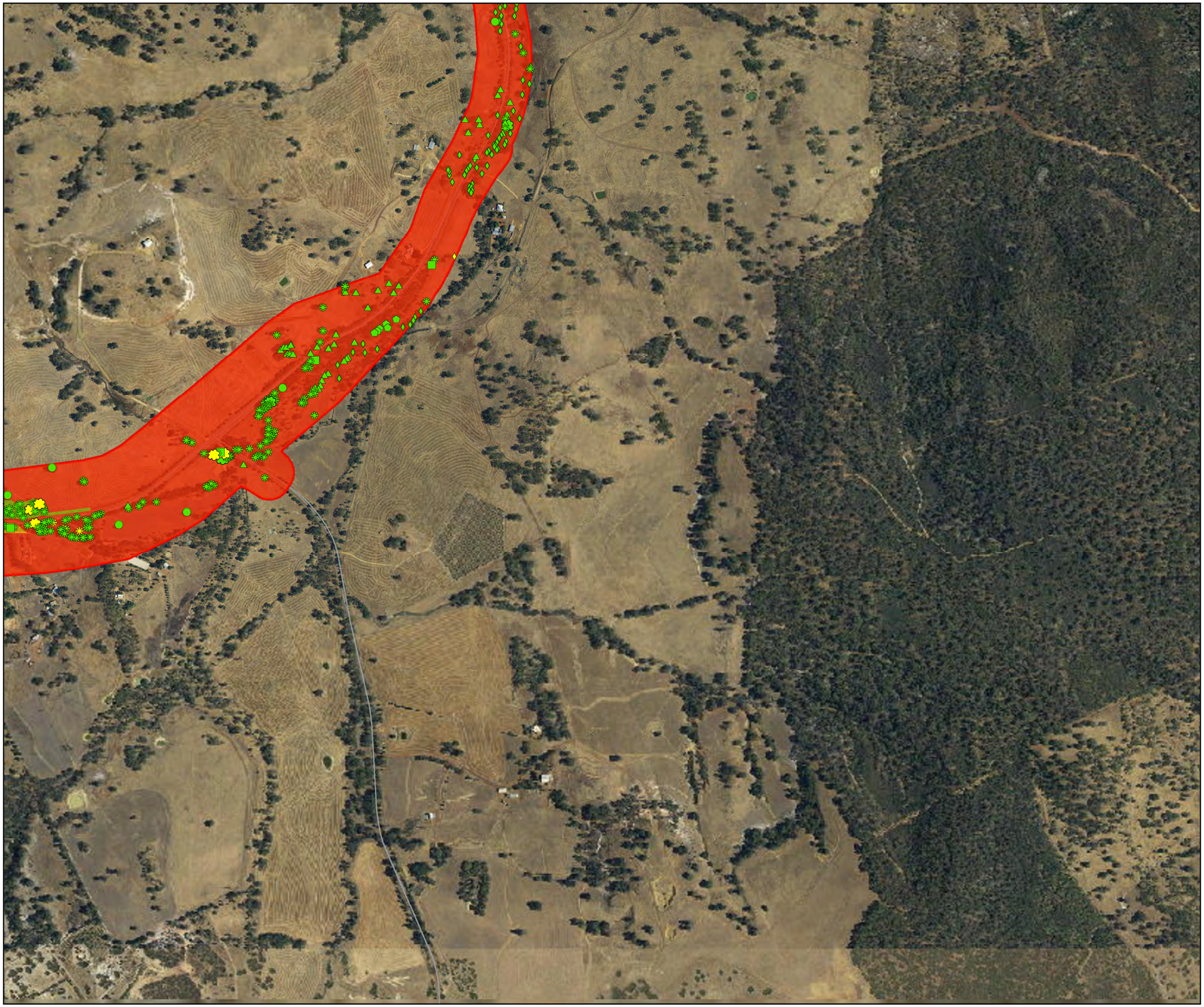

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0 125 250 500
Metres

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LEGEND

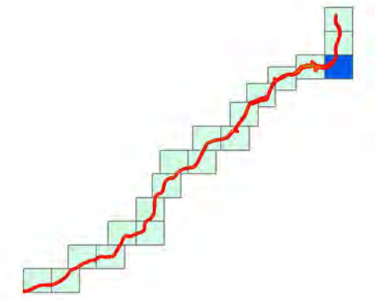
- Study Area

Toodyay Trees

- Corymbia calophylla, No Hollows
- Eucalyptus accedens, No Hollows
- Eucalyptus loxophleba, No Hollows
- Eucalyptus marginata, No Hollows
- Eucalyptus rudis, No Hollows
- Eucalyptus rudis, Hollows
- Eucalyptus wandoo, No Hollows
- Eucalyptus wandoo, Hollows
- Stag, No Hollows
- Stag, Hollows

Carnaby's Black Cockatoo Foraging Habitat Quality

- Poor (0 - 3)
- Moderate (4 - 5)
- Good (6 - 8)
- Excellent (9 - 10)



Data sources:

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Toodyay Biological Assessment

Carnaby's Black-Cockatoo Habitat Assessment

PROJECT ID	60344161
CREATED BY	DGF
LAST MODIFIED	fotheringhamd - 20 Oct 2016
VERSION:	2

Figure
9C

A3 size

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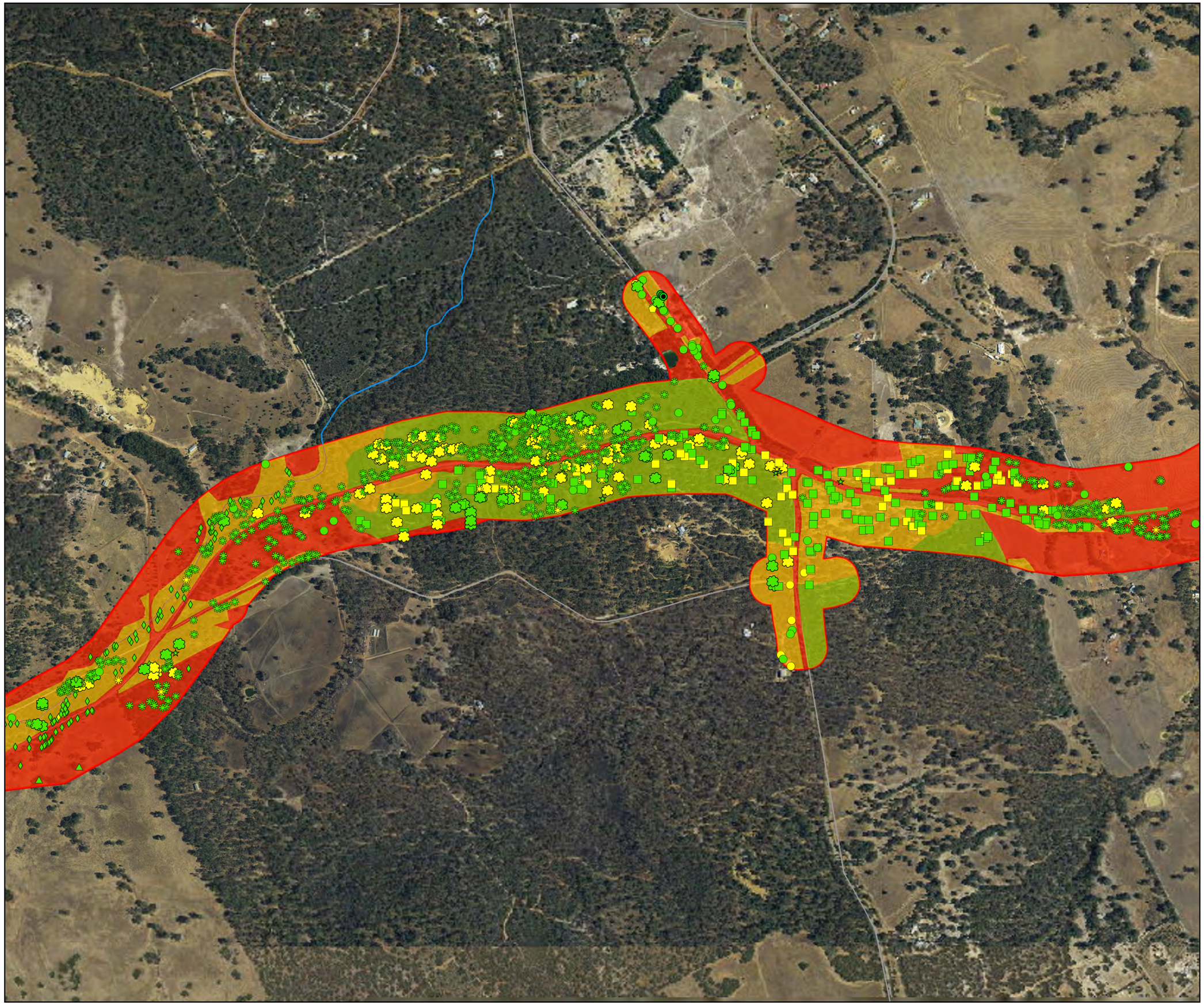

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GDA 1994 MGA Zone 50

0 125 250 500

Metres

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LEGEND

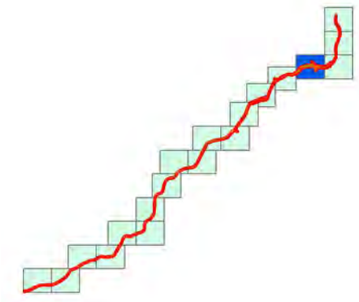
- Study Area

Toodyay Trees

- Corymbia calophylla, No Hollows
- Corymbia calophylla, Hollows
- Eucalyptus accedens, No Hollows
- Eucalyptus accedens, Hollows
- Eucalyptus loxophleba, No Hollows
- Eucalyptus marginata, No Hollows
- Eucalyptus marginata, Hollows
- Eucalyptus patens, No Hollows
- Eucalyptus patens, Hollows
- Eucalyptus rudis, No Hollows
- Eucalyptus rudis, Hollows
- Eucalyptus wandoo, No Hollows
- Eucalyptus wandoo, Hollows
- Planted Tree, No
- Stag, No Hollows
- Stag, Hollows

Carnaby's Black Cockatoo Foraging Habitat Quality

- Poor (0 - 3)
- Moderate (4 - 5)
- Good (6 - 8)
- Excellent (9 - 10)



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Toodyay Biological Assessment

Carnaby's Black-Cockatoo Habitat Assessment

PROJECT ID	60344161
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LAST MODIFIED	fotheringhamd - 20 Oct 2016
VERSION:	2

Figure 9D

A3 size

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Metres

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LEGEND

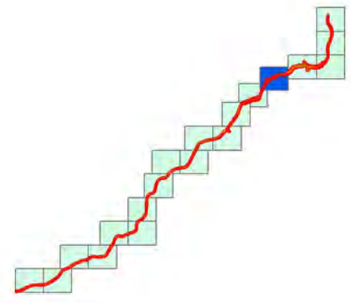
Study Area

Toodyay Trees

- Corymbia calophylla, No Hollows
- Corymbia calophylla, Hollows
- Eucalyptus accedens, No Hollows
- Eucalyptus loxophleba, No Hollows
- Eucalyptus loxophleba, Hollows
- Eucalyptus rudis, No Hollows
- Eucalyptus rudis, Hollows
- Eucalyptus wandoo, No Hollows
- Eucalyptus wandoo, Hollows
- Stag, No Hollows
- Stag, Hollows

Carnaby's Black Cockatoo Foraging Habitat Quality

- Poor (0 - 3)
- Moderate (4 - 5)
- Good (6 - 8)
- Excellent (9 - 10)



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Toodyay Biological Assessment

Carnaby's Black-Cockatoo Habitat Assessment

PROJECT ID	60344161
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Figure 9E

A3 size

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0 125 250 500
Metres

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LEGEND

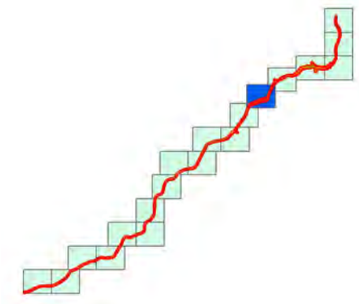
- Study Area

Toodyay Trees

- Corymbia calophylla, No Hollows
- Corymbia calophylla, Hollows
- Eucalyptus accedens, No Hollows
- Eucalyptus accedens, Hollows
- Eucalyptus loxophleba, No Hollows
- Eucalyptus loxophleba, Hollows
- Eucalyptus marginata, No Hollows
- Eucalyptus marginata, Hollows
- Eucalyptus rudis, No Hollows
- Eucalyptus rudis, Hollows
- Eucalyptus wandoo, No Hollows
- Eucalyptus wandoo, Hollows
- Stag, No Hollows
- Stag, Hollows

Carnaby's Black Cockatoo Foraging Habitat Quality

- Poor (0 - 3)
- Moderate (4 - 5)
- Good (6 - 8)
- Excellent (9 - 10)



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Carnaby's Black-Cockatoo Habitat Assessment

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Figure 9F

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Metres

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LEGEND

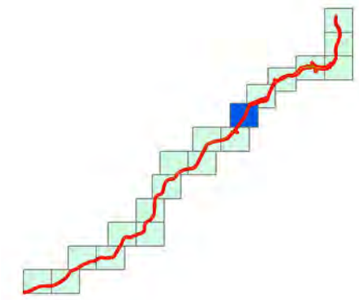
Study Area

Toodyay Trees

- Corymbia calophylla, No Hollows
- Corymbia calophylla, Hollows
- Eucalyptus accedens, No Hollows
- Eucalyptus accedens, Hollows
- Eucalyptus loxophleba, Hollows
- Eucalyptus marginata, No Hollows
- Eucalyptus marginata, Hollows
- Eucalyptus patens, No Hollows
- Eucalyptus rudis, No Hollows
- Eucalyptus rudis, Hollows
- Eucalyptus wandoo, No Hollows
- Eucalyptus wandoo, Hollows
- Stag, No Hollows
- Stag, Hollows

Carnaby's Black Cockatoo Foraging Habitat Quality

- Poor (0 - 3)
- Moderate (4 - 5)
- Good (6 - 8)
- Excellent (9 - 10)



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Carnaby's Black-Cockatoo Habitat Assessment

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Figure 9G

A3 size

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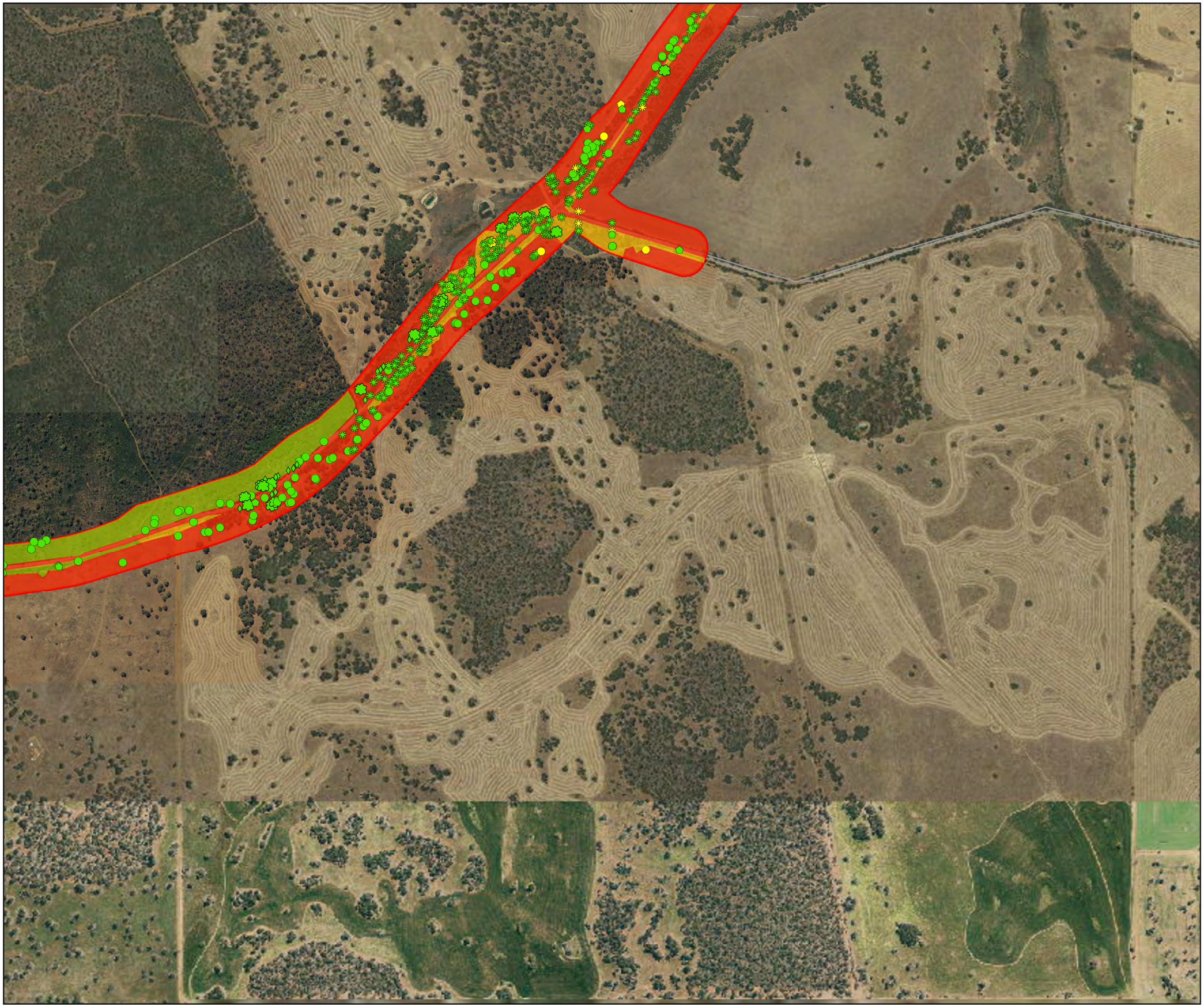

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LEGEND

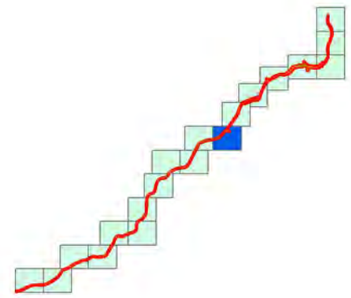
Study Area

Toodyay Trees

- Corymbia calophylla, No Hollows
- Corymbia calophylla, Hollows
- Eucalyptus marginata, No Hollows
- Eucalyptus marginata, Hollows
- Eucalyptus rudis, No Hollows
- Eucalyptus rudis, Hollows
- Eucalyptus wandoo, No Hollows
- Eucalyptus wandoo, Hollows
- Stag, No Hollows
- Stag, Hollows

Carnaby's Black Cockatoo Foraging Habitat Quality

- Poor (0 - 3)
- Moderate (4 - 5)
- Good (6 - 8)
- Excellent (9 - 10)



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Toodyay Biological Assessment

Carnaby's Black-Cockatoo Habitat Assessment

PROJECT ID	60344161
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Figure
9H

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Metres

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LEGEND

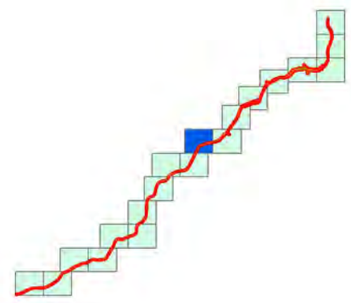
Study Area

Toodyay Trees

- Corymbia calophylla, No Hollows
- Corymbia calophylla, Hollows
- Eucalyptus accedens, No Hollows
- Eucalyptus marginata, No Hollows
- Eucalyptus rudis, No Hollows
- Eucalyptus wandoo, No Hollows
- Stag, No Hollows
- Stag, Hollows

Carnaby's Black Cockatoo Foraging Habitat Quality

- Poor (0 - 3)
- Moderate (4 - 5)
- Good (6 - 8)
- Excellent (9 - 10)



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Toodyay Biological Assessment

Carnaby's Black-Cockatoo Habitat Assessment

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Figure 9I

A3 size

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Metres

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LEGEND

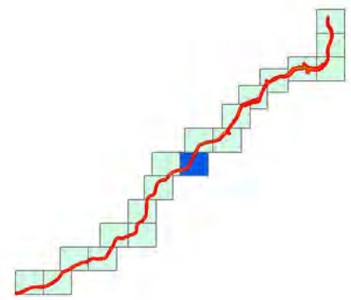
Study Area

Toodyay Trees

- Corymbia calophylla, No Hollows
- Corymbia calophylla, Hollows
- Eucalyptus marginata, No Hollows
- Eucalyptus rudis, Hollows
- Eucalyptus wandoo, No Hollows
- Stag, No Hollows

Carnaby's Black Cockatoo Foraging Habitat Quality

- Poor (0 - 3)
- Moderate (4 - 5)
- Good (6 - 8)
- Excellent (9 - 10)



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Toodyay Biological Assessment

Carnaby's Black-Cockatoo Habitat Assessment

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Figure 9J

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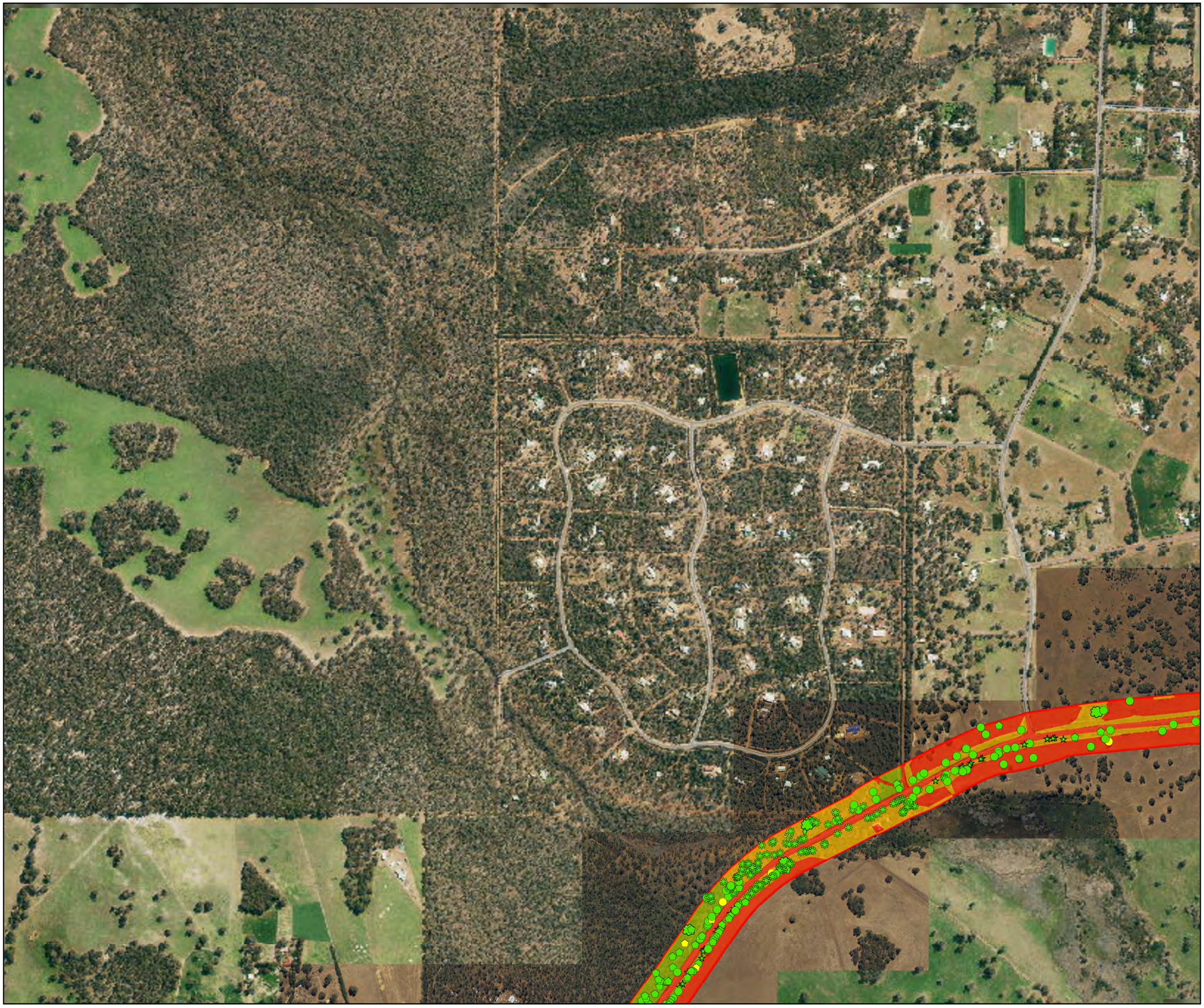

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N

GDA 1994 MGA Zone 50

0 125 250 500

Metres

1:10,000 (when printed at A3)

LEGEND

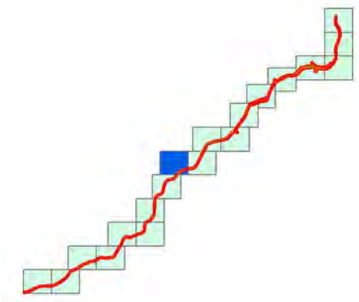
Study Area

Toodyay Trees

- Corymbia calophylla, No Hollows
- Corymbia calophylla, Hollows
- Eucalyptus marginata, No Hollows
- Eucalyptus marginata, Hollows
- Eucalyptus patens, No Hollows
- Eucalyptus rudis, No Hollows
- Eucalyptus wandoo, No Hollows
- Eucalyptus wandoo, Hollows
- Stag, No Hollows

Carnaby's Black Cockatoo Foraging Habitat Quality

- Poor (0 - 3)
- Moderate (4 - 5)
- Good (6 - 8)
- Excellent (9 - 10)



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Toodyay Biological Assessment

Carnaby's Black-Cockatoo Habitat Assessment

PROJECT ID	60344161
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VERSION:	2

Figure 9K

A3 size

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GDA 1994 MGA Zone 50

0 125 250 500

Metres

1:10,000 (when printed at A3)

LEGEND

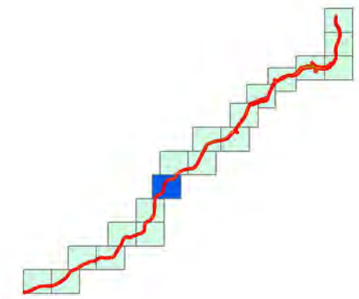
Study Area

Toodyay Trees

- Corymbia calophylla, No Hollows
- Corymbia calophylla, Hollows
- Eucalyptus marginata, No Hollows
- Eucalyptus marginata, Hollows
- Eucalyptus patens, No Hollows
- Eucalyptus patens, Hollows
- Eucalyptus rudis, No Hollows
- Eucalyptus rudis, Hollows
- Eucalyptus wandoo, No Hollows
- Stag, No Hollows
- Stag, Hollows

Carnaby's Black Cockatoo Foraging Habitat Quality

- Poor (0 - 3)
- Moderate (4 - 5)
- Good (6 - 8)
- Excellent (9 - 10)



Data sources:

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Toodyay Biological Assessment

Carnaby's Black-Cockatoo Habitat Assessment

PROJECT ID	60344161
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VERSION:	2

Figure 9L

A3 size

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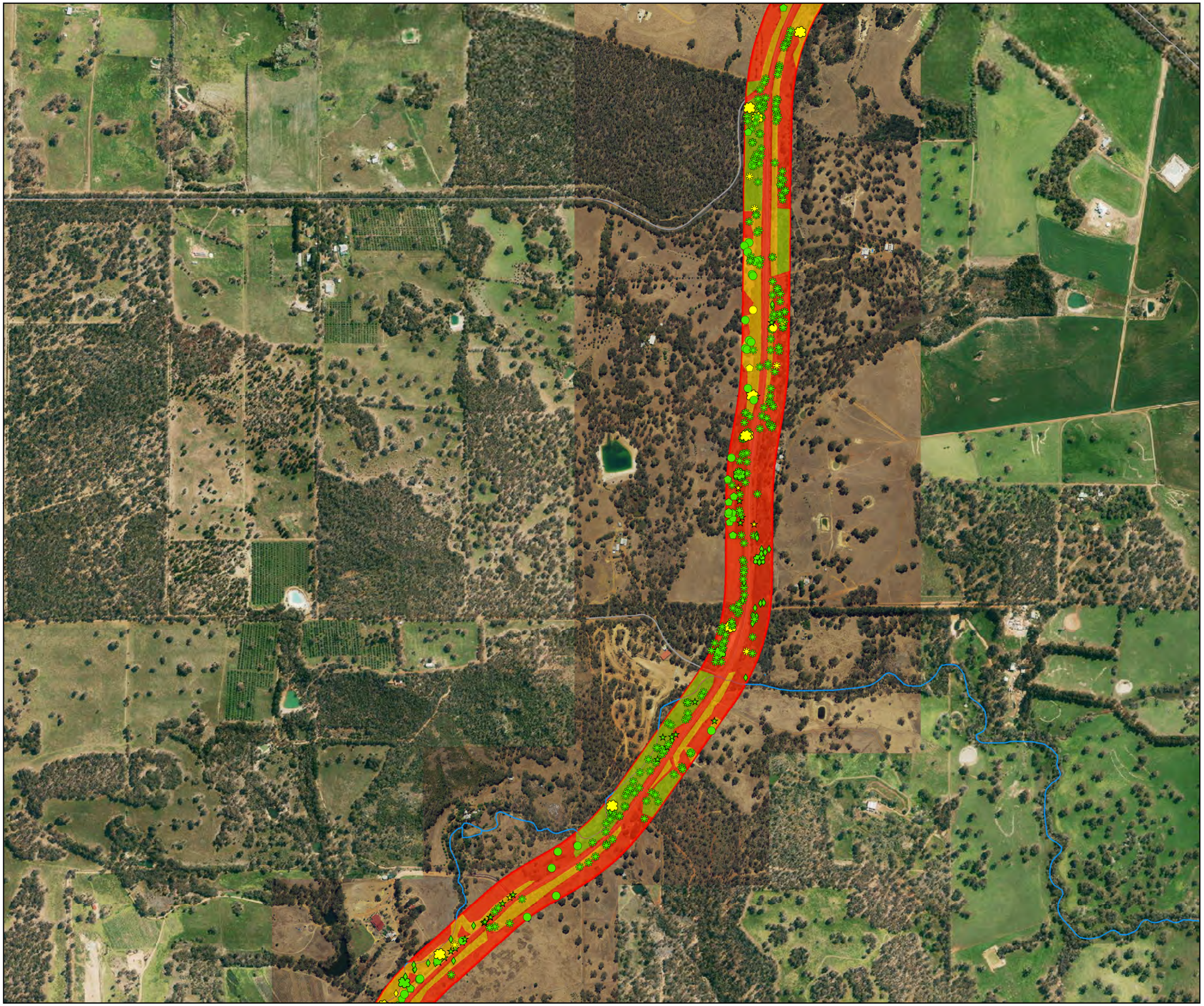

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GDA 1994 MGA Zone 50

0 125 250 500
Metres

1:10,000 (when printed at A3)

LEGEND

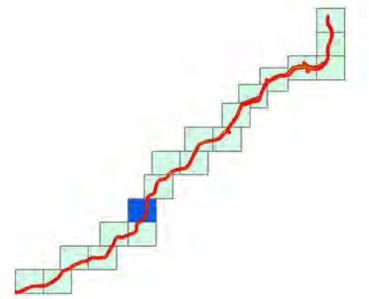
- Study Area

Toodyay Trees

- Corymbia calophylla, No Hollows
- Corymbia calophylla, Hollows
- Eucalyptus marginata, No Hollows
- Eucalyptus marginata, Hollows
- Eucalyptus patens, No Hollows
- Eucalyptus patens, Hollows
- Eucalyptus rudis, No Hollows
- Eucalyptus rudis, Hollows
- Eucalyptus wandoo, No Hollows
- Eucalyptus wandoo, Hollows
- Stag, No Hollows
- Stag, Hollows

Carnaby's Black Cockatoo Foraging Habitat Quality

- Poor (0 - 3)
- Moderate (4 - 5)
- Good (6 - 8)
- Excellent (9 - 10)



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Toodyay Biological Assessment

Carnaby's Black-Cockatoo Habitat Assessment

PROJECT ID	60344161
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VERSION:	2

Figure 9M

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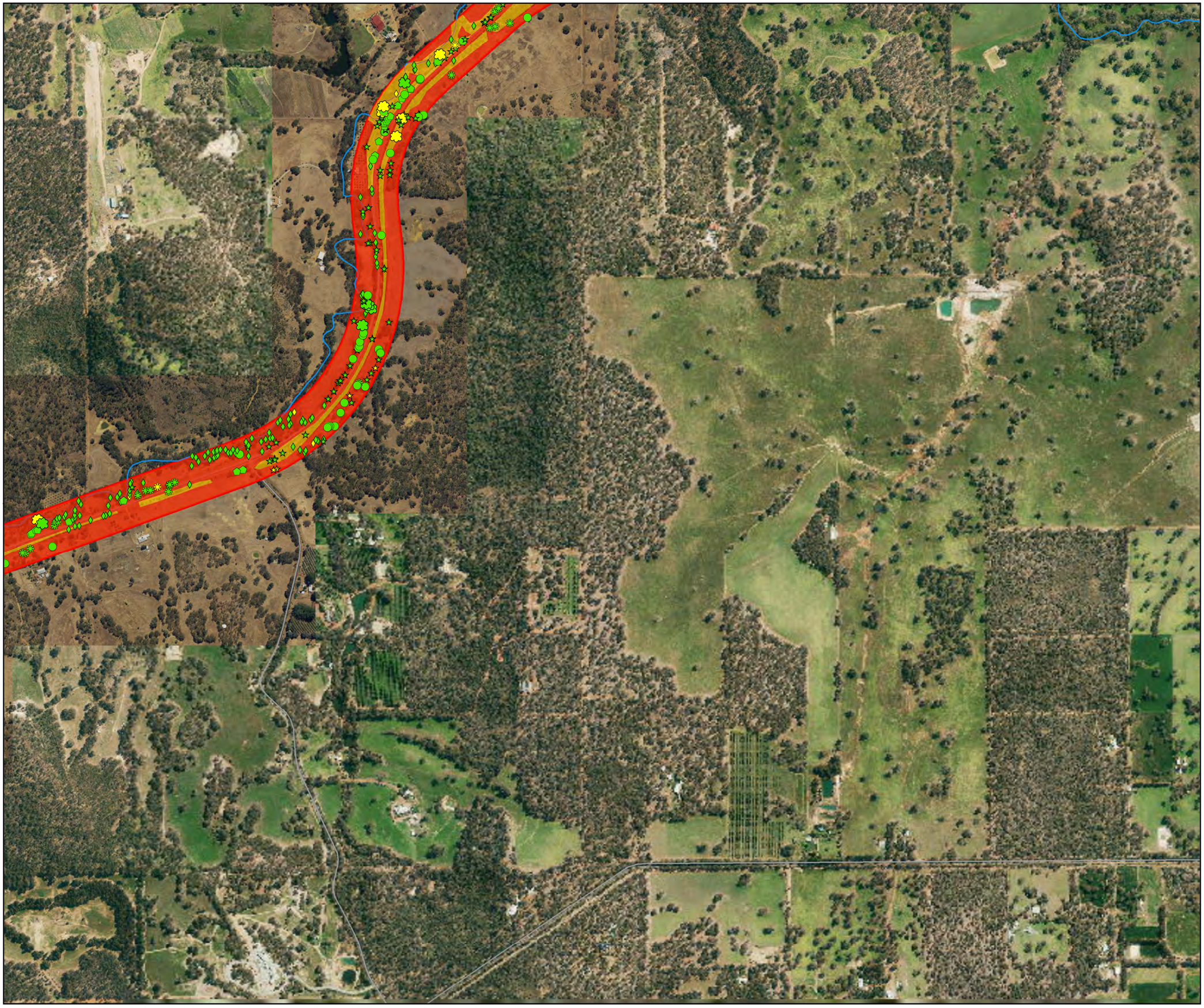
A3 size



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GDA 1994 MGA Zone 50

0 125 250 500

Metres

1:10,000 (when printed at A3)

LEGEND

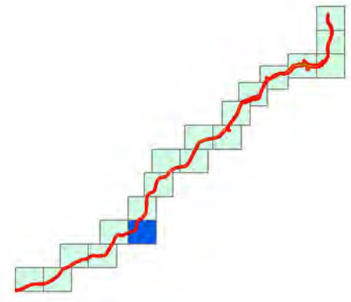
Study Area

Toodyay Trees

- Corymbia calophylla, No Hollows
- Eucalyptus marginata, No Hollows
- Eucalyptus patens, No Hollows
- Eucalyptus patens, Hollows
- Eucalyptus rudis, No Hollows
- Eucalyptus rudis, Hollows
- Eucalyptus wandoo, No Hollows
- Eucalyptus wandoo, Hollows
- Stag, No Hollows
- Stag, Hollows

Carnaby's Black Cockatoo Foraging Habitat Quality

- Poor (0 - 3)
- Moderate (4 - 5)
- Good (6 - 8)
- Excellent (9 - 10)



Data sources:

Base Data: © Western Australia Land Information Authority (Landgate) (2016)
NearMap Imagery 2016

Toodyay Biological Assessment

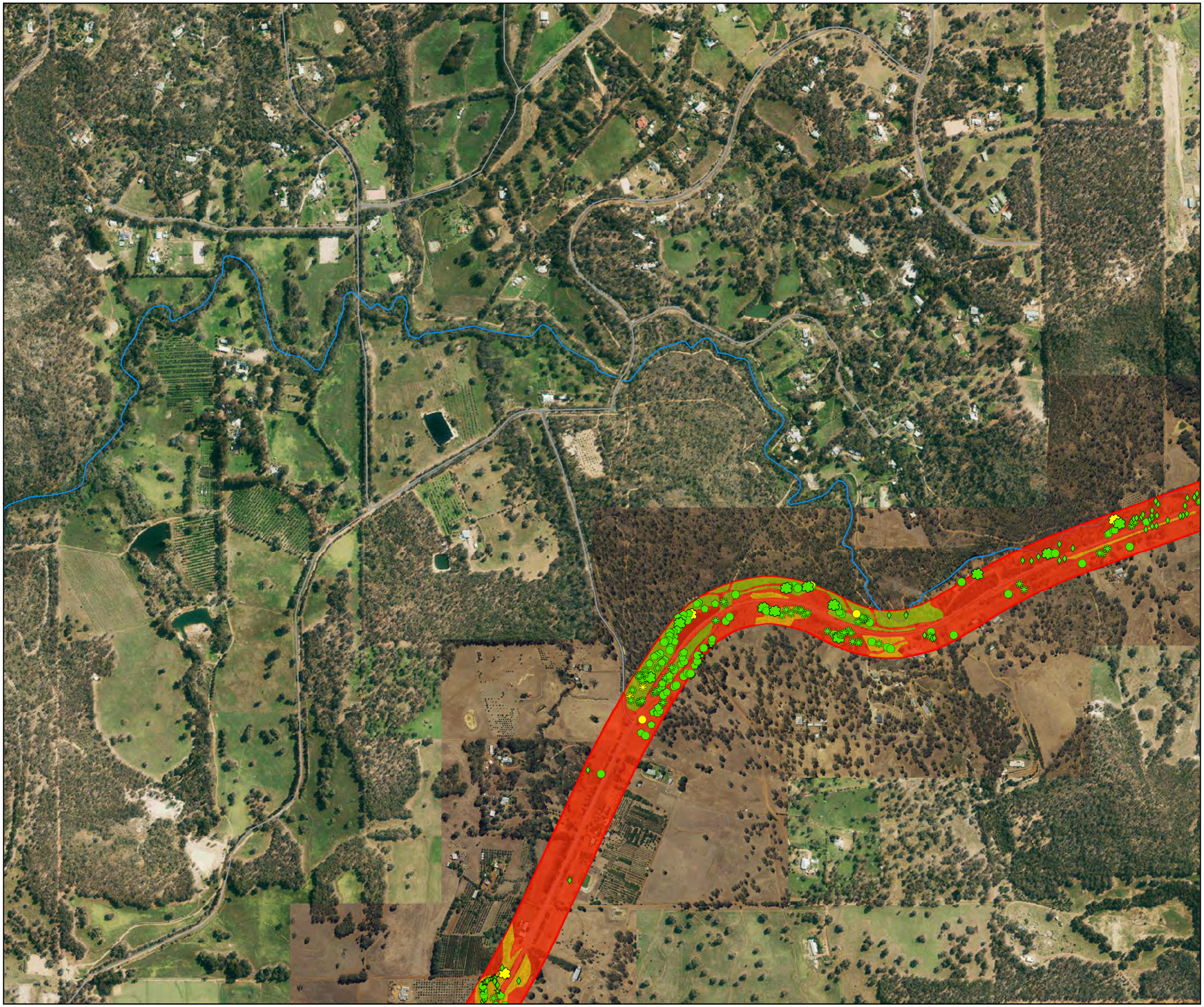
Carnaby's Black-Cockatoo Habitat Assessment

PROJECT ID	60344161
CREATED BY	DGF
LAST MODIFIED	fotheringhamd - 20 Oct 2016
VERSION:	2

Figure **9N**

A3 size

Filename: \\AUPER1FP001.AU.AECOMNET.COM\Projects\605X\605155\84. Tech Work Area\4.99 GIS\02_MXDs\Figures\G60344161_Figure9_CarnabysBlackCockatooHabitatAssessment_v02_20161019_A3.mxd



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Metres

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LEGEND

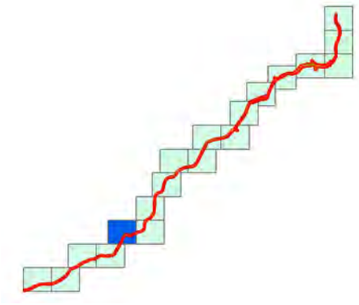
- Study Area

Toodyay Trees

- Corymbia calophylla, No Hollows
- Corymbia calophylla, Hollows
- Eucalyptus marginata, No Hollows
- Eucalyptus marginata, Hollows
- Eucalyptus patens, No Hollows
- Eucalyptus rudis, No Hollows
- Eucalyptus wandoo, No Hollows
- Eucalyptus wandoo, Hollows
- Stag, No Hollows
- Stag, Hollows

Carnaby's Black Cockatoo Foraging Habitat Quality

- Poor (0 - 3)
- Moderate (4 - 5)
- Good (6 - 8)
- Excellent (9 - 10)



Data sources:

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Toodyay Biological Assessment

Carnaby's Black-Cockatoo Habitat Assessment

PROJECT ID	60344161
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VERSION:	2

Figure 9O

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A3 size

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GDA 1994 MGA Zone 50

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Metres

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LEGEND

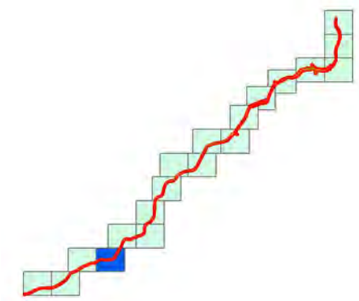
Study Area

Toodyay Trees

- Corymbia calophylla, No Hollows
- Corymbia calophylla, Hollows
- Eucalyptus marginata, No Hollows
- Eucalyptus patens, No Hollows
- Eucalyptus rudis, No Hollows
- Eucalyptus rudis, Hollows
- Eucalyptus wandoo, No Hollows
- Stag, No Hollows
- Stag, Hollows

Carnaby's Black Cockatoo Foraging Habitat Quality

- Poor (0 - 3)
- Moderate (4 - 5)
- Good (6 - 8)
- Excellent (9 - 10)



Data sources:

Base Data: © Western Australia Land Information Authority (Landgate) (2016)
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Toodyay Biological Assessment

Carnaby's Black-Cockatoo Habitat Assessment

PROJECT ID	60344161
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VERSION:	2

Figure 9P

A3 size

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GDA 1994 MGA Zone 50

0 125 250 500

Metres

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LEGEND

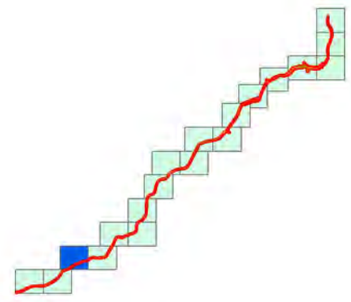
Study Area

Toodyay Trees

- Corymbia calophylla, No Hollows
- Corymbia calophylla, Hollows
- Eucalyptus marginata, No Hollows
- Eucalyptus marginata, Hollows
- Eucalyptus patens, No Hollows
- Eucalyptus rudis, No Hollows
- Eucalyptus wandoo, No Hollows
- Stag, No Hollows
- Stag, Hollows

Carnaby's Black Cockatoo Foraging Habitat Quality

- Poor (0 - 3)
- Moderate (4 - 5)
- Good (6 - 8)
- Excellent (9 - 10)



Data sources:

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Toodyay Biological Assessment

Carnaby's Black-Cockatoo Habitat Assessment

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A3 size

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Metres

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LEGEND

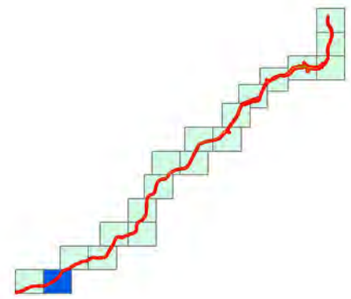
Study Area

Toodyay Trees

- Corymbia calophylla, No Hollows
- Corymbia calophylla, Hollows
- Eucalyptus marginata, No Hollows
- Eucalyptus marginata, Hollows
- Eucalyptus patens, No Hollows
- Eucalyptus rudis, No Hollows
- Eucalyptus wandoo, No Hollows
- Stag, No Hollows

Carnaby's Black Cockatoo Foraging Habitat Quality

- Poor (0 - 3)
- Moderate (4 - 5)
- Good (6 - 8)
- Excellent (9 - 10)



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Toodyay Biological Assessment

Carnaby's Black-Cockatoo Habitat Assessment

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Figure 9R

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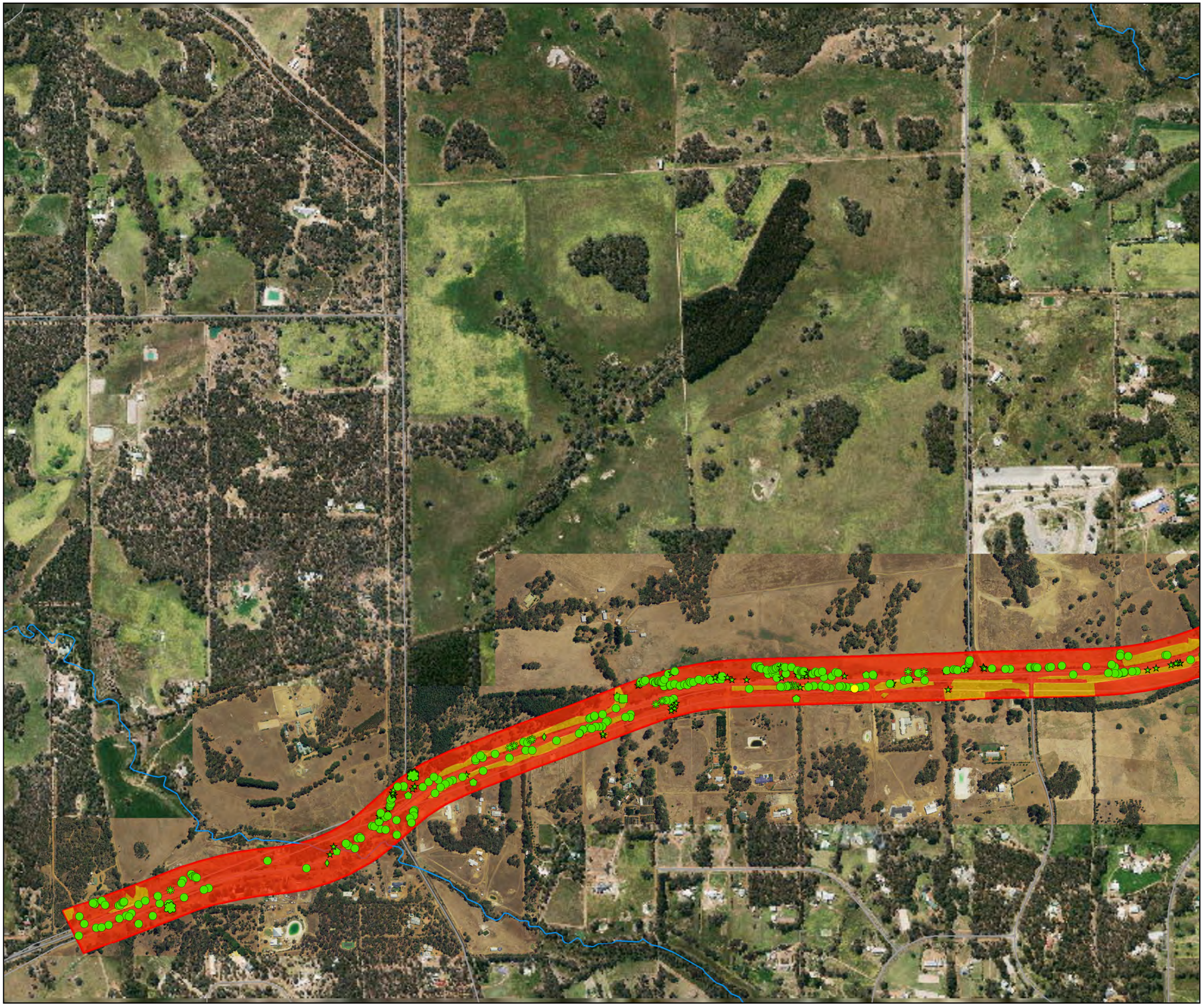

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LEGEND

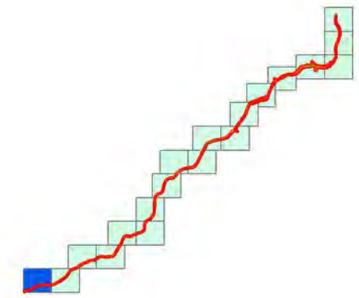
- Study Area

Toodyay Trees

- Corymbia calophylla, No Hollows
- Corymbia calophylla, Hollows
- Eucalyptus accedens, No Hollows
- Eucalyptus marginata, No Hollows
- Eucalyptus patens, No Hollows
- Eucalyptus rudis, No Hollows
- Eucalyptus wandoo, No Hollows
- Stag, No Hollows

Carnaby's Black Cockatoo Foraging Habitat Quality

- Poor (0 - 3)
- Moderate (4 - 5)
- Good (6 - 8)
- Excellent (9 - 10)



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Carnaby's Black-Cockatoo Habitat Assessment

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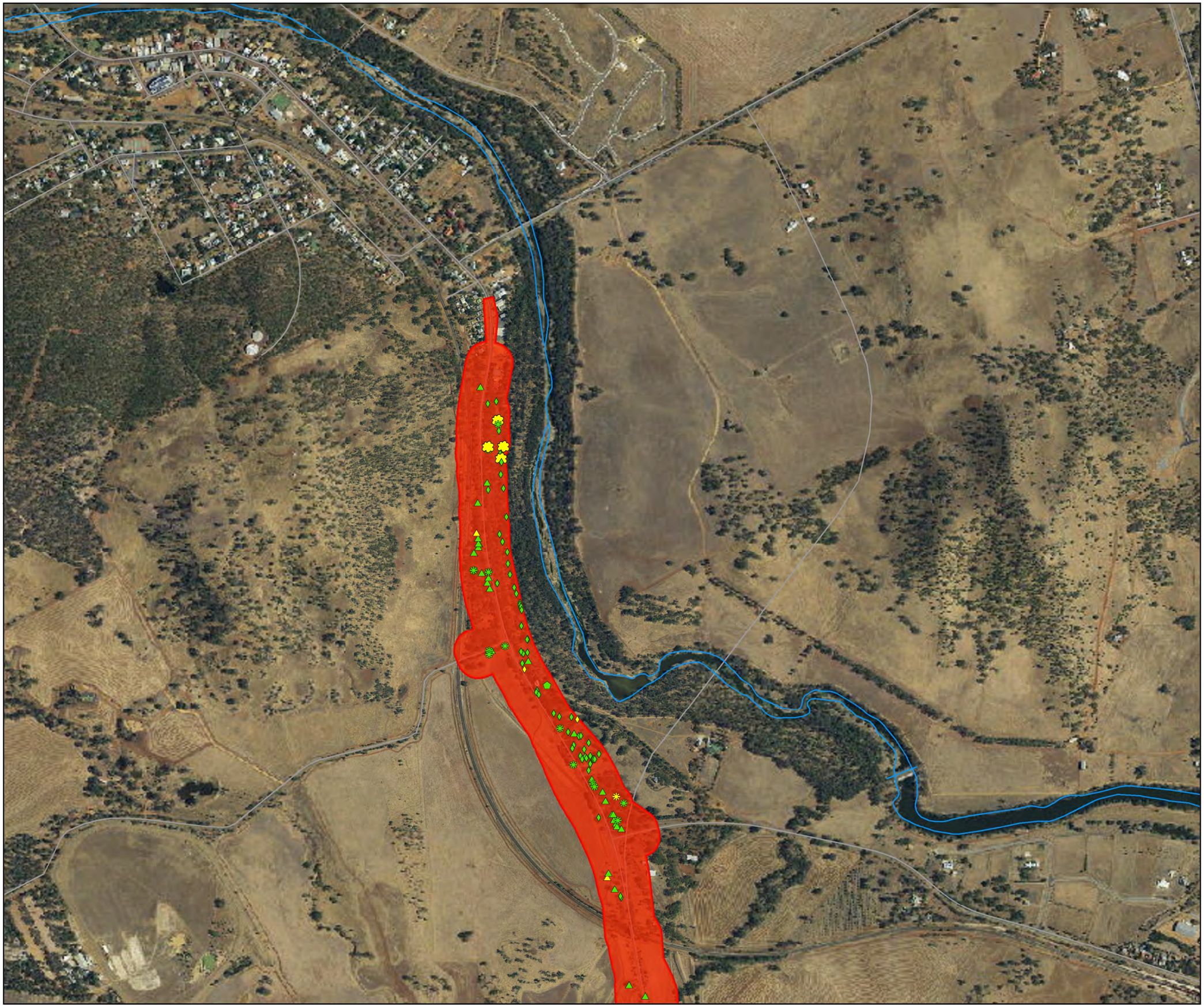

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LEGEND

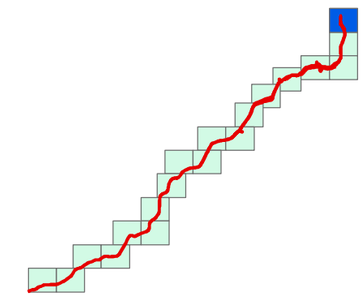
Study Area

Toodyay Trees

- Eucalyptus loxophleba, No Hollows
- Eucalyptus loxophleba, Hollows
- Eucalyptus marginata, No Hollows
- Eucalyptus rudis, No Hollows
- Eucalyptus rudis, Hollows
- Eucalyptus wandoo, No Hollows
- Eucalyptus wandoo, Hollows
- Stag, Hollows

Forest Red-tail Black Cockatoo Foraging Habitat Quality

- Poor (0 - 3)
- Moderate (4 - 5)
- Good (6 - 8)
- Excellent (9 - 10)



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Toodyay Biological Assessment

Forest Red-tail Black Cockatoo Habitat Assessment

PROJECT ID	60344161
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VERSION:	2

Figure
10A

A3 size

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LEGEND

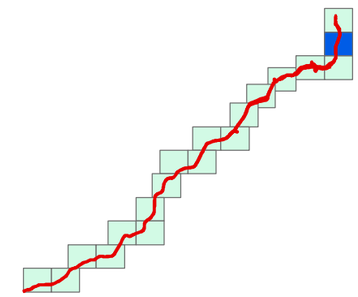
Study Area

Toodyay Trees

- Corymbia calophylla, No Hollows
- Eucalyptus loxophleba, No Hollows
- Eucalyptus rudis, No Hollows
- Eucalyptus rudis, Hollows
- Eucalyptus wandoo, No Hollows
- Stag, No Hollows
- Stag, Hollows

Forest Red-tail Black Cockatoo Foraging Habitat Quality

- Poor (0 - 3)
- Moderate (4 - 5)
- Good (6 - 8)
- Excellent (9 - 10)



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Toodyay Biological Assessment

Forest Red-tail Black Cockatoo Habitat Assessment

PROJECT ID	60344161
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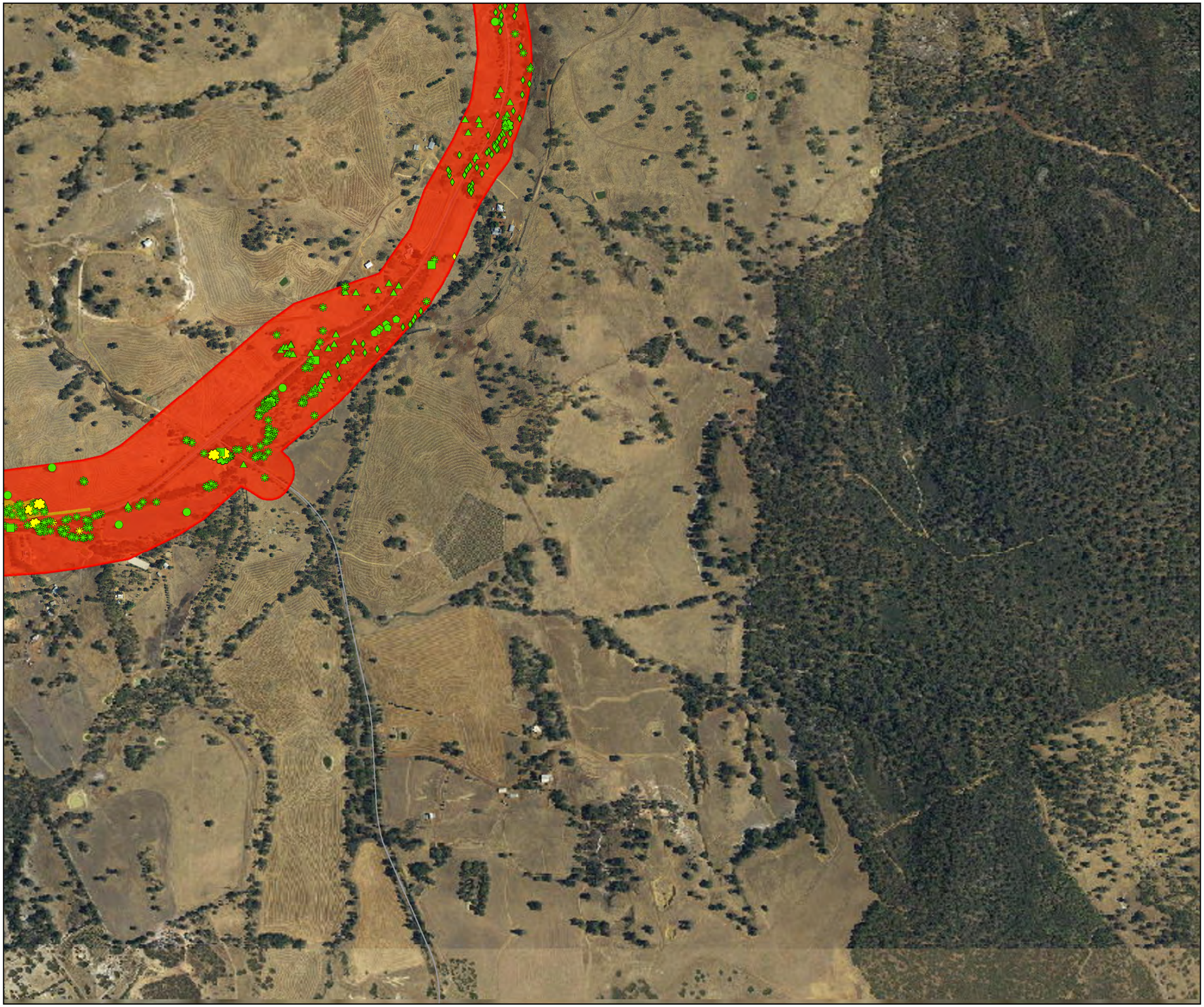
VERSION:	2

Figure

10B

A3 size

Filename: \\AUPER1FP001.AU.AECOMNET.COM\Projects\605X\605155881\4. Tech Work Area\4.99 GIS\02_MXDs\Figures\G60344161_Figure10_RedTailBlackCockatooHabitatAssessment_v01_20161020_A3.mxd



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Metres

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LEGEND

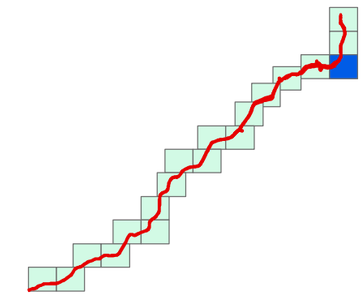
- Study Area

Toodyay Trees

- Corymbia calophylla, No Hollows
- Eucalyptus accedens, No Hollows
- Eucalyptus loxophleba, No Hollows
- Eucalyptus marginata, No Hollows
- Eucalyptus rudis, No Hollows
- Eucalyptus rudis, Hollows
- Eucalyptus wandoo, No Hollows
- Eucalyptus wandoo, Hollows
- Stag, No Hollows
- Stag, Hollows

Forest Red-tail Black Cockatoo Foraging Habitat Quality

- Poor (0 - 3)
- Moderate (4 - 5)
- Good (6 - 8)
- Excellent (9 - 10)



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Toodyay Biological Assessment

Forest Red-tail Black Cockatoo Habitat Assessment

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Figure
10C

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A3 size

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0 125 250 500

Metres

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LEGEND

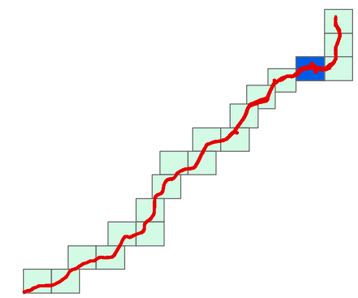
Study Area

Toodyay Trees

- Corymbia calophylla, No Hollows
- Corymbia calophylla, Hollows
- Eucalyptus accedens, No Hollows
- Eucalyptus accedens, Hollows
- Eucalyptus loxophleba, No Hollows
- Eucalyptus marginata, No Hollows
- Eucalyptus marginata, Hollows
- Eucalyptus patens, No Hollows
- Eucalyptus patens, Hollows
- Eucalyptus rudis, No Hollows
- Eucalyptus rudis, Hollows
- Eucalyptus wandoo, No Hollows
- Eucalyptus wandoo, Hollows
- Planted Tree, No
- Stag, No Hollows
- Stag, Hollows

Forest Red-tail Black Cockatoo Foraging Habitat Quality

- Poor (0 - 3)
- Moderate (4 - 5)
- Good (6 - 8)
- Excellent (9 - 10)



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Toodyay Biological Assessment

Forest Red-tail Black Cockatoo Habitat Assessment

PROJECT ID	60344161
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Figure

10D

A3 size

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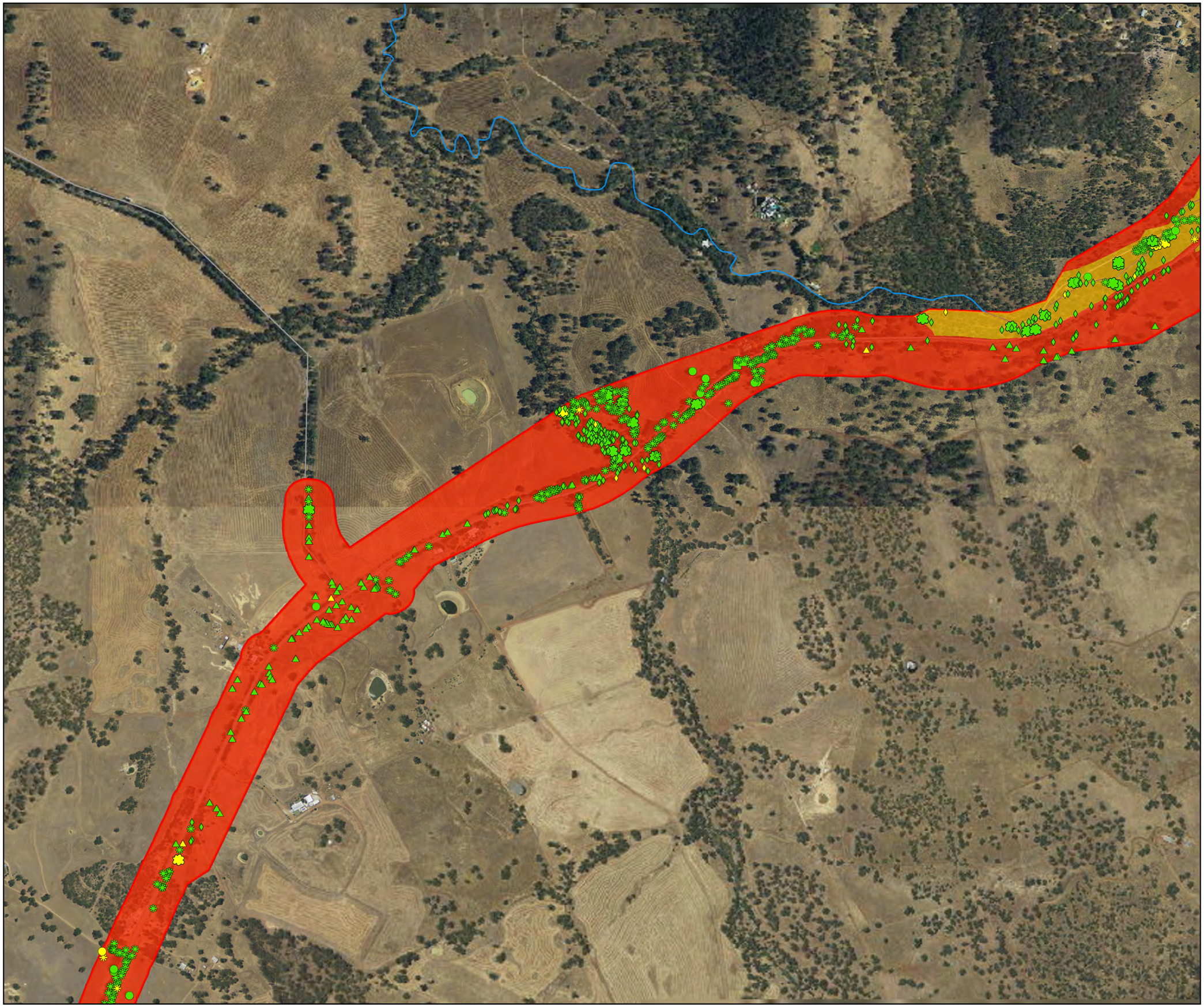

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0 125 250 500

Metres

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LEGEND

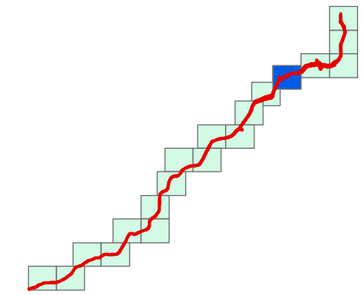
- Study Area

Toodyay Trees

- Corymbia calophylla, No Hollows
- Corymbia calophylla, Hollows
- Eucalyptus accedens, No Hollows
- Eucalyptus loxophleba, No Hollows
- Eucalyptus loxophleba, Hollows
- Eucalyptus rudis, No Hollows
- Eucalyptus rudis, Hollows
- Eucalyptus wandoo, No Hollows
- Eucalyptus wandoo, Hollows
- Stag, No Hollows
- Stag, Hollows

Forest Red-tail Black Cockatoo Foraging Habitat Quality

- Poor (0 - 3)
- Moderate (4 - 5)
- Good (6 - 8)
- Excellent (9 - 10)



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Toodyay Biological Assessment

Forest Red-tail Black Cockatoo Habitat Assessment

PROJECT ID	60344161
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Figure

10E

A3 size

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GDA 1994 MGA Zone 50

0 125 250 500

Metres

1:10,000 (when printed at A3)

LEGEND

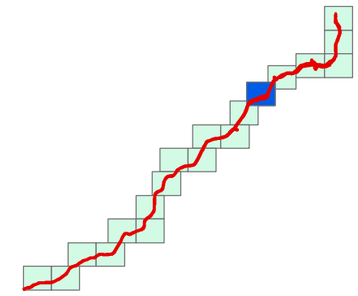
Study Area

Toodyay Trees

- Corymbia calophylla, No Hollows
- Corymbia calophylla, Hollows
- Eucalyptus accedens, No Hollows
- Eucalyptus accedens, Hollows
- Eucalyptus loxophleba, No Hollows
- Eucalyptus loxophleba, Hollows
- Eucalyptus marginata, No Hollows
- Eucalyptus marginata, Hollows
- Eucalyptus rudis, No Hollows
- Eucalyptus rudis, Hollows
- Eucalyptus wandoo, No Hollows
- Eucalyptus wandoo, Hollows
- Stag, No Hollows
- Stag, Hollows

Forest Red-tail Black Cockatoo Foraging Habitat Quality

- Poor (0 - 3)
- Moderate (4 - 5)
- Good (6 - 8)
- Excellent (9 - 10)



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Toodyay Biological Assessment

Forest Red-tail Black Cockatoo Habitat Assessment

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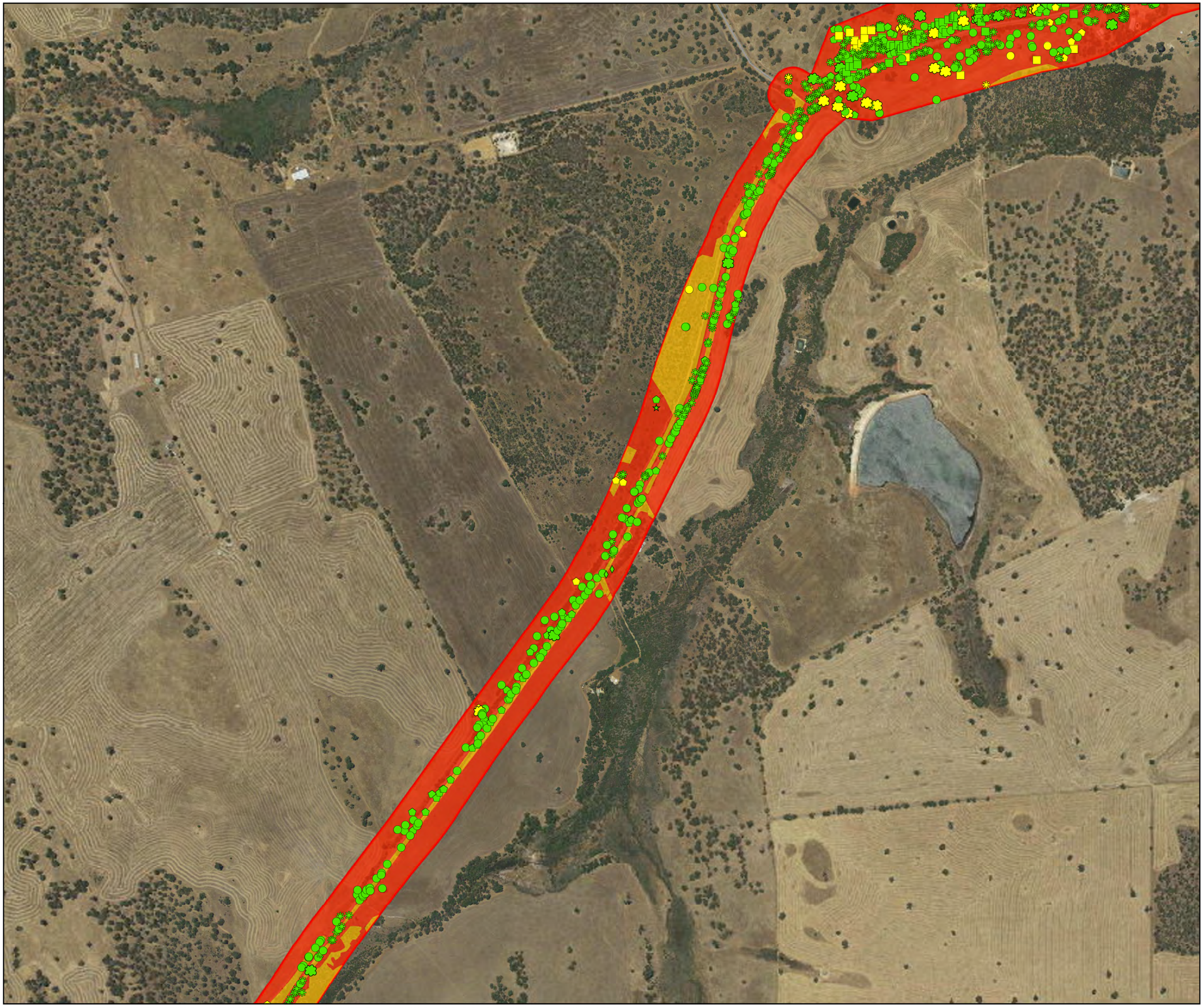
Figure

10F

A3 size

Filename: \\AUPER1FP001.AU.AECOMNET.COM\Projects\605X\605155\84. Tech Work Area\4.99 GIS\02_MXDs\Figures\G60344161_Figure10_RedTailBlackCockatooHabitatAssessment_v01_20161020_A3.mxd



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GDA 1994 MGA Zone 50

0 125 250 500

Metres

1:10,000 (when printed at A3)

LEGEND

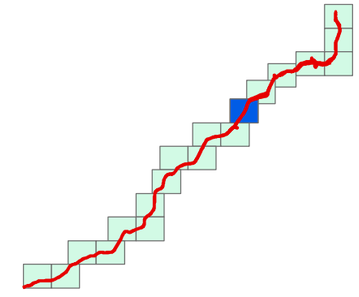
Study Area

Toodyay Trees

- Corymbia calophylla, No Hollows
- Corymbia calophylla, Hollows
- Eucalyptus accedens, No Hollows
- Eucalyptus accedens, Hollows
- Eucalyptus loxophleba, Hollows
- Eucalyptus marginata, No Hollows
- Eucalyptus marginata, Hollows
- Eucalyptus patens, No Hollows
- Eucalyptus rudis, No Hollows
- Eucalyptus rudis, Hollows
- Eucalyptus wandoo, No Hollows
- Eucalyptus wandoo, Hollows
- Stag, No Hollows
- Stag, Hollows

Forest Red-tail Black Cockatoo Foraging Habitat Quality

- Poor (0 - 3)
- Moderate (4 - 5)
- Good (6 - 8)
- Excellent (9 - 10)



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Forest Red-tail Black Cockatoo Habitat Assessment

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Figure

10G

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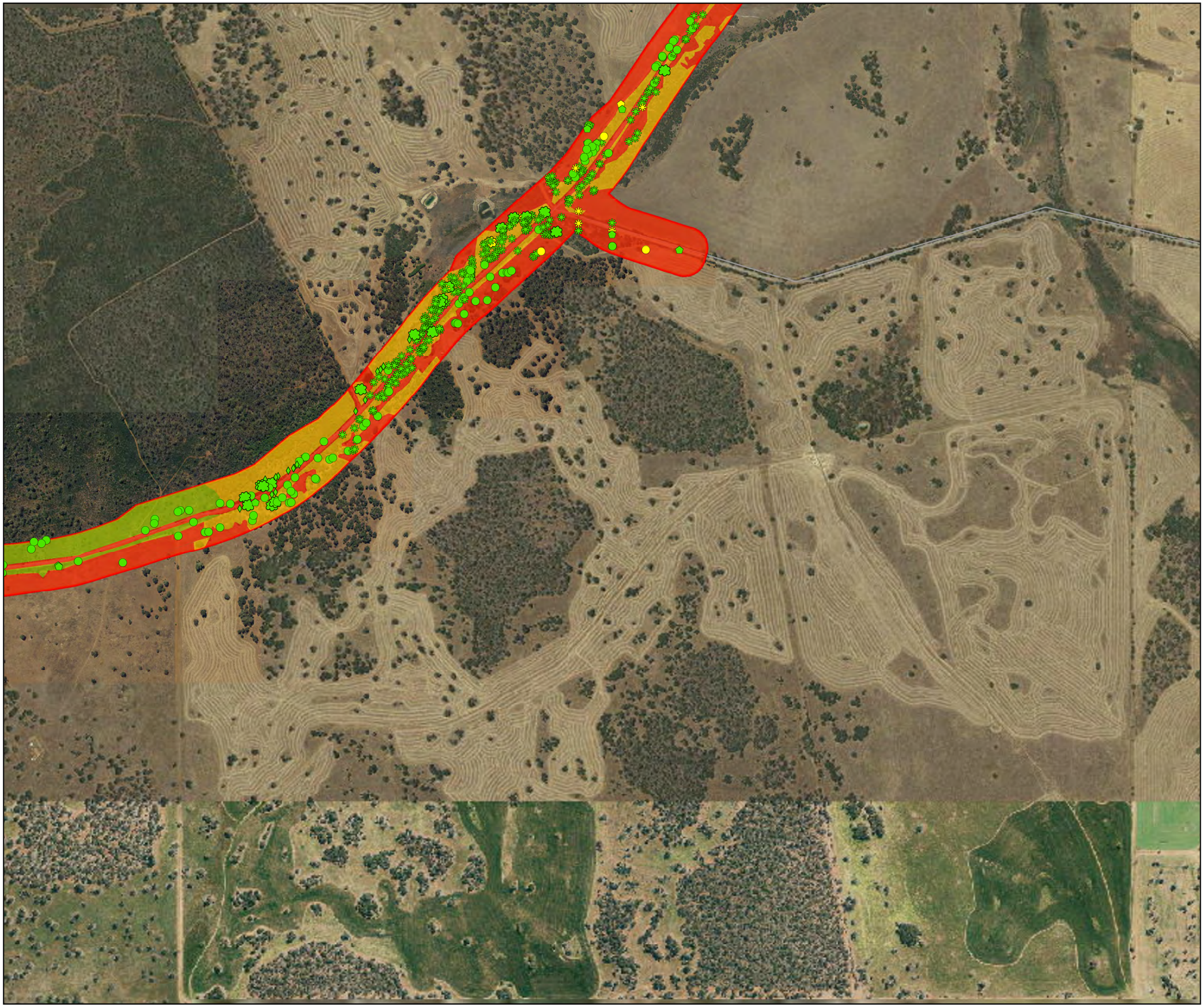

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GDA 1994 MGA Zone 50

0 125 250 500

Metres

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LEGEND

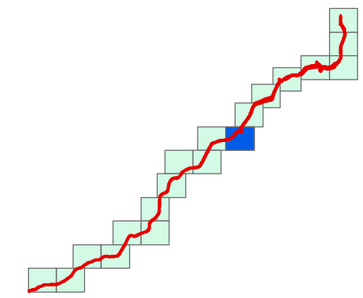
Study Area

Toodyay Trees

- Corymbia calophylla, No Hollows
- Corymbia calophylla, Hollows
- Eucalyptus marginata, No Hollows
- Eucalyptus marginata, Hollows
- Eucalyptus rudis, No Hollows
- Eucalyptus rudis, Hollows
- Eucalyptus wandoo, No Hollows
- Eucalyptus wandoo, Hollows
- Stag, No Hollows
- Stag, Hollows

Forest Red-tail Black Cockatoo Foraging Habitat Quality

- Poor (0 - 3)
- Moderate (4 - 5)
- Good (6 - 8)
- Excellent (9 - 10)



Data sources:

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Toodyay Biological Assessment

Forest Red-tail Black Cockatoo Habitat Assessment

PROJECT ID	60344161
CREATED BY	DGF
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VERSION:	2

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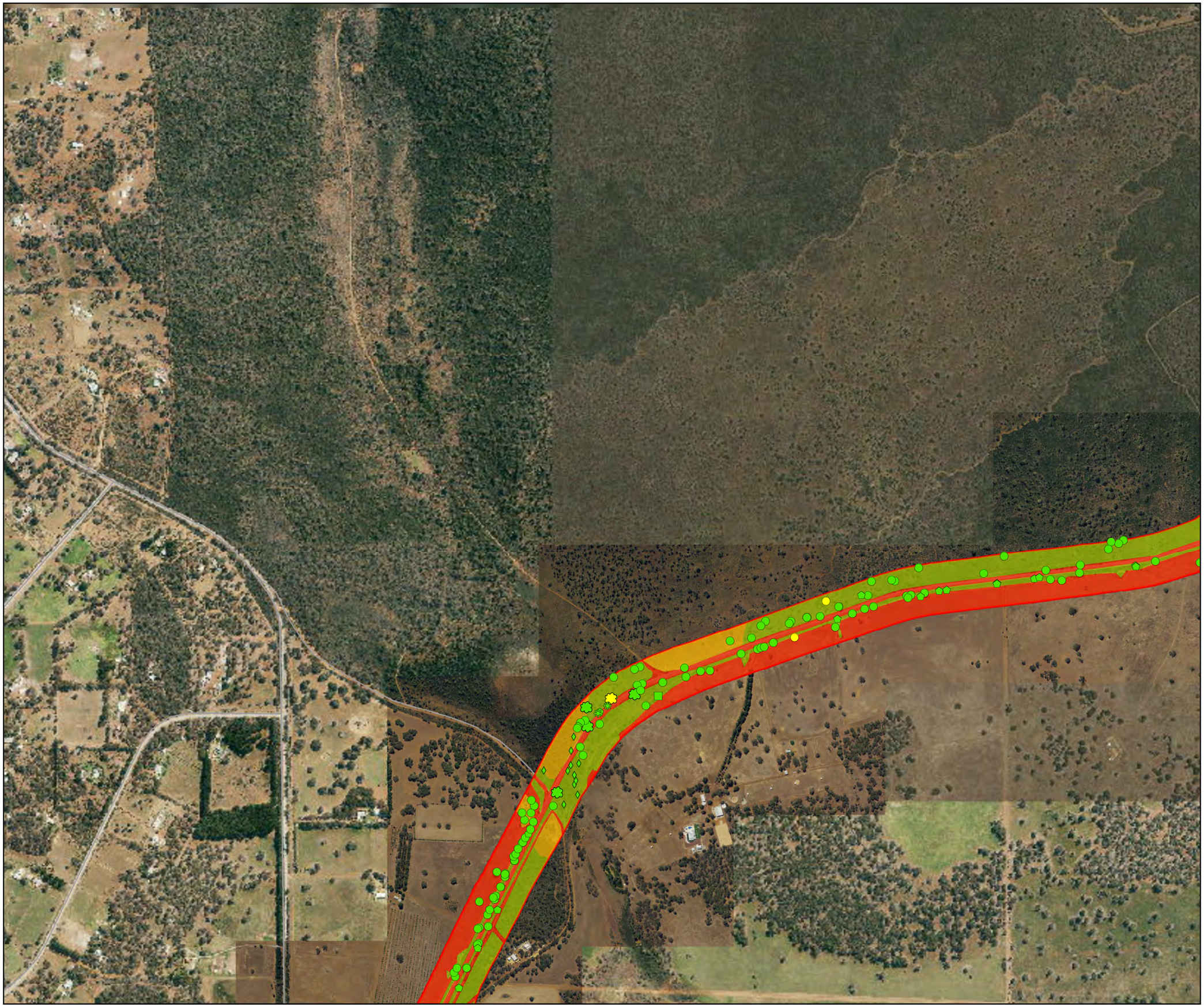

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Metres

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LEGEND

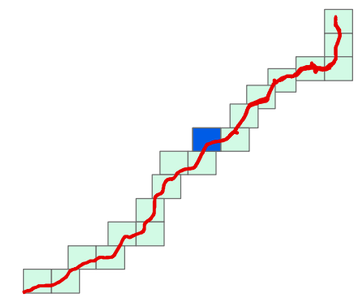
Study Area

Toodyay Trees

- Corymbia calophylla, No Hollows
- Corymbia calophylla, Hollows
- Eucalyptus accedens, No Hollows
- Eucalyptus marginata, No Hollows
- Eucalyptus rudis, No Hollows
- Eucalyptus wandoo, No Hollows
- Stag, No Hollows
- Stag, Hollows

Forest Red-tail Black Cockatoo Foraging Habitat Quality

- Poor (0 - 3)
- Moderate (4 - 5)
- Good (6 - 8)
- Excellent (9 - 10)



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Toodyay Biological Assessment

Forest Red-tail Black Cockatoo Habitat Assessment

PROJECT ID	60344161
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LEGEND

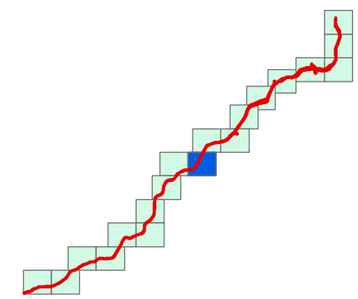
Study Area

Toodyay Trees

- Corymbia calophylla, No Hollows
- Corymbia calophylla, Hollows
- Eucalyptus marginata, No Hollows
- Eucalyptus rudis, Hollows
- Eucalyptus wandoo, No Hollows
- Stag, No Hollows

Forest Red-tail Black Cockatoo Foraging Habitat Quality

- Poor (0 - 3)
- Moderate (4 - 5)
- Good (6 - 8)
- Excellent (9 - 10)



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Toodyay Biological Assessment

Forest Red-tail Black Cockatoo Habitat Assessment

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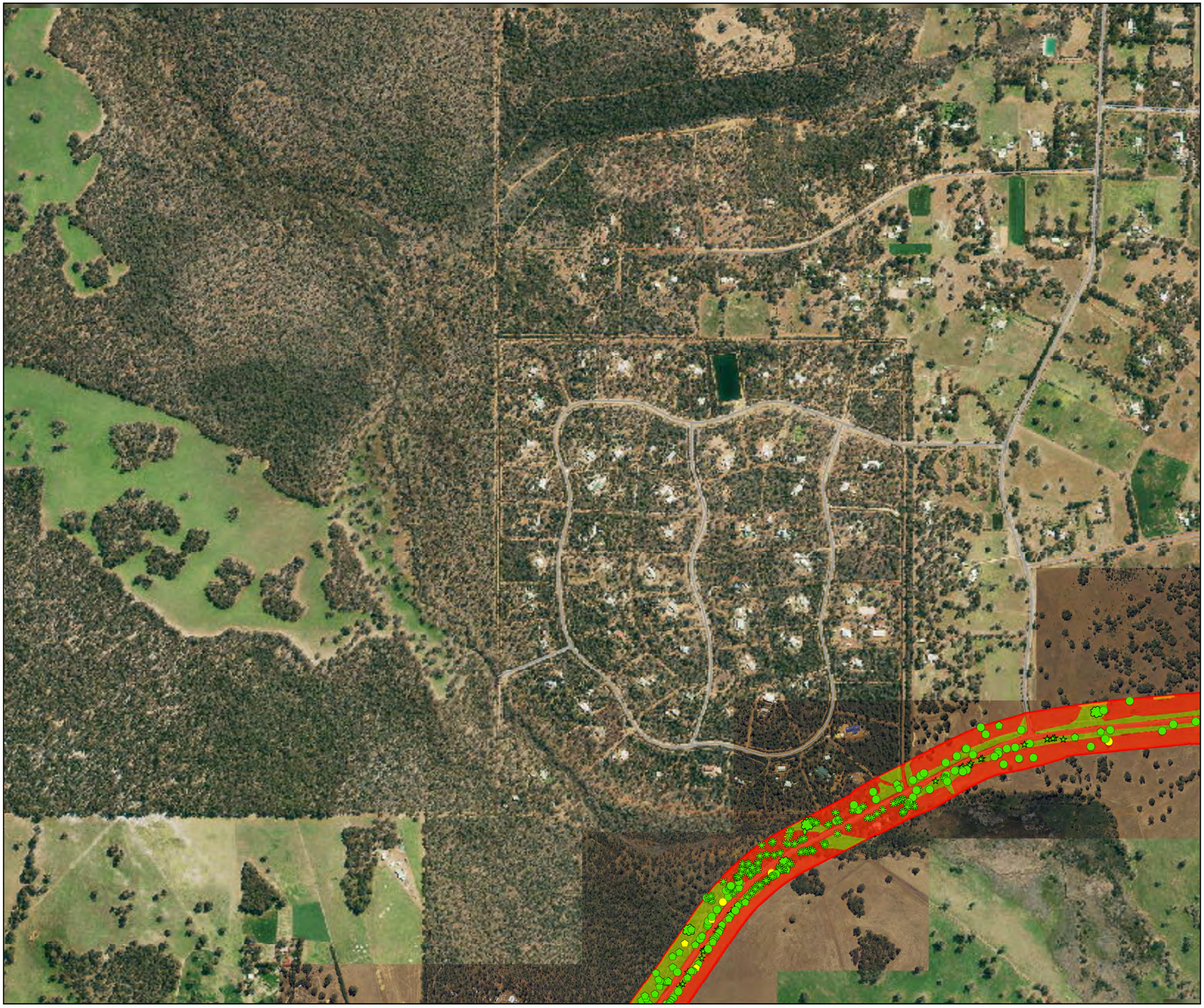

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Metres

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LEGEND

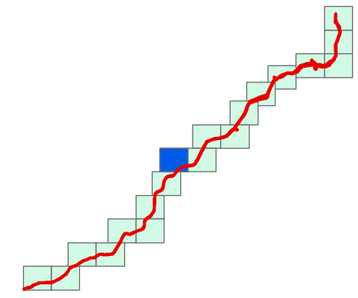
- Study Area

Toodyay Trees

- Corymbia calophylla, No Hollows
- Corymbia calophylla, Hollows
- Eucalyptus marginata, No Hollows
- Eucalyptus marginata, Hollows
- Eucalyptus patens, No Hollows
- Eucalyptus rudis, No Hollows
- Eucalyptus wandoo, No Hollows
- Eucalyptus wandoo, Hollows
- Stag, No Hollows

Forest Red-tail Black Cockatoo Foraging Habitat Quality

- Poor (0 - 3)
- Moderate (4 - 5)
- Good (6 - 8)
- Excellent (9 - 10)



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Toodyay Biological Assessment

Forest Red-tail Black Cockatoo Habitat Assessment

PROJECT ID	60344161
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Metres

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LEGEND

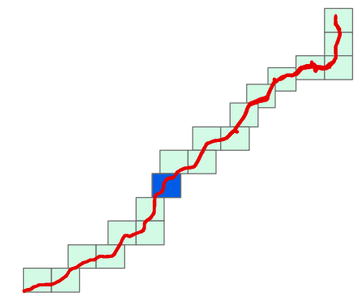
Study Area

Toodyay Trees

- Corymbia calophylla, No Hollows
- Corymbia calophylla, Hollows
- Eucalyptus marginata, No Hollows
- Eucalyptus marginata, Hollows
- Eucalyptus patens, No Hollows
- Eucalyptus patens, Hollows
- Eucalyptus rudis, No Hollows
- Eucalyptus rudis, Hollows
- Eucalyptus wandoo, No Hollows
- Stag, No Hollows
- Stag, Hollows

Forest Red-tail Black Cockatoo Foraging Habitat Quality

- Poor (0 - 3)
- Moderate (4 - 5)
- Good (6 - 8)
- Excellent (9 - 10)



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Toodyay Biological Assessment

Forest Red-tail Black Cockatoo Habitat Assessment

PROJECT ID	60344161
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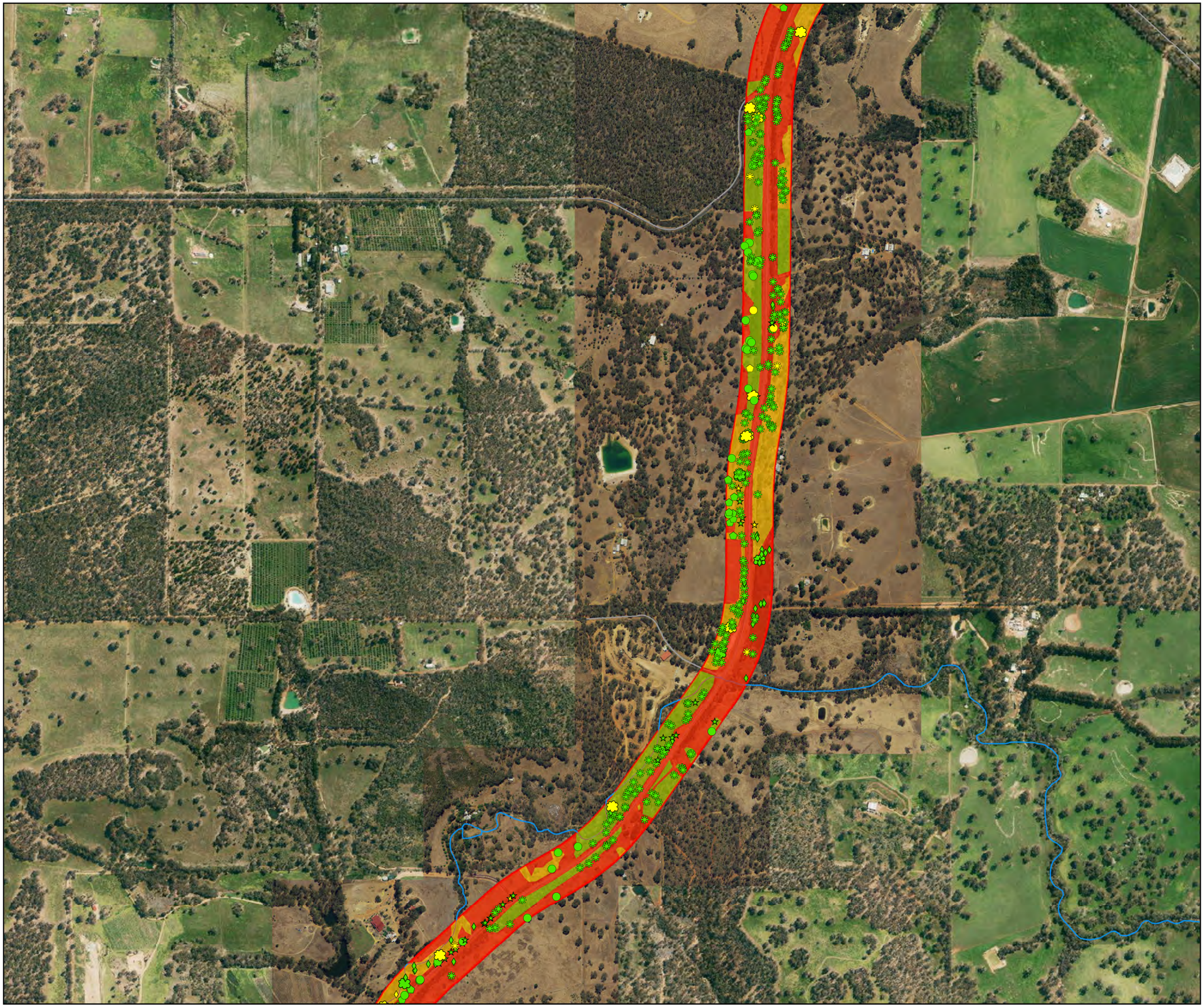

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LEGEND

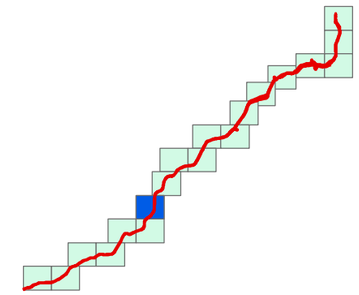
- Study Area

Toodyay Trees

- Corymbia calophylla, No Hollows
- Corymbia calophylla, Hollows
- Eucalyptus marginata, No Hollows
- Eucalyptus marginata, Hollows
- Eucalyptus patens, No Hollows
- Eucalyptus patens, Hollows
- Eucalyptus rudis, No Hollows
- Eucalyptus rudis, Hollows
- Eucalyptus wandoo, No Hollows
- Eucalyptus wandoo, Hollows
- Stag, No Hollows
- Stag, Hollows

Forest Red-tail Black Cockatoo Foraging Habitat Quality

- Poor (0 - 3)
- Moderate (4 - 5)
- Good (6 - 8)
- Excellent (9 - 10)



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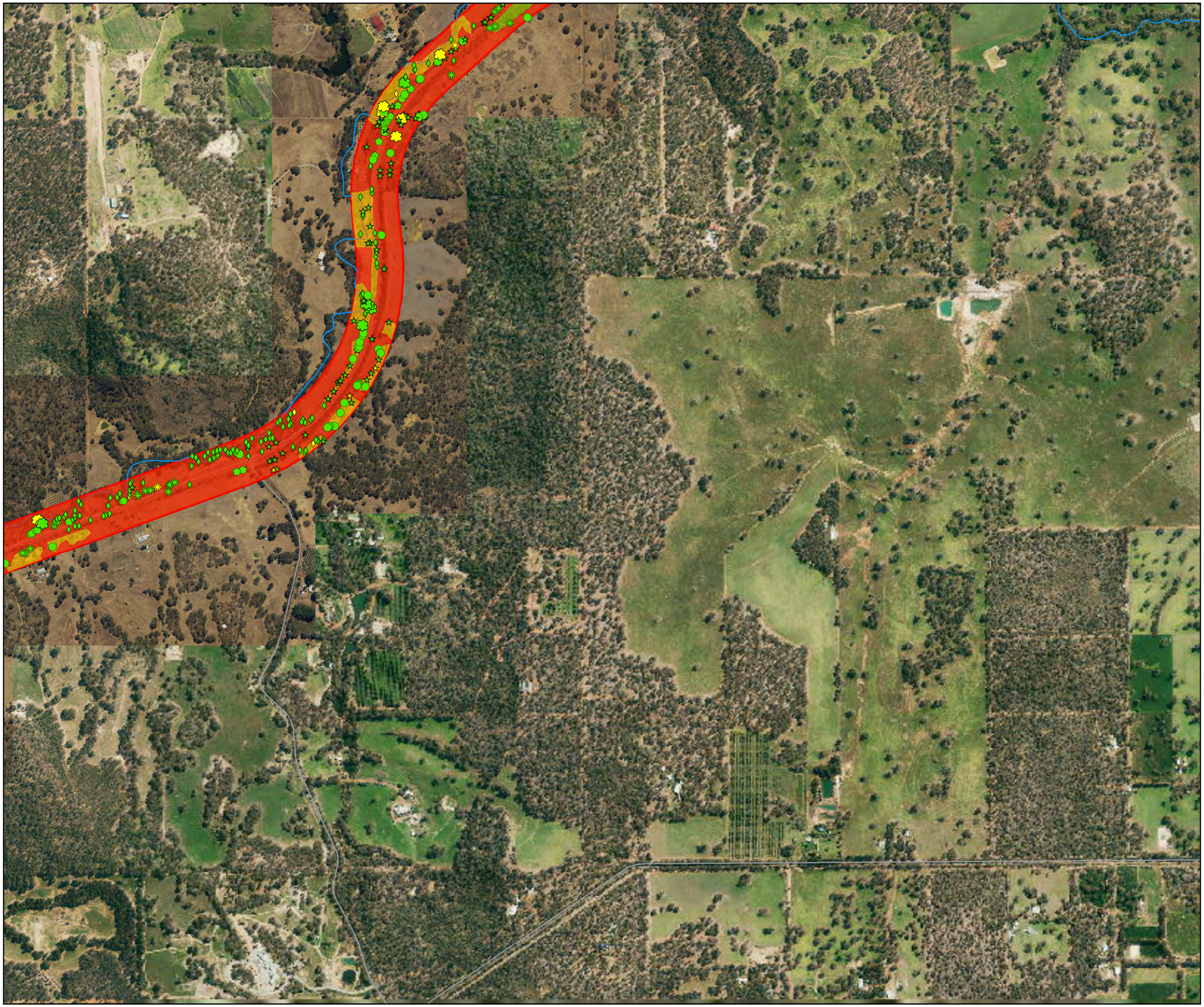

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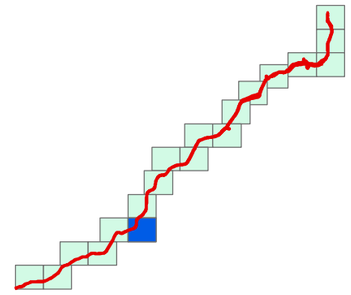
- Study Area

Toodyay Trees

- Corymbia calophylla, No Hollows
- Eucalyptus marginata, No Hollows
- Eucalyptus patens, No Hollows
- Eucalyptus patens, Hollows
- Eucalyptus rudis, No Hollows
- Eucalyptus rudis, Hollows
- Eucalyptus wandoo, No Hollows
- Eucalyptus wandoo, Hollows
- Stag, No Hollows
- Stag, Hollows

Forest Red-tail Black Cockatoo Foraging Habitat Quality

- Poor (0 - 3)
- Moderate (4 - 5)
- Good (6 - 8)
- Excellent (9 - 10)



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Toodyay Biological Assessment

Forest Red-tail Black Cockatoo Habitat Assessment

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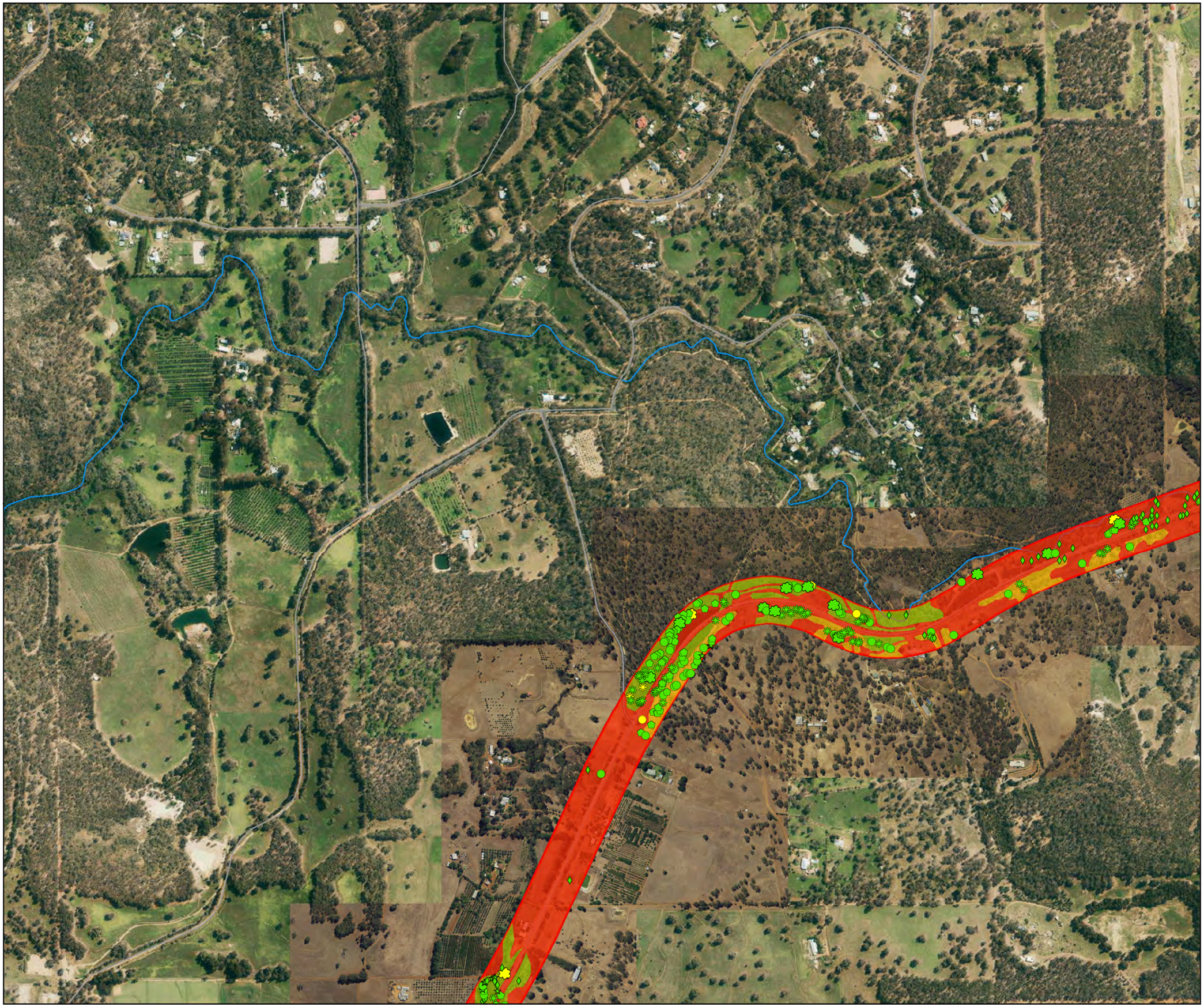

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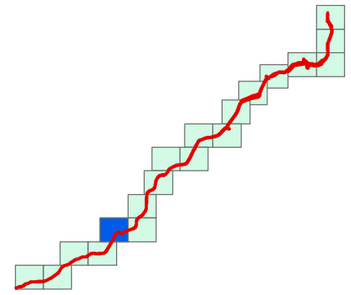
Study Area

Toodyay Trees

- Corymbia calophylla, No Hollows
- Corymbia calophylla, Hollows
- Eucalyptus marginata, No Hollows
- Eucalyptus marginata, Hollows
- Eucalyptus patens, No Hollows
- Eucalyptus rudis, No Hollows
- Eucalyptus wandoo, No Hollows
- Eucalyptus wandoo, Hollows
- Stag, No Hollows
- Stag, Hollows

Forest Red-tail Black Cockatoo Foraging Habitat Quality

- Poor (0 - 3)
- Moderate (4 - 5)
- Good (6 - 8)
- Excellent (9 - 10)



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Toodyay Biological Assessment

Forest Red-tail Black Cockatoo Habitat Assessment

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LEGEND

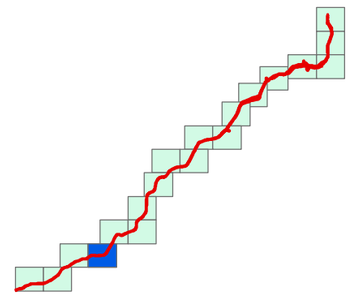
Study Area

Toodyay Trees

- Corymbia calophylla, No Hollows
- Corymbia calophylla, Hollows
- Eucalyptus marginata, No Hollows
- Eucalyptus patens, No Hollows
- Eucalyptus rudis, No Hollows
- Eucalyptus rudis, Hollows
- Eucalyptus wandoo, No Hollows
- Stag, No Hollows
- Stag, Hollows

Forest Red-tail Black Cockatoo Foraging Habitat Quality

- Poor (0 - 3)
- Moderate (4 - 5)
- Good (6 - 8)
- Excellent (9 - 10)



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Toodyay Biological Assessment

Forest Red-tail Black Cockatoo Habitat Assessment

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Metres

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LEGEND

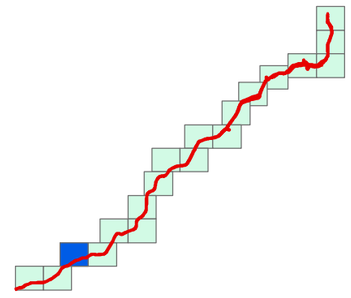
Study Area

Toodyay Trees

- Corymbia calophylla, No Hollows
- Corymbia calophylla, Hollows
- Eucalyptus marginata, No Hollows
- Eucalyptus marginata, Hollows
- Eucalyptus patens, No Hollows
- Eucalyptus rudis, No Hollows
- Eucalyptus wandoo, No Hollows
- Stag, No Hollows
- Stag, Hollows

Forest Red-tail Black Cockatoo Foraging Habitat Quality

- Poor (0 - 3)
- Moderate (4 - 5)
- Good (6 - 8)
- Excellent (9 - 10)



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Toodyay Biological Assessment

Forest Red-tail Black Cockatoo Habitat Assessment

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Metres

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LEGEND

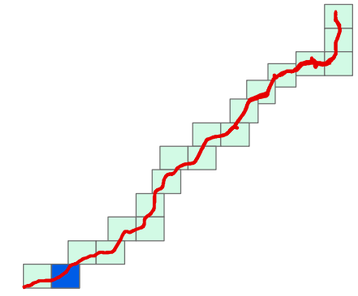
Study Area

Toodyay Trees

- Corymbia calophylla, No Hollows
- Corymbia calophylla, Hollows
- Eucalyptus marginata, No Hollows
- Eucalyptus marginata, Hollows
- Eucalyptus patens, No Hollows
- Eucalyptus rudis, No Hollows
- Eucalyptus wandoo, No Hollows
- Stag, No Hollows

Forest Red-tail Black Cockatoo Foraging Habitat Quality

- Poor (0 - 3)
- Moderate (4 - 5)
- Good (6 - 8)
- Excellent (9 - 10)



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Toodyay Biological Assessment

Forest Red-tail Black Cockatoo Habitat Assessment

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Metres

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LEGEND

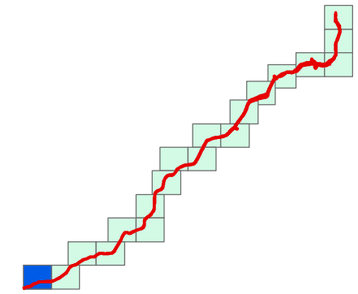
Study Area

Toodyay Trees

- Corymbia calophylla, No Hollows
- Corymbia calophylla, Hollows
- Eucalyptus accedens, No Hollows
- Eucalyptus marginata, No Hollows
- Eucalyptus patens, No Hollows
- Eucalyptus rudis, No Hollows
- Eucalyptus wandoo, No Hollows
- Stag, No Hollows

Forest Red-tail Black Cockatoo Foraging Habitat Quality

- Poor (0 - 3)
- Moderate (4 - 5)
- Good (6 - 8)
- Excellent (9 - 10)



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Forest Red-tail Black Cockatoo Habitat Assessment

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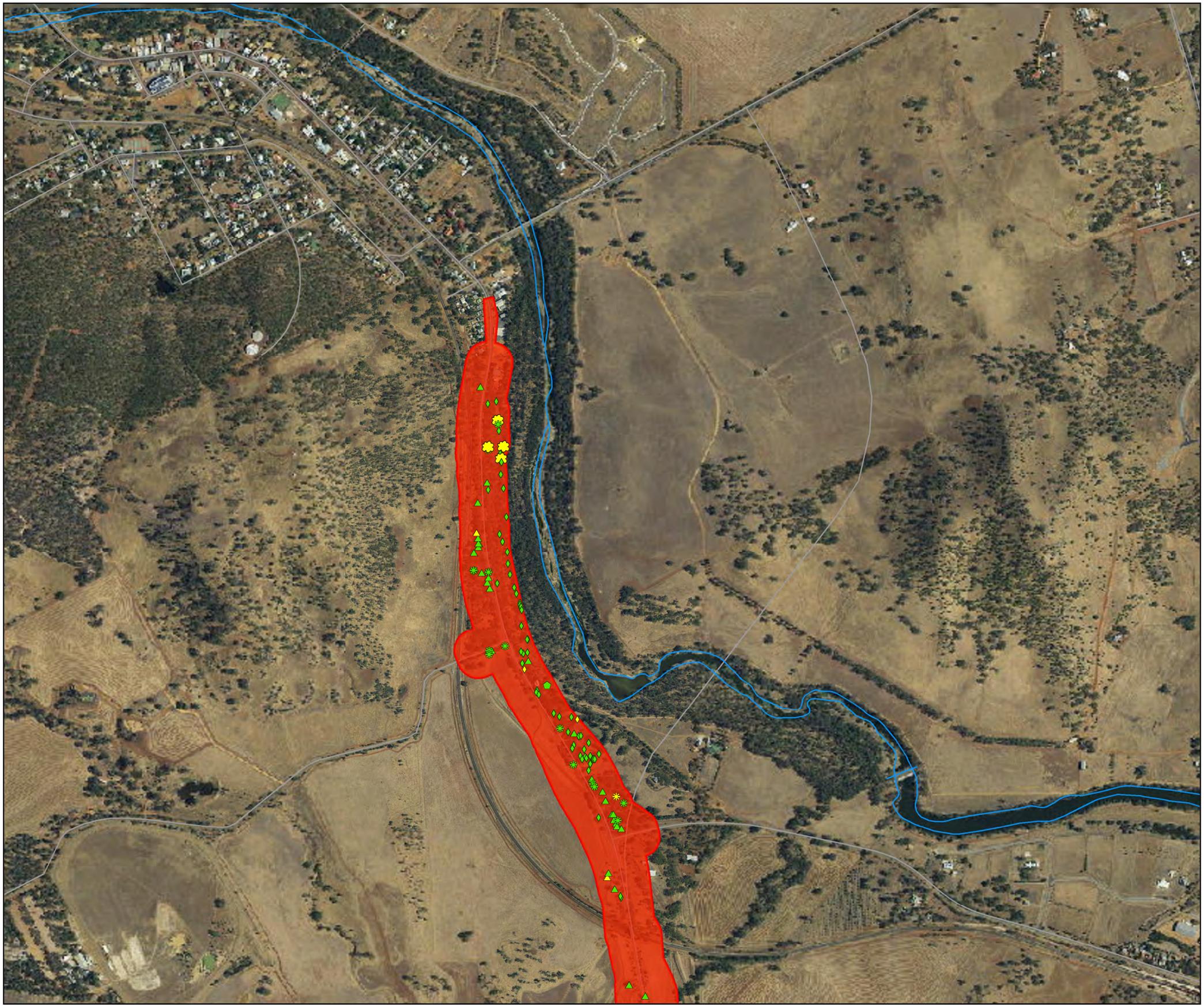

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GDA 1994 MGA Zone 50

0 125 250 500

Metres

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LEGEND

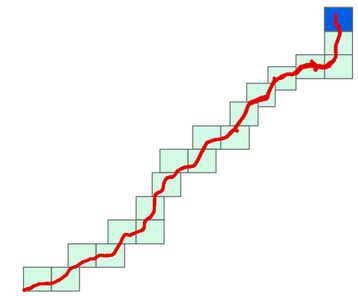
Study Area

Toodyay Trees

- Eucalyptus loxophleba, No Hollows
- Eucalyptus loxophleba, Hollows
- Eucalyptus marginata, No Hollows
- Eucalyptus rudis, No Hollows
- Eucalyptus rudis, Hollows
- Eucalyptus wandoo, No Hollows
- Eucalyptus wandoo, Hollows
- Stag, Hollows

Baudin's Black Cockatoo Foraging Habitat Quality

- Poor (0 - 3)
- Moderate (4 - 5)
- Good (6 - 8)
- Excellent (9 - 10)



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Toodyay Biological Assessment

Baudin's Black-Cockatoo Habitat Assessment

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Metres

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LEGEND

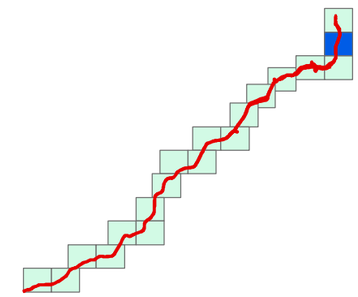
- Study Area

Toodyay Trees

- Corymbia calophylla, No Hollows
- Eucalyptus loxophleba, No Hollows
- Eucalyptus rudis, No Hollows
- Eucalyptus rudis, Hollows
- Eucalyptus wandoo, No Hollows
- Stag, No Hollows
- Stag, Hollows

Baudin's Black Cockatoo Foraging Habitat Quality

- Poor (0 - 3)
- Moderate (4 - 5)
- Good (6 - 8)
- Excellent (9 - 10)



Data sources:

Base Data: © Western Australia Land Information Authority (Landgate) (2016)
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Toodyay Biological Assessment

Baudin's Black-Cockatoo Habitat Assessment

PROJECT ID	60344161
CREATED BY	DGF
LAST MODIFIED	fotheringhamd - 20 Oct 2016
VERSION:	2

Figure

11B

A3 size

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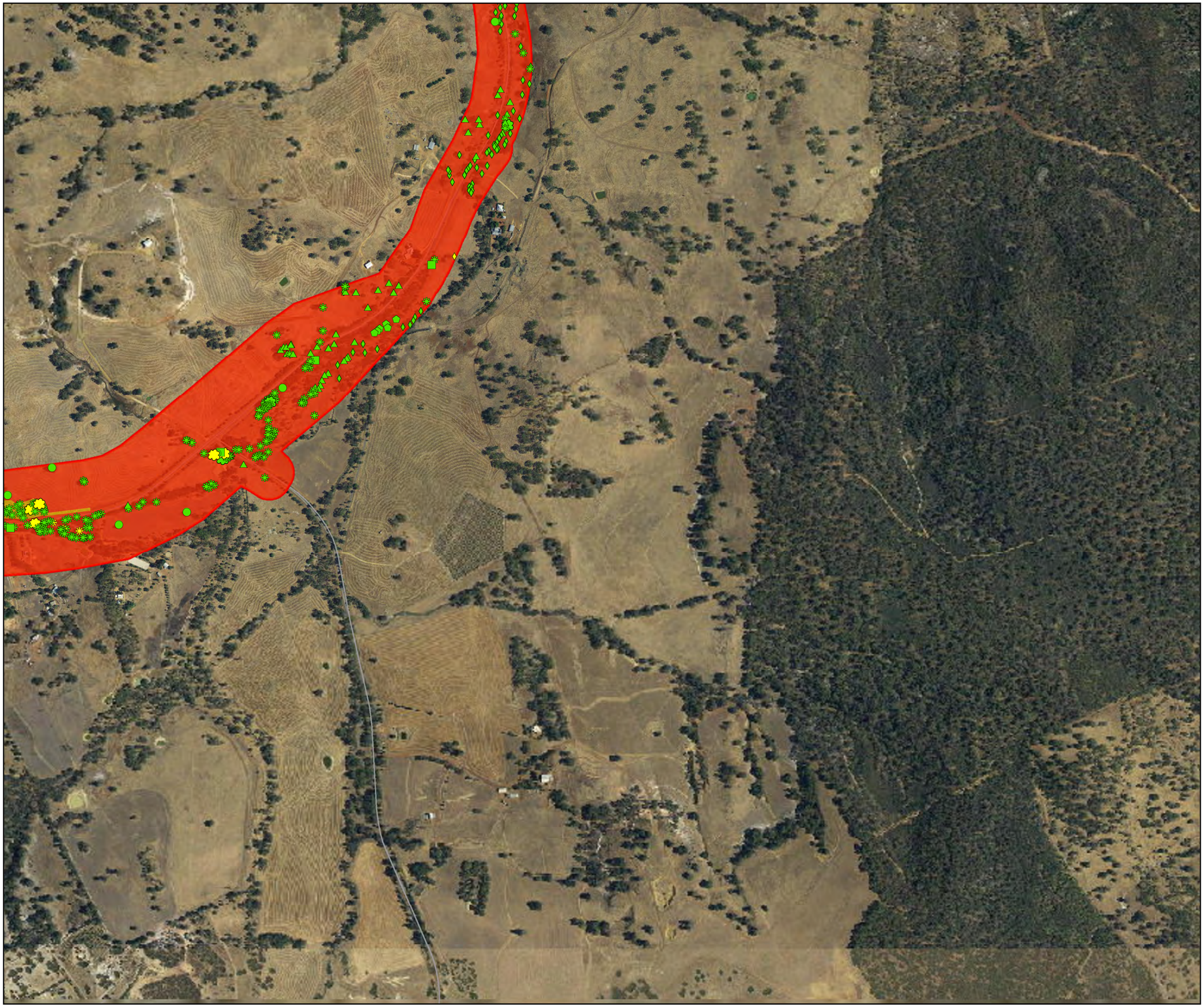

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N

GDA 1994 MGA Zone 50

0 125 250 500

Metres

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LEGEND

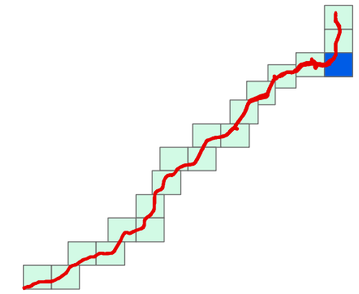
Study Area

Toodyay Trees

- Corymbia calophylla, No Hollows
- Eucalyptus accedens, No Hollows
- Eucalyptus loxophleba, No Hollows
- Eucalyptus marginata, No Hollows
- Eucalyptus rudis, No Hollows
- Eucalyptus rudis, Hollows
- Eucalyptus wandoo, No Hollows
- Eucalyptus wandoo, Hollows
- Stag, No Hollows
- Stag, Hollows

Baudin's Black Cockatoo Foraging Habitat Quality

- Poor (0 - 3)
- Moderate (4 - 5)
- Good (6 - 8)
- Excellent (9 - 10)



Data sources:

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NearMap Imagery 2016

Toodyay Biological Assessment

Baudin's Black-Cockatoo Habitat Assessment

PROJECT ID	60344161
CREATED BY	DGF
LAST MODIFIED	fotheringhamd - 20 Oct 2016
VERSION:	2

Figure
11C

A3 size

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N

GDA 1994 MGA Zone 50

0 125 250 500

Metres

1:10,000 (when printed at A3)

LEGEND

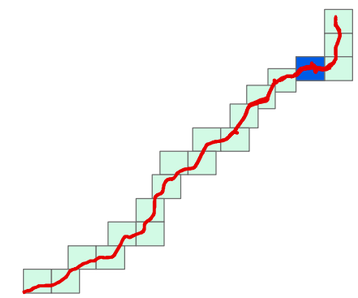
Study Area

Toodyay Trees

- Corymbia calophylla, No Hollows
- Corymbia calophylla, Hollows
- Eucalyptus accedens, No Hollows
- Eucalyptus accedens, Hollows
- Eucalyptus loxophleba, No Hollows
- Eucalyptus marginata, No Hollows
- Eucalyptus marginata, Hollows
- Eucalyptus patens, No Hollows
- Eucalyptus patens, Hollows
- Eucalyptus rudis, No Hollows
- Eucalyptus rudis, Hollows
- Eucalyptus wandoo, No Hollows
- Eucalyptus wandoo, Hollows
- Planted Tree, No
- Stag, No Hollows
- Stag, Hollows

Baudin's Black Cockatoo Foraging Habitat Quality

- Poor (0 - 3)
- Moderate (4 - 5)
- Good (6 - 8)
- Excellent (9 - 10)



Data sources:

Base Data: © Western Australia Land Information Authority (Landgate) (2016)
NearMap Imagery 2016

Toodyay Biological Assessment

Baudin's Black-Cockatoo Habitat Assessment

PROJECT ID	60344161
CREATED BY	DGF
LAST MODIFIED	fotheringhamd - 20 Oct 2016
VERSION:	2

Figure

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A3 size

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GDA 1994 MGA Zone 50

0 125 250 500

Metres

1:10,000 (when printed at A3)

LEGEND

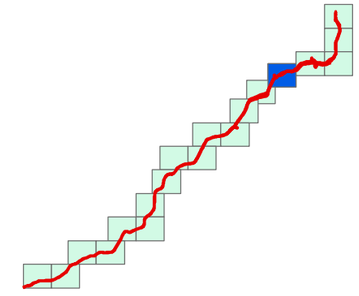
Study Area

Toodyay Trees

- Corymbia calophylla, No Hollows
- Corymbia calophylla, Hollows
- Eucalyptus accedens, No Hollows
- Eucalyptus loxophleba, No Hollows
- Eucalyptus loxophleba, Hollows
- Eucalyptus rudis, No Hollows
- Eucalyptus rudis, Hollows
- Eucalyptus wandoo, No Hollows
- Eucalyptus wandoo, Hollows
- Stag, No Hollows
- Stag, Hollows

Baudin's Black Cockatoo Foraging Habitat Quality

- Poor (0 - 3)
- Moderate (4 - 5)
- Good (6 - 8)
- Excellent (9 - 10)



Data sources:

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Toodyay Biological Assessment

Baudin's Black-Cockatoo Habitat Assessment

PROJECT ID	60344161
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VERSION:	2

Figure

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A3 size

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GDA 1994 MGA Zone 50

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Metres

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LEGEND

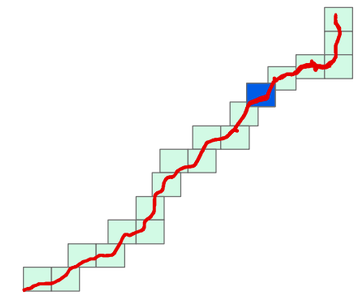
Study Area

Toodyay Trees

- Corymbia calophylla, No Hollows
- Corymbia calophylla, Hollows
- Eucalyptus accedens, No Hollows
- Eucalyptus accedens, Hollows
- Eucalyptus loxophleba, No Hollows
- Eucalyptus loxophleba, Hollows
- Eucalyptus marginata, No Hollows
- Eucalyptus marginata, Hollows
- Eucalyptus rudis, No Hollows
- Eucalyptus rudis, Hollows
- Eucalyptus wandoo, No Hollows
- Eucalyptus wandoo, Hollows
- Stag, No Hollows
- Stag, Hollows

Baudin's Black Cockatoo Foraging Habitat Quality

- Poor (0 - 3)
- Moderate (4 - 5)
- Good (6 - 8)
- Excellent (9 - 10)



Data sources:

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Toodyay Biological Assessment

Baudin's Black-Cockatoo Habitat Assessment

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VERSION:	2

Figure

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GDA 1994 MGA Zone 50

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Metres

1:10,000 (when printed at A3)

LEGEND

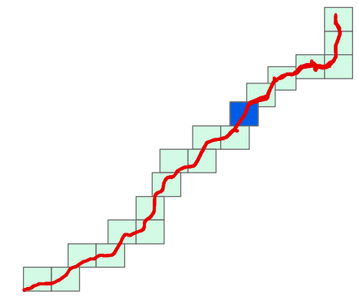
Study Area

Toodyay Trees

- Corymbia calophylla, No Hollows
- Corymbia calophylla, Hollows
- Eucalyptus accedens, No Hollows
- Eucalyptus accedens, Hollows
- Eucalyptus loxophleba, Hollows
- Eucalyptus marginata, No Hollows
- Eucalyptus marginata, Hollows
- Eucalyptus patens, No Hollows
- Eucalyptus rudis, No Hollows
- Eucalyptus rudis, Hollows
- Eucalyptus wandoo, No Hollows
- Eucalyptus wandoo, Hollows
- Stag, No Hollows
- Stag, Hollows

Baudin's Black Cockatoo Foraging Habitat Quality

- Poor (0 - 3)
- Moderate (4 - 5)
- Good (6 - 8)
- Excellent (9 - 10)



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Baudin's Black-Cockatoo Habitat Assessment

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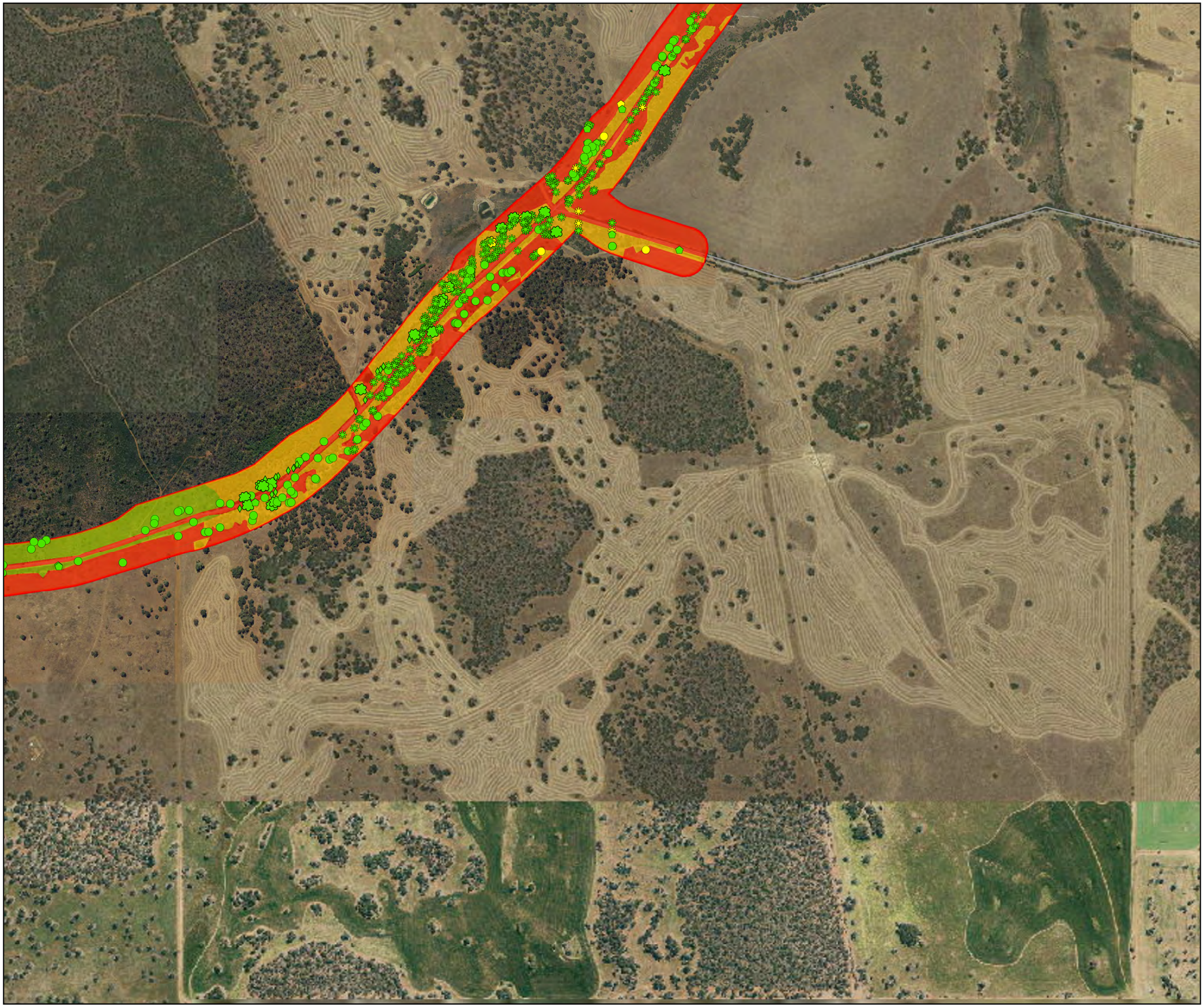

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N

GDA 1994 MGA Zone 50

0 125 250 500

Metres

1:10,000 (when printed at A3)

LEGEND

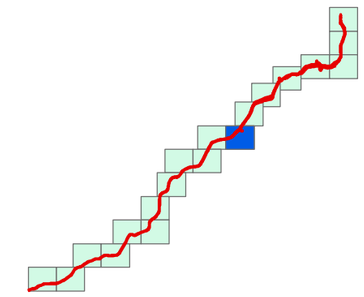
Study Area

Toodyay Trees

- Corymbia calophylla, No Hollows
- Corymbia calophylla, Hollows
- Eucalyptus marginata, No Hollows
- Eucalyptus marginata, Hollows
- Eucalyptus rudis, No Hollows
- Eucalyptus rudis, Hollows
- Eucalyptus wandoo, No Hollows
- Eucalyptus wandoo, Hollows
- Stag, No Hollows
- Stag, Hollows

Baudin's Black Cockatoo Foraging Habitat Quality

- Poor (0 - 3)
- Moderate (4 - 5)
- Good (6 - 8)
- Excellent (9 - 10)



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Toodyay Biological Assessment

Baudin's Black-Cockatoo Habitat Assessment

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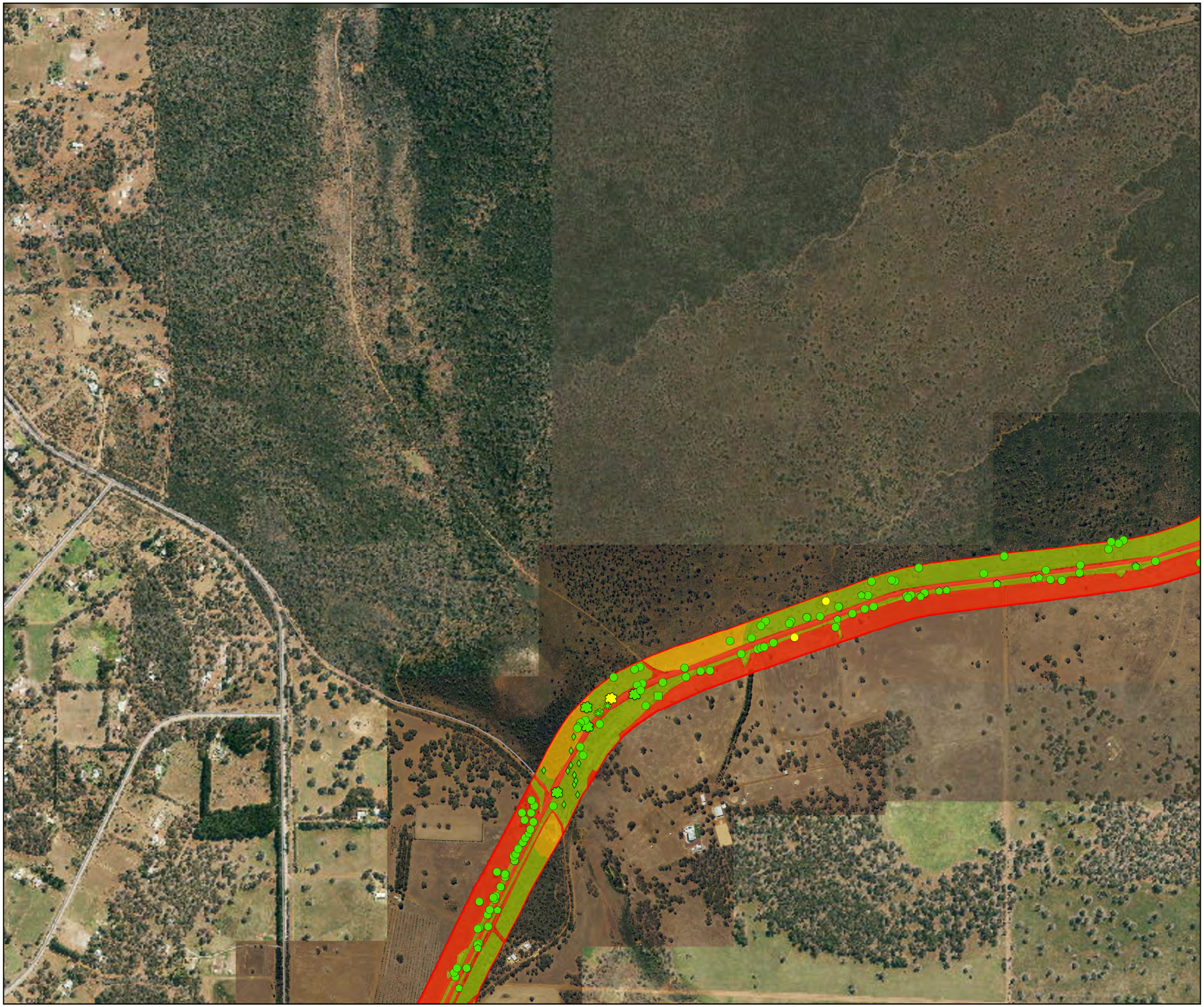

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GDA 1994 MGA Zone 50

0 125 250 500

Metres

1:10,000 (when printed at A3)

LEGEND

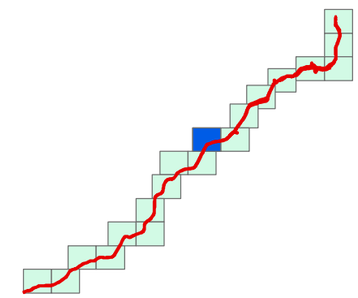
- Study Area

Toodyay Trees

- Corymbia calophylla, No Hollows
- Corymbia calophylla, Hollows
- Eucalyptus accedens, No Hollows
- Eucalyptus marginata, No Hollows
- Eucalyptus rudis, No Hollows
- Eucalyptus wandoo, No Hollows
- Stag, No Hollows
- Stag, Hollows

Baudin's Black Cockatoo Foraging Habitat Quality

- Poor (0 - 3)
- Moderate (4 - 5)
- Good (6 - 8)
- Excellent (9 - 10)



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Toodyay Biological Assessment

Baudin's Black-Cockatoo Habitat Assessment

PROJECT ID	60344161
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VERSION:	2

Figure

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GDA 1994 MGA Zone 50

0 125 250 500

Metres

1:10,000 (when printed at A3)

LEGEND

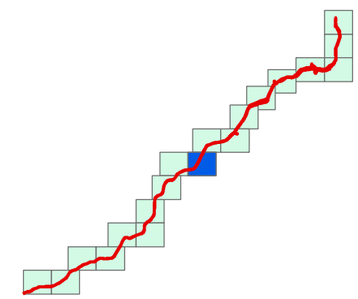
Study Area

Toodyay Trees

- Corymbia calophylla, No Hollows
- Corymbia calophylla, Hollows
- Eucalyptus marginata, No Hollows
- Eucalyptus rudis, Hollows
- Eucalyptus wandoo, No Hollows
- Stag, No Hollows

Baudin's Black Cockatoo Foraging Habitat Quality

- Poor (0 - 3)
- Moderate (4 - 5)
- Good (6 - 8)
- Excellent (9 - 10)



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Toodyay Biological Assessment

Baudin's Black-Cockatoo Habitat Assessment

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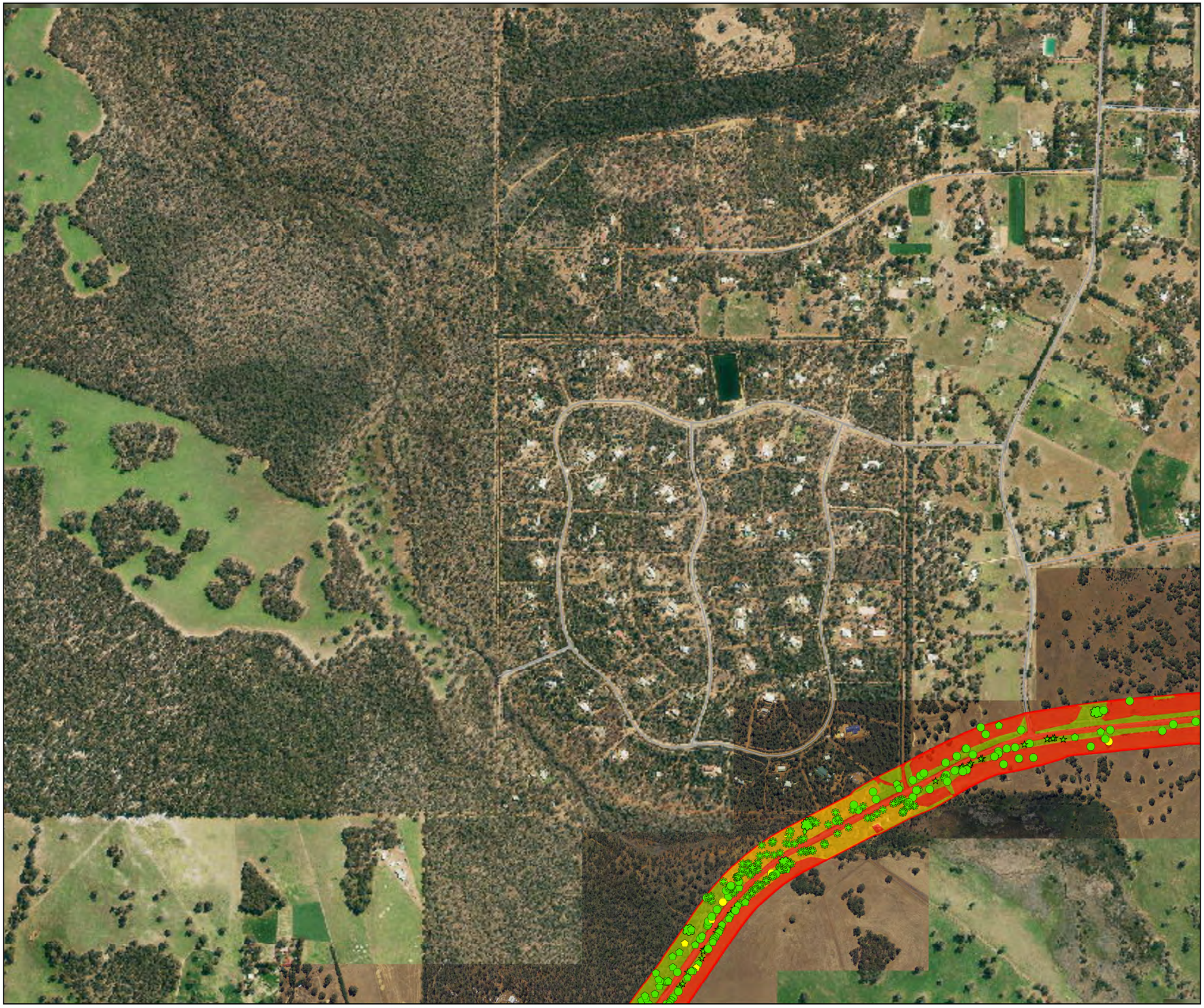

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GDA 1994 MGA Zone 50

0 125 250 500

Metres

1:10,000 (when printed at A3)

LEGEND

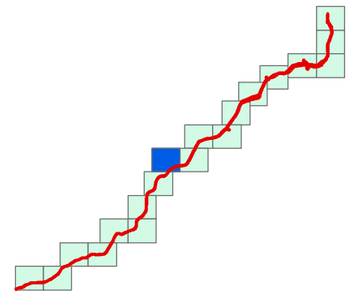
Study Area

Toodyay Trees

- Corymbia calophylla, No Hollows
- Corymbia calophylla, Hollows
- Eucalyptus marginata, No Hollows
- Eucalyptus marginata, Hollows
- Eucalyptus patens, No Hollows
- Eucalyptus rudis, No Hollows
- Eucalyptus wandoo, No Hollows
- Eucalyptus wandoo, Hollows
- Stag, No Hollows

Baudin's Black Cockatoo Foraging Habitat Quality

- Poor (0 - 3)
- Moderate (4 - 5)
- Good (6 - 8)
- Excellent (9 - 10)



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Toodyay Biological Assessment

Baudin's Black-Cockatoo Habitat Assessment

PROJECT ID	60344161
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LAST MODIFIED	fotheringhamd - 20 Oct 2016
VERSION:	2

Figure

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A3 size

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N

GDA 1994 MGA Zone 50

0 125 250 500

Metres

1:10,000 (when printed at A3)

LEGEND

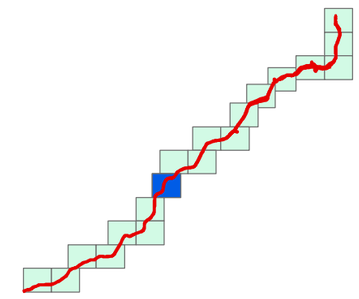
Study Area

Toodyay Trees

- Corymbia calophylla, No Hollows
- Corymbia calophylla, Hollows
- Eucalyptus marginata, No Hollows
- Eucalyptus marginata, Hollows
- Eucalyptus patens, No Hollows
- Eucalyptus patens, Hollows
- Eucalyptus rudis, No Hollows
- Eucalyptus rudis, Hollows
- Eucalyptus wandoo, No Hollows
- Stag, No Hollows
- Stag, Hollows

Baudin's Black Cockatoo Foraging Habitat Quality

- Poor (0 - 3)
- Moderate (4 - 5)
- Good (6 - 8)
- Excellent (9 - 10)



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Toodyay Biological Assessment

Baudin's Black-Cockatoo Habitat Assessment

PROJECT ID	60344161
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VERSION:	2

Figure

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A3 size

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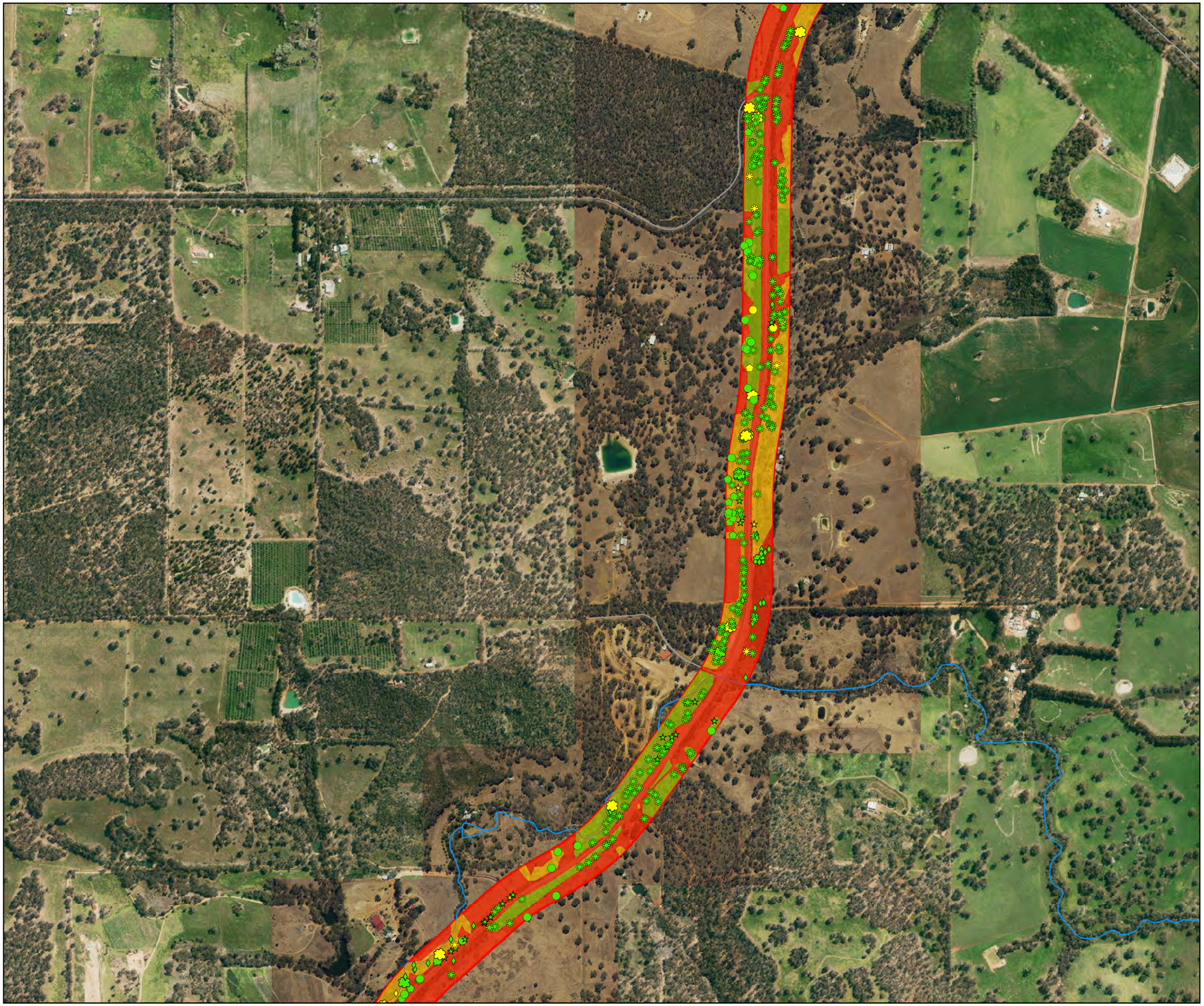

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GDA 1994 MGA Zone 50

0 125 250 500

Metres

1:10,000 (when printed at A3)

LEGEND

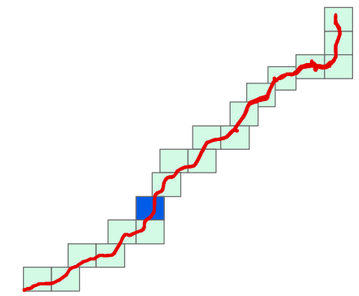
Study Area

Toodyay Trees

- Corymbia calophylla, No Hollows
- Corymbia calophylla, Hollows
- Eucalyptus marginata, No Hollows
- Eucalyptus marginata, Hollows
- Eucalyptus patens, No Hollows
- Eucalyptus patens, Hollows
- Eucalyptus rudis, No Hollows
- Eucalyptus rudis, Hollows
- Eucalyptus wandoo, No Hollows
- Eucalyptus wandoo, Hollows
- Stag, No Hollows
- Stag, Hollows

Baudin's Black Cockatoo Foraging Habitat Quality

- Poor (0 - 3)
- Moderate (4 - 5)
- Good (6 - 8)
- Excellent (9 - 10)



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Toodyay Biological Assessment

Baudin's Black-Cockatoo Habitat Assessment

PROJECT ID	60344161
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VERSION:	2

Figure

11M

A3 size

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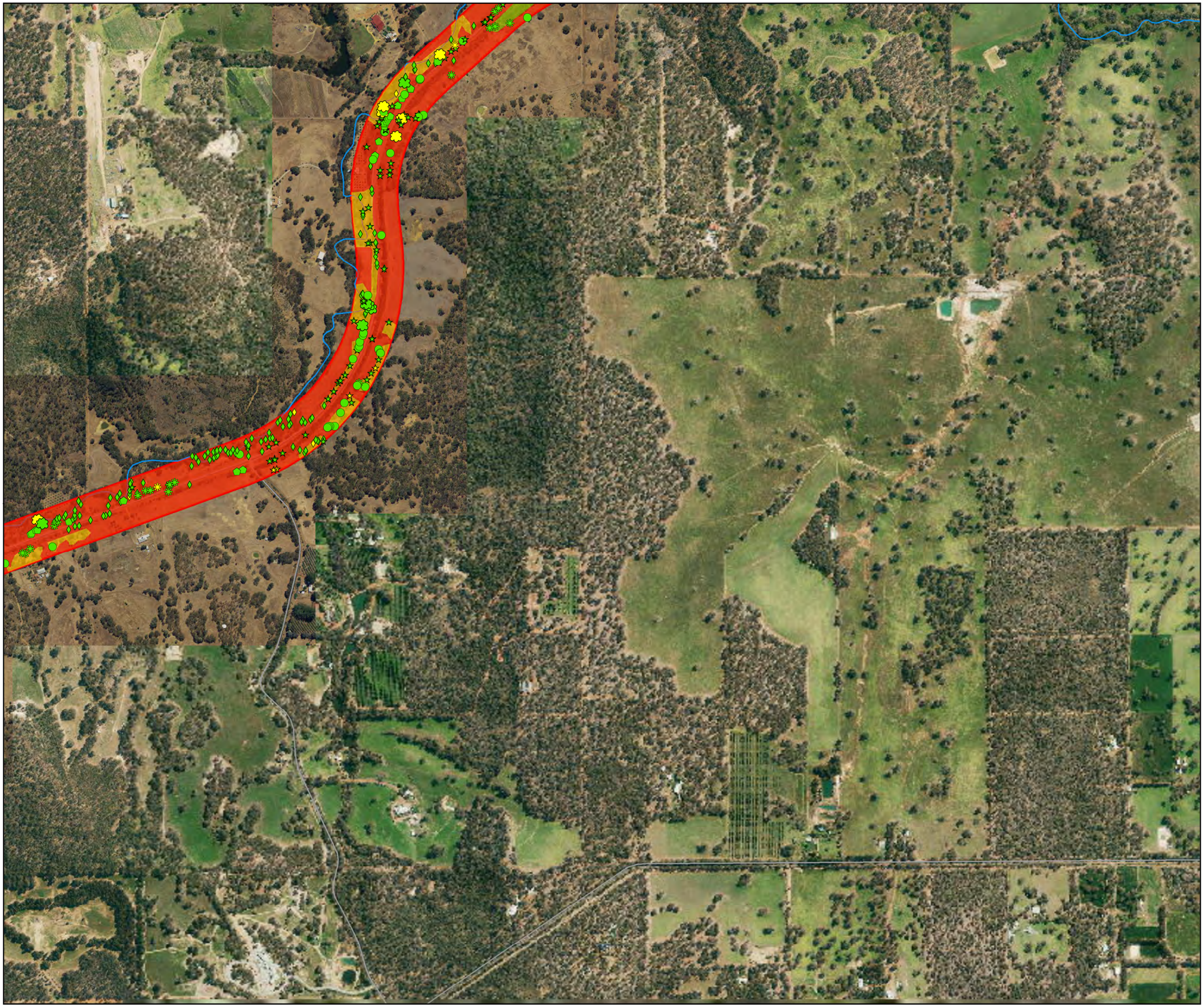

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GDA 1994 MGA Zone 50

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Metres

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LEGEND

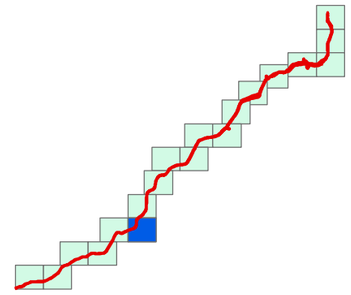
Study Area

Toodyay Trees

- Corymbia calophylla, No Hollows
- Eucalyptus marginata, No Hollows
- Eucalyptus patens, No Hollows
- Eucalyptus patens, Hollows
- Eucalyptus rudis, No Hollows
- Eucalyptus rudis, Hollows
- Eucalyptus wandoo, No Hollows
- Eucalyptus wandoo, Hollows
- Stag, No Hollows
- Stag, Hollows

Baudin's Black Cockatoo Foraging Habitat Quality

- Poor (0 - 3)
- Moderate (4 - 5)
- Good (6 - 8)
- Excellent (9 - 10)



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Baudin's Black-Cockatoo Habitat Assessment

PROJECT ID	60344161
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VERSION:	2

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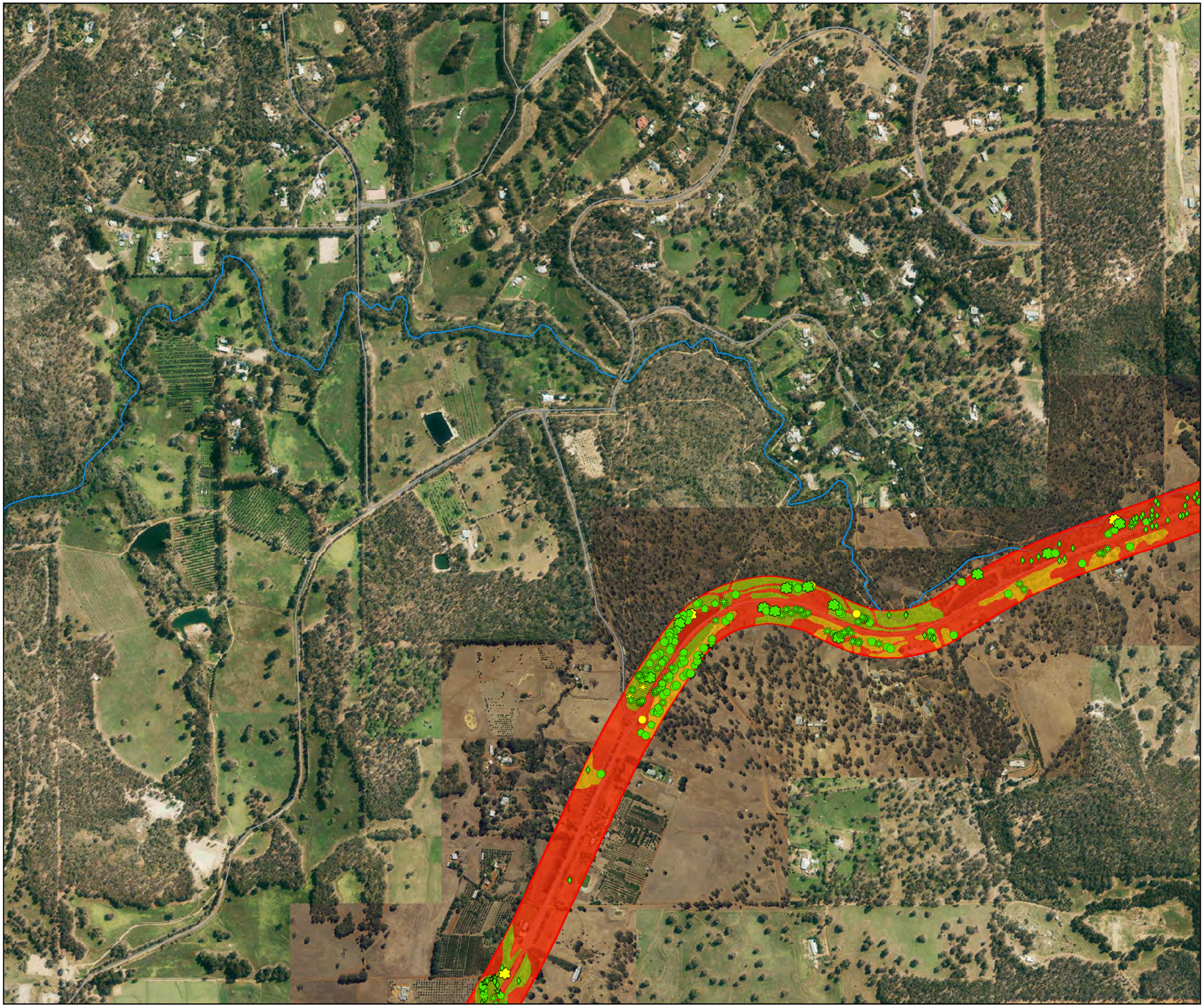

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LEGEND

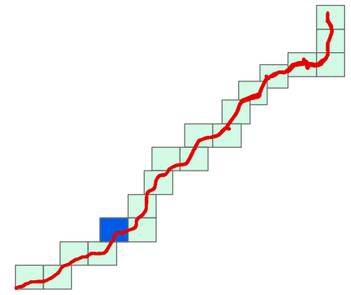
Study Area

Toodyay Trees

- Corymbia calophylla, No Hollows
- Corymbia calophylla, Hollows
- Eucalyptus marginata, No Hollows
- Eucalyptus marginata, Hollows
- Eucalyptus patens, No Hollows
- Eucalyptus rudis, No Hollows
- Eucalyptus wandoo, No Hollows
- Eucalyptus wandoo, Hollows
- Stag, No Hollows
- Stag, Hollows

Baudin's Black Cockatoo Foraging Habitat Quality

- Poor (0 - 3)
- Moderate (4 - 5)
- Good (6 - 8)
- Excellent (9 - 10)



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Baudin's Black-Cockatoo Habitat Assessment

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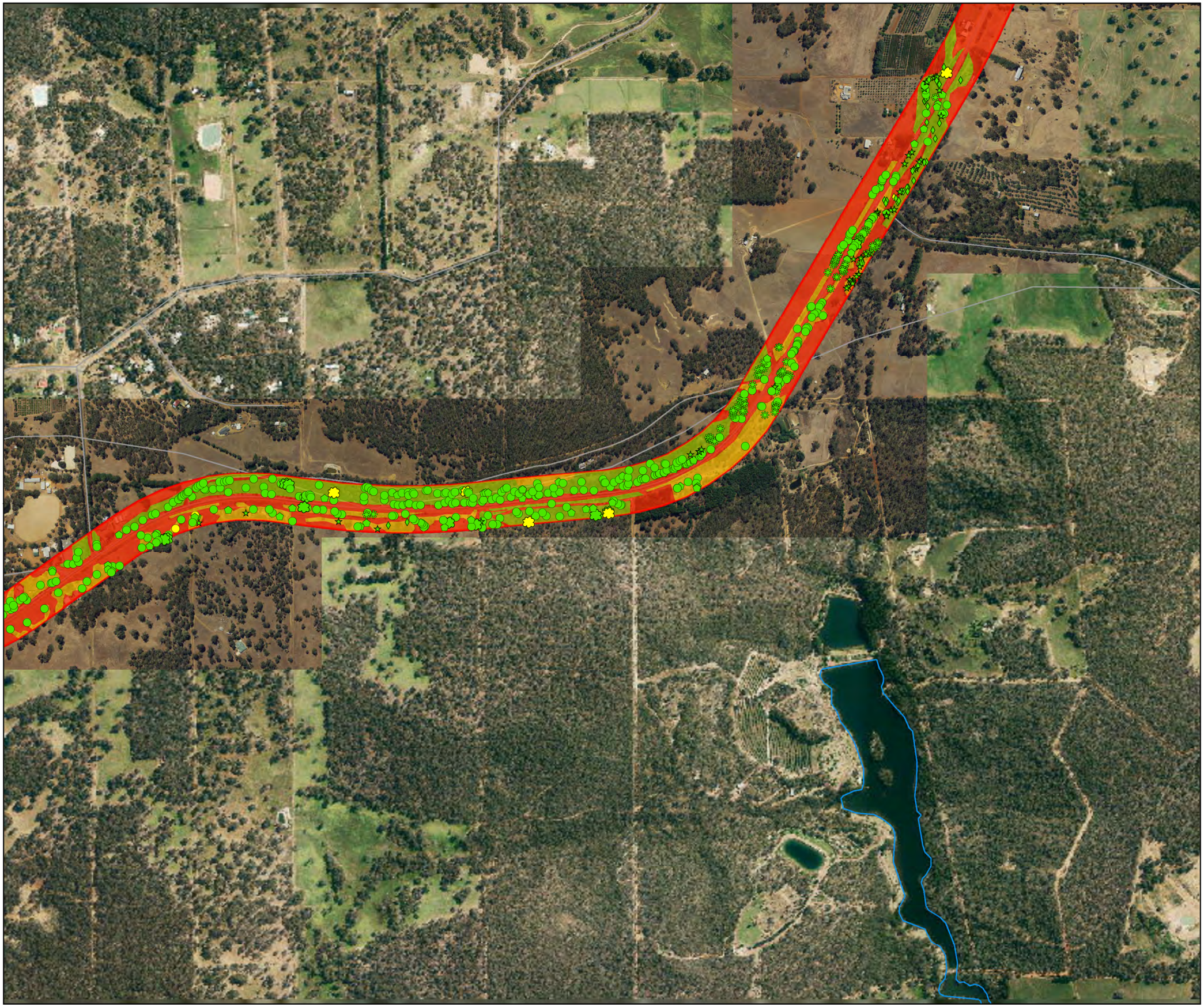

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Study Area

Toodyay Trees

- Corymbia calophylla, No Hollows
- Corymbia calophylla, Hollows
- Eucalyptus marginata, No Hollows
- Eucalyptus patens, No Hollows
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- Eucalyptus rudis, Hollows
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Baudin's Black Cockatoo Foraging Habitat Quality

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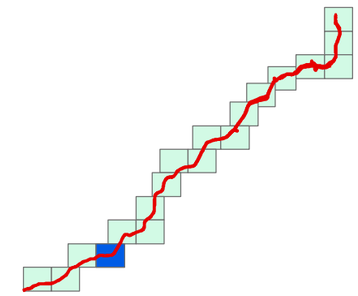
- Moderate (4 - 5)
- Good (6 - 8)
- Excellent (9 - 10)



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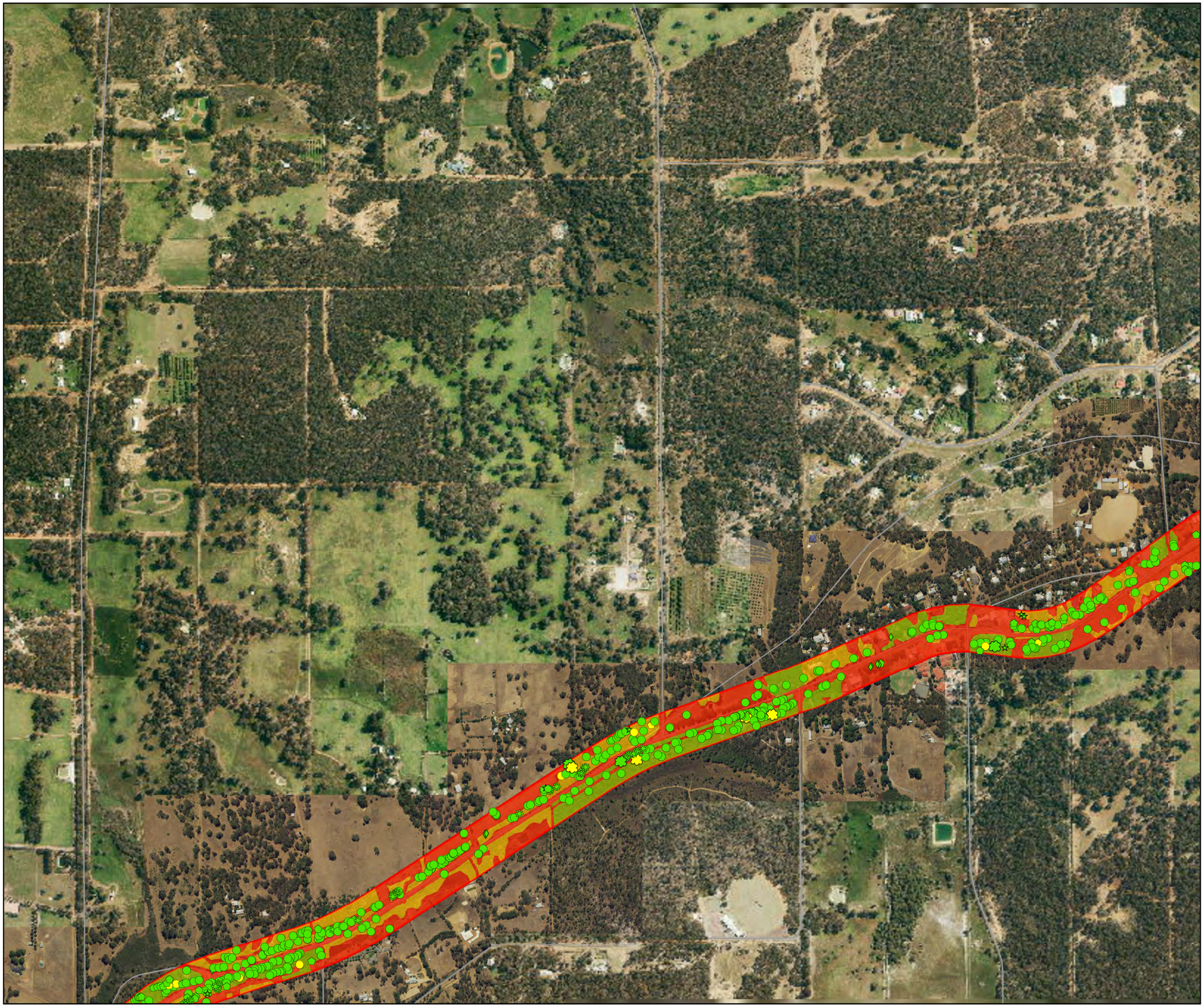

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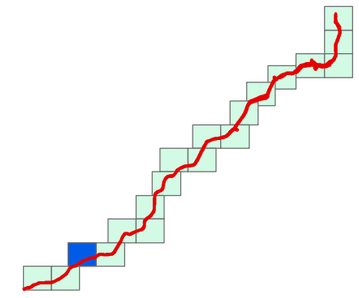
Study Area

Toodyay Trees

- Corymbia calophylla, No Hollows
- Corymbia calophylla, Hollows
- Eucalyptus marginata, No Hollows
- Eucalyptus marginata, Hollows
- Eucalyptus patens, No Hollows
- Eucalyptus rudis, No Hollows
- Eucalyptus wandoo, No Hollows
- Stag, No Hollows
- Stag, Hollows

Baudin's Black Cockatoo Foraging Habitat Quality

- Poor (0 - 3)
- Moderate (4 - 5)
- Good (6 - 8)
- Excellent (9 - 10)



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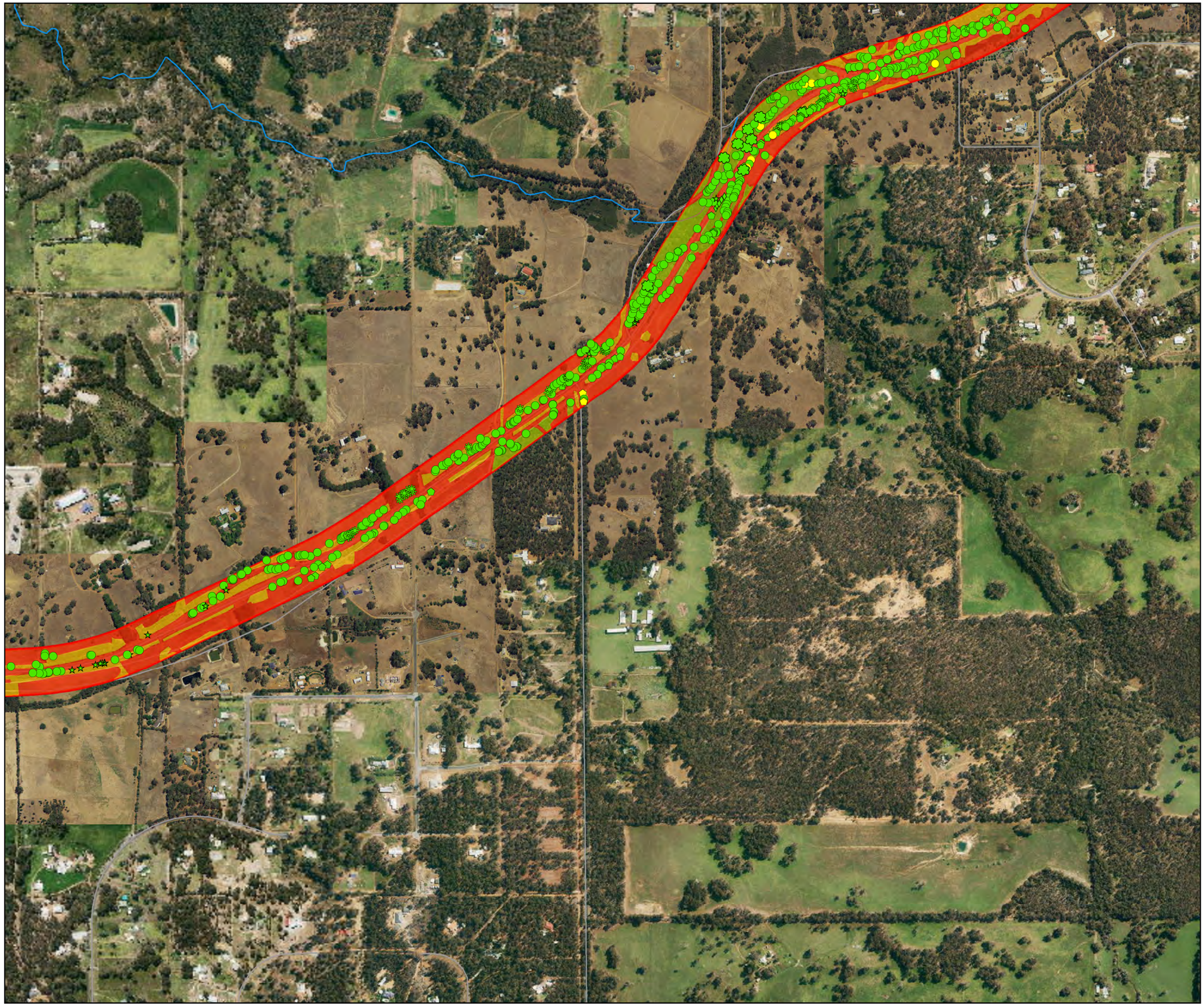

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LEGEND

Study Area

Toodyay Trees

- Corymbia calophylla, No Hollows
- Corymbia calophylla, Hollows
- Eucalyptus marginata, No Hollows
- Eucalyptus marginata, Hollows
- Eucalyptus patens, No Hollows
- Eucalyptus rudis, No Hollows
- Eucalyptus wandoo, No Hollows
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Baudin's Black Cockatoo Foraging Habitat Quality

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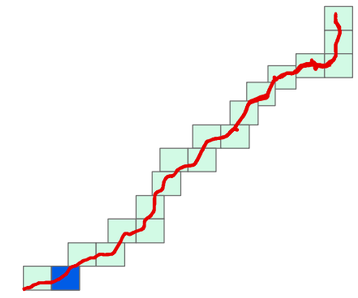
- Moderate (4 - 5)
- Good (6 - 8)
- Excellent (9 - 10)



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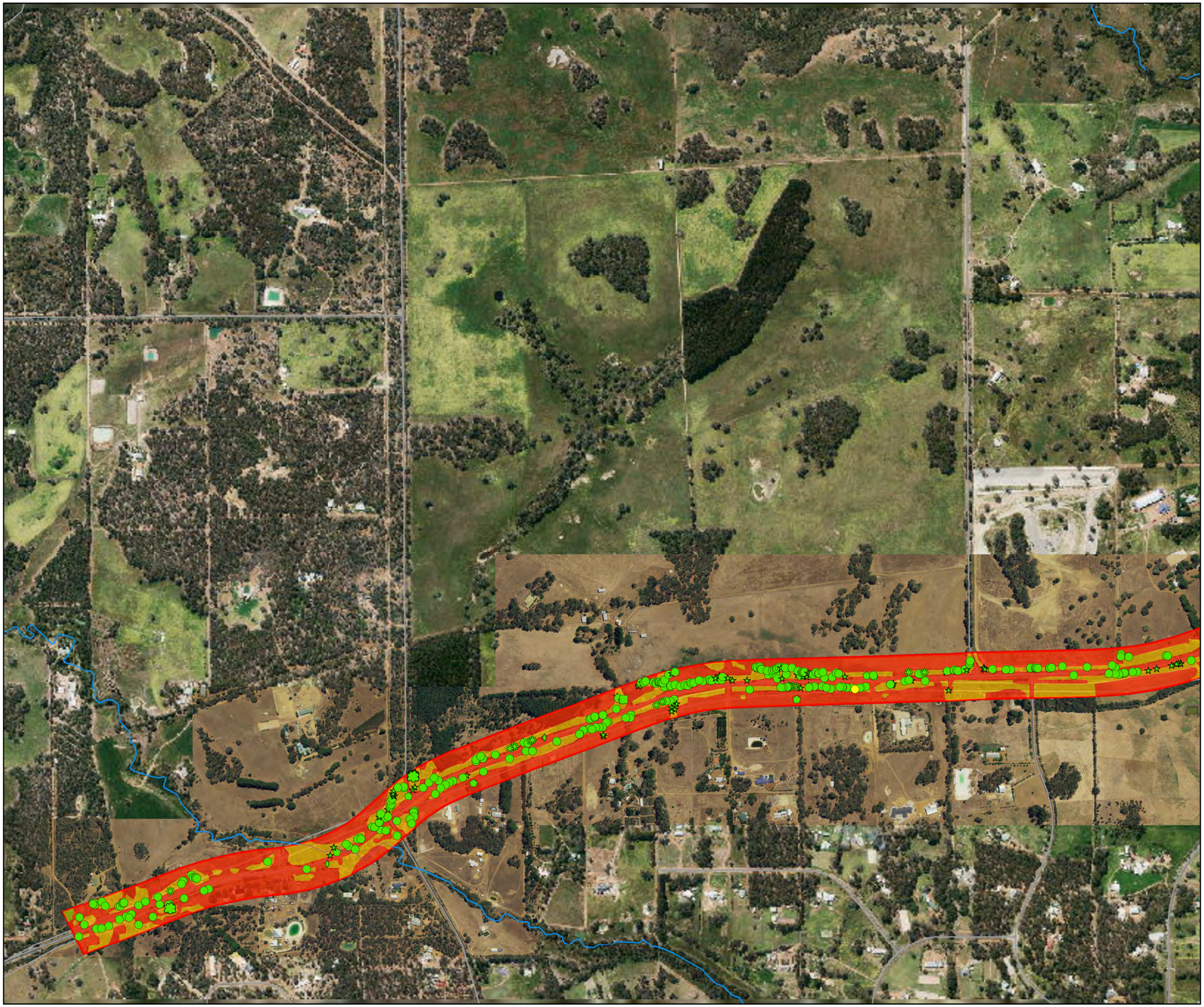

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LEGEND

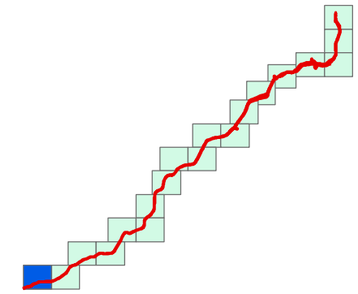
Study Area

Toodyay Trees

- Corymbia calophylla, No Hollows
- Corymbia calophylla, Hollows
- Eucalyptus accedens, No Hollows
- Eucalyptus marginata, No Hollows
- Eucalyptus patens, No Hollows
- Eucalyptus rudis, No Hollows
- Eucalyptus wandoo, No Hollows
- Stag, No Hollows

Baudin's Black Cockatoo Foraging Habitat Quality

- Poor (0 - 3)
- Moderate (4 - 5)
- Good (6 - 8)
- Excellent (9 - 10)



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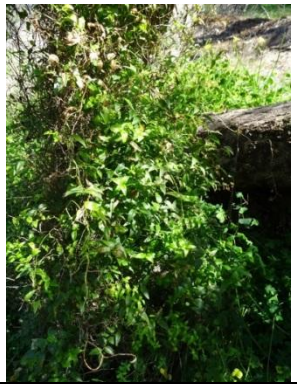
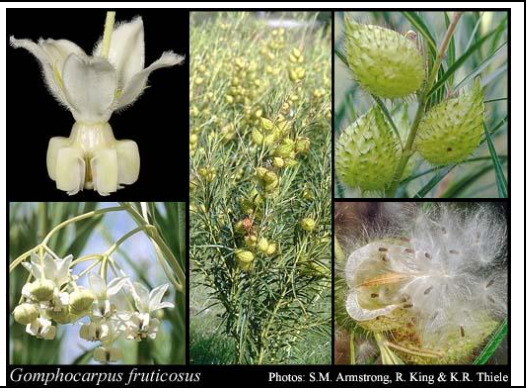
6.11 Declared Pests

Two Declared Pest flora species (*Asparagus asparagoides* / Bridal Creeper and *Gomphocarpus fruticosus* / Narrow Leaf Cotton Bush) and two Declared Pest fauna species (*Oryctolagus cuniculus* / Rabbit and *Vulpes vulpes* / Red Fox) were recorded within the Study area. All four species are considered as a C3 management category under the BAM Act. This means, "Organisms that should have some form of management applied that will alleviate the harmful impact of the organism, reduce the numbers or distribution of the organism or prevent or contain the spread of the organism." Pests are assigned to this category if they are established in WA but it is feasible, or desirable, to manage them in order to limit their damage. Control measures can prevent a C3 pest from increasing in population size or density or moving from an area in which it is established into an area which currently is free of that pest (DAF, 2014).

One of these species, *Asparagus asparagoides,* is also listed as a WoNS (Commonwealth of Australia, 2012). This species is an aggressive vine-like plant that is highly invasive in temperate bushland and coastal ecosystems of Australia (Scott & Batchelor, 2006). This weed grows quickly producing dense, vigorous thickets of foliage that smother native herbs and shrubs, displacing native plants and altering native ecosystems (Scott & Batchelor, 2006). They are difficult to control due to their vegetative reproduction and dispersal, by birds in particular (Gannaway & Virtue, 2006). Declaring a weed a WoNS ensures the proactive attempt to strategically manage these weeds (Commonwealth of Australia, 2012). All landowners and land managers at all levels are responsible for managing WoNS, with States and Territory Governments responsible for legislation, regulation and administration of weeds (Commonwealth of Australia, 2012).

The spatial distribution of Declared Pests is shown in Figure 6.

Table 33 Declared Pests recorded within the Study area

Details	Photographs
Asparagus asparagoides Bridal Creeper Recorded at four locations BAM Act - C3 management category across all of State Weed of National Significance	
Gomphocarpus fruticosus Narrow Leaf Cotton Bush Recorded at one location BAM Act - C3 management category in the Shire of Toodyay Photo source: WAH (1998-)	

7.0 Conclusion

A biological assessment was undertaken for the Toodyay Road Study area in Spring 2015, late Summer 2016, and Spring 2016. The objective was to record and describe the environmental values of the Study area, focussing on assessing environmental constraints for the Project. In summary:

- three fauna species listed as MNES were recorded within the Study area during the field survey. Species comprised the Endangered Carnaby's Black Cockatoo , Vulnerable Forest Red-tailed Black Cockatoo and the Marine listed Rainbow Bee-eater
- seven other conservation significant fauna species have been assessed as likely to utilise fauna habitats within the Study area, although they were not recorded during the survey. These comprise Baudin's Black Cockatoo (*Calyptorhynchus baudinii*), Chuditch (*Dasyurus geoffroii*), Common Sandpiper (*Actitis hypoleucos*), Fork-tailed Swift (*Apus pacificus*), Eastern Great Egret (*Ardea modesta*), Western Brush Wallaby (*Macropus irma*) and Peregrine Falcon (*Falco peregrinus)*
- nine fauna habitats have been mapped within the Study area, these comprise Eucalypt Woodland, Native Shrublands, Heath, Wetland, Planted Vegetation, Main Roads Rehabilitation, Isolated Trees, River / Drainage Channels, and Cleared
- extensive Black Cockatoo potential breeding habitat was identified within the Study area
- extensive Carnaby's Black Cockatoo potential foraging habitat was mapped within the Study area
- extensive Forest Red-tailed Black Cockatoo potential foraging habitat was mapped within the Study area
- seven conservation significant flora species were recorded within the Study area during the 2015 field survey, including *Banksia nivea* subsp. Morangup (P2), *Boronia scabra* subsp. *condensata* (P2), *Caladenia integra* (P4)*, Calytrix oncophylla* (P2)*, Grevillea candolleana* (P2), *Hibbertia montana* (P4) and *Verticordia citrella* (P2)
- there are two Class A nature reserves comprising the Morangup Nature Reserve and an unnamed recreational reserve
- there are two restricted pre-European (1981) vegetation associations that have less than 30% native vegetation remaining in the Jarrah Forest and Avon Wheatbelt bioregions. One of these vegetation associations has less than 30% remaining in the Shire of Toodyay.
- there are three restricted vegetation complexes as mapped by Heddle *et al.* (1980) that have less than 30% native vegetation remaining, including Bindoon (25%), Michibin (22%) and Williams (14%).
- five conservation significant vegetation communities were identified (including CcXpHh, EwGtAl, EwBsLp, EaXpBe, EdBn) that support populations of Priority flora and/or have unique vegetation composition
- four Declared Pest species were recorded within the Study area including two flora species (**Asparagus asparagoides* / Bridal Creeper and **Gomphocarpus fruticosus* / Narrow Leaf Cotton Bush) and two fauna species (*Oryctolagus cuniculus* / Rabbit and *Vulpes vulpes* / Red Fox)
- One WoNS was recorded, **Asparagus asparagoides* (Bridal Creeper)
- Four waterways including the Avon River and Susannah Brook intersect the Study area.

Limitations of the survey included significantly low rainfall experienced in Toodyay in 2015. This may affect species presence and orchid flowering periods, in particular orchids and annual flora species. At the time of undertaking targeted flora searches in September 2016, rainfall was not considered a limitation due to several months of adequate rain. Four of the five Priority flora species were in flower at the time of undertaking the targeted surveys, ensuring easy detection and counting of individuals.

The final design and route of the Toodyay Road upgrade will determine what level of environmental assessment is required and the significance of impacts on environmental values.

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Appendix A

Conservation Categories

Appendix A – Conservation Categories

1.1 Western Australia

Plants and animals that are considered threatened and need to be specially protected because they are under identifiable threat of extinction are listed under the *Wildlife Conservation Act* (WC Act). These categories are defined in Table 1. Threatened species are published as Specially Protected under the Wildlife Conservation Act 1950, and listed under Schedules 1 to 4 of the Wildlife Conservation (Specially Protected Fauna) Notice for Threatened Fauna and Wildlife Conservation (Rare Flora) Notice for Threatened Flora (which may also be referred to as Declared Rare Flora). The assessment of the conservation status of these species is based on their national extent and ranked according to their level of threat using IUCN Red List categories and criteria as outlined in Table 1.

Species that have not yet been adequately surveyed to warrant being listed under Schedule 1 or 2 are added to the Priority Flora or Fauna Lists under Priority 1, 2 or 3. Species that are adequately known, are rare but not threatened, or meet criteria for Near Threatened, or that have been recently removed from the threatened list for other than taxonomic reasons, are placed in Priority 4 and require regular monitoring. Conservation Dependent species and ecological communities are placed in Priority 5. Categories and definitions of Priority Flora and Fauna species are provided in Table 2.

Table 1 Conservation codes for WA flora and fauna listed under the *Wildlife Conservation Act 1950* updated November 2015

Conservation Code	Category
CR	**Critically endangered species** Threatened species considered to be facing an extremely high risk of extinction in the wild. Published as Specially Protected under the Wildlife Conservation Act 1950, in Schedule 1 of the Wildlife Conservation (Specially Protected Fauna) Notice for Threatened Fauna and Wildlife Conservation (Rare Flora) Notice for Threatened Flora.
EN	**Endangered species** Threatened species considered to be facing a very high risk of extinction in the wild. Published as Specially Protected under the Wildlife Conservation Act 1950, in Schedule 2 of the Wildlife Conservation (Specially Protected Fauna) Notice for Threatened Fauna and Wildlife Conservation (Rare Flora) Notice for Threatened Flora.
VU	**Vulnerable species** Threatened species considered to be facing a high risk of extinction in the wild. Published as Specially Protected under the Wildlife Conservation Act 1950, in Schedule 3 of the Wildlife Conservation (Specially Protected Fauna) Notice for Threatened Fauna and Wildlife Conservation (Rare Flora) Notice for Threatened Flora.
EX	**Presumed extinct species** Species which have been adequately searched for and there is no reasonable doubt that the last individual has died. Published as Specially Protected under the Wildlife Conservation Act 1950, in Schedule 4 of the Wildlife Conservation (Specially Protected Fauna) Notice for Presumed Extinct Fauna and Wildlife Conservation (Rare Flora) Notice for Presumed Extinct Flora.
IA	**Migratory birds protected under an international agreement** Birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and the Bonn Convention, relating to the protection of migratory birds. Published as Specially Protected under the Wildlife Conservation Act 1950, in Schedule 5 of the Wildlife Conservation (Specially Protected Fauna) Notice.

Table 2 Conservation codes for WA flora and fauna (DPaW 2015)

Conservation Code	Category
P1	Priority One – Poorly Known Species Species that are known from one or a few collections or sight records (generally less than five), all on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, Shire, Westrail and Main Roads WA road, gravel and soil reserves, and active mineral leases and under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes.
P2	Priority Two – Poorly Known Species Species that are known from one or a few collections or sight records, some of which are on lands not under imminent threat of habitat destruction or degradation, e.g. national parks, conservation parks, nature reserves, State forest, vacant Crown land, water reserves, etc. Species may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes.
P3	Priority Three – Poorly Known Species Species that are known from collections or sight records from several localities not under imminent threat, or from few but widespread localities with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and known threatening processes exist that could affect them.
P4	Priority Four – Rare, Near Threatened and other species in need of monitoring a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These species are usually represented on conservation lands. b) Near Threatened. Species that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable. c) (c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.
P5	Priority Five: Conservation Dependent species Species that are not threatened but are subject to a specific conservation program, the cessation of which would result in the species becoming threatened within five years.

1.2 Commonwealth

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is Australia's central piece of environmental legislation which provides for the listing of nationally Threatened native species and ecological communities, native migratory species and marine species.

Threatened fauna and flora may be listed in any one of seven categories as defined in Section 179 of the EPBC Act. These categories are defined in Table 3.

Table 3 Categories of Species Listed under Schedule 179 of the EPBC Act 1999 [Commonwealth]

Conservation	Code Category
Ex	**Extinct Taxa** which at a particular time if, at that time, there is no reasonable doubt that the last member of the species has died.
ExW	**Extinct in the Wild** Taxa which is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
CE	**Critically Endangered** Taxa which at a particular time if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
E	**Endangered** Taxa which is not critically endangered and it is facing a very high risk of extinction in the wild in the immediate or near future, as determined in accordance with the prescribed criteria.
V	**Vulnerable** Taxa which is not critically endangered or endangered and is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.
CD	**Conservation Dependent** Taxa which at a particular time if, at that time: a) the species is the focus of a specific conservation program the cessation of which would result in the species becoming vulnerable, endangered or critically endangered b) the following subparagraphs are satisfied: i. the species is a species of fish ii. the species is the focus of a plan of management that provides for management actions necessary to stop the decline of, and support the recovery of, the species so that its chances of long term survival in nature are maximised iii. the plan of management is in force under a law of the Commonwealth or of a State or Territory iv. cessation of the plan of management would adversely affect the conservation status of the species.

2.0 Threatened and Priority Ecological Communities

2.1 Western Australia

State listed TECs are not protected under any legislation, rather they are endorsed by the Environment Minister. Categories of TECs are defined in Table 4. Priority Ecological Communities are endorsed by the Environment Minister as having insufficient information available to be considered a TEC, or which are rare but not currently threatened. Categories are described in Table 5.

Table 4 Conservation codes for state-listed Threatened Ecological Communities

Conservation Code	Category
PD	Presumed Totally Destroyed An ecological community that has been adequately searched for but for which no representative occurrences have been located. The community has been found to be totally destroyed or so extensively modified throughout its range that no occurrence of it is likely to recover its species composition and/or structure in the foreseeable future. An Ecological community will be listed as presumed totally destroyed if there are no recent records of the community being extant and either of the following applies (A or B): A) Records within the last 50 years have not been confirmed despite thorough searches of known or likely habitats or B) All occurrences recorded within the last 50 years have since been destroyed
CR	Critically Endangered An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or that was originally of limited distribution and is facing severe modification or destruction throughout its range in the immediate future, or is already severely degraded throughout its range but capable of being substantially restored or rehabilitated. An ecological community will be listed as Critically Endangered when it has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future. This will be determined on the basis of the best available information, by it meeting any one or more of the following criteria (A, B or C): A) The estimated geographic range, and/or total area occupied, and/or number of discrete occurrences since European settlement have been reduced by at least 90% and either or both of the following apply (i or ii): i. geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is imminent (within approximately 10 years); ii. modification throughout its range is continuing such that in the immediate future (within approximately 10 years) the community is unlikely to be capable of being substantially rehabilitated. B) Current distribution is limited, and one or more of the following apply (i, ii or iii): i. geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the immediate future (within approximately 10 years); ii. there are very few occurrences, each of which is small and/or isolated and extremely vulnerable to known threatening processes; iii. there may be many occurrences but total area is very small and each occurrence is small and/or isolated and extremely vulnerable to known threatening processes. C) The ecological community exists only as highly modified occurrences that may be capable of being rehabilitated if such work begins in the immediate future (within approximately 10 years).

Conservation Code	Category
EN	Endangered An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or was originally of limited distribution and is in danger of significant modification throughout its range or severe modification or destruction over most of its range in the near future. An ecological community will be listed as Endangered when it has been adequately surveyed and is not Critically Endangered but is facing a very high risk of total destruction in the near future. This will be determined on the basis of the best available information by it meeting any one or more of the following criteria (A, B, or C). A) The geographic range, and/or total area occupied, and/or number of discrete occurrences since European settlement have been reduced by at least 70% and either or both of the following apply (i or ii): i. the estimated geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is imminent (within approximately 20 years); ii. modification throughout its range is continuing such that in the immediate future (within approximately 20 years) the community is unlikely to be capable of being substantially rehabilitated. B) Current distribution is limited, and one or more of the following apply (i, ii or iii): i. geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the immediate future (within approximately 20 years); ii. there are very few occurrences, each of which is small and/or isolated and extremely vulnerable to known threatening processes; iii. there may be many occurrences but total area is very small and each occurrence is small and/or isolated and extremely vulnerable to known threatening processes. The ecological community exists only as highly modified occurrences that may be capable of being rehabilitated if such work begins in the immediate future (within approximately 20 years).
VU	Vulnerable An ecological community that has been adequately surveyed and is found to be declining and/or has declined in distribution and/or condition and whose ultimate security has not yet been assured and/or a community that is still widespread but is believed likely to move into a category of higher threat in the near future if threatened processes continue or begin operating throughout its range. An ecological community will be listed as Vulnerable when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing a high risk of total destruction or significant modification in the medium to long-term future. This will be determined on the4 basis of the best available information by it meeting any one or more of the following criteria (A, B, or C). A) The ecological community exists largely as modified occurrences that are likely to be capable of being substantially restored or rehabilitated. B) The ecological community may already be modified and would be vulnerable to threatening processes, is restricted in area and/or range and/or is only found at a few locations. C) The ecological community may be still widespread but is believed likely to move into a category of higher threat in the medium or long term future because of existing or impending threatening processes.

Table 5 Categories for Priority Ecological Communities

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

2.2 Commonwealth

Communities can be classified as TECs under the *Environment Protection and Biodiversity Conservation Act 1999*. The EPBC act protects Australia's ecological communities by providing for:

- Identification and listing of ecological communities as threatened
- Development of conservation advice and recovery plans for listed ecological communities
- Recognition of key threatening processes
- Where appropriate, reducing the impact of these processes through threat abatement plans.

Categories of federally listed TECs are described in Table 6.

Table 6 Categories of TECs that are listed under the EPBC Act

Conservation Code	Category
CE	Critically Endangered If, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future.
E	Endangered If, at that time, it is not critically endangered and is facing a very high risk of extinction in the wild in the near future.
V	Vulnerable If, at that time, it is not critically endangered or endangered, and is facing a high risk of extinction in the wild in the medium-term future.

2.3 References

Department of Parks and Wildlife (DPaW), 2015 Conservation Codes for Western Australian Flora and Fauna. Department of Parks and Wildlife, Perth, WA.

Appendix B

Declared Pests

Appendix B Declared Pests

1.1 The BAM Act

Biosecurity is the management of the risk of animal and plant pests and diseases entering, emerging, establishing or spreading in WA to protect the economy, environment and community. Biosecurity is managed under the *Biosecurity and Agriculture Management Act 2007* (BAM Act) which came into effect 1 May 2013. Exotic animals and plants can become an invasive species if they can establish in new areas where local conditions are favourable for their growth. They usually invade as a result of human activities both accidental and deliberate. These invasive species can often have a damaging impact on the natural environment and agriculture, and therefore requires careful management. The Department of Agriculture and Food, Western Australia (DAFWA) has developed an Invasive Species Program which provides the strategic and operational management of serious weeds and pest animals.

The Minister for Agriculture and Food can declare invasive exotic plants and animals as pests under the BAM Act. These species are listed on the Western Australian Organism List (WAOL) and classified in four categories:

- declared pests
- permitted
- prohibited
- permitted requiring a permit.

The Minister can declare an organism as a declared pest if there are reasonable grounds for believing that the organism:

a) has or may have an adverse effect on
    a. another organism in the area
    b. human beings in the area
    c. the environment or part of the environment in an area
    d. agricultural activities, fishing or pearling activities, or related commercial activities carried on or intended to be carried on in the area.

b) May have an adverse effect on any of those things if it were present in the area, or if it were present in the area in greater numbers or to a greater extent.

Under the BAM Act declared pests are placed in one of three categories, as explained in Table 1. Many of the declared pest plant species are also on the list of Weeds of National Significance. This list was compiled to prioritise future management and allocation of resources for weed control. Species were selected based on their invasiveness and impact characteristics, potential and current area of spread and their environmental, industrial or socioeconomic impacts.

Under the BAM Act, local government authorities can prescribe any plant, other than a declared plant, to be a pest plant. Local law can be used to assist in pest plant management by enforcing that the owner or occupier of the land can be held financially responsible for the management of any pest plant.

Department of Parks and Wildlife (DPaW) recognise weeds as one of the most significant threats to biodiversity as they outcompete native species for resources, reduce natural diversity by smothering native plants, displace and replace native plants, and alter fire regimes. DPaW have prioritised their focus on infestations of species considered to be high impact, rapidly invasive and still at a population size that can feasibly be eradicated or contained to a manageable size. DPaW's rankings are provided to help landholders, community groups and private enterprises manage weeds that may impact on the natural environment. Weed species are listed according to the region they occur in and are ranked as very high, high, medium, low, negligible, or further assessment required. Furthermore, an example of management actions that may be appropriate for a species of that ranking is provided (DPaW, 2013).

Table 1 Declared Pest categories under the BAM Act

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

Appendix C

Survey Scales

Appendix C Survey Scales

1.0 Desktop Assessment

Table 1 Categories of likelihood of occurrence for species and communities

Likelihood Category	Flora	Fauna	Communities
Likely to occur	Habitat is present in the Study area and the species has been recorded in close proximity to the Study area	Study area is within the known distribution of the species, habitat is present in the Study area and the species has been recorded in close proximity to the Study area	Known occurrences of the community in close proximity to the Study area. Vegetation looks the same within the known occurrence and Study area based on aerial imagery. Geographic location is similar to the Study area
May occur	Habitat may be present and/or the species has been recorded in close proximity to the Study area	Study area is within the known distribution of the species, marginal habitat may be present and/or the species has been recorded in close proximity to the Study area	Known occurrence of the community in the local area, and/or vegetation looks the same within known occurrence and Study area based on aerial imagery. Geographic location is similar to the Study area
Unlikely to occur	No suitable habitat is present and the species has not been recorded in close proximity to the Study area	Study area is outside the known distribution for the species, or no suitable habitat is present and the species has not been recorded in close proximity to the Study area	Known occurrence of the community in close proximity to the project area however geographic location does not occur in Study area

2.0 Ecological Community Mapping

Table 2 Braun-Blanquet scale

Scale	Range of cover
5	75-100
4	50-75
3	25-50
2	5-25
1	<5 numerous individuals
+	<5 few individuals
R	Solitary, with small cover

3.0 Condition Rating

Table 3 Bushland condition ratings

Descriptor	Explanation
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

Descriptor	Explanation
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 of 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

Source: Keighery (1994).

4.0 Black Cockatoo Habitat Quality Assessment

Table 4 Habitat quality definitions

Habitat quality	Definition
Poor: 0-3	A combination of the following factors (not all must apply): • Site condition - Low diversity of host/food species - Poor structure and condition of vegetation - Lack of relevant features on site or in low numbers (Breeding trees, water sources) • Site context - Low connectivity to other suitable remnants - Low importance of site in relation to overall species population - Large number of threats occur on the site • Species stocking rate - Species may be modelled but not confirmed to occur in the regional area
Moderate: 4-5	A combination of the following factors (not all must apply): • Site condition - Low to medium diversity of host/food species - Low to medium structure and condition of vegetation at site - Moderate number of relevant habitat features • Site context - Moderate connectivity to other suitable remnants - Site population is of moderate importance to overall population - Medium level of threats occur at site • Species stocking rate - Species is either modelled in the regional area or confirmed at the local level
Good: 6-8	A combination of the following factors (not all must apply): • Site condition - High diversity of host/food species - Moderate to excellent structure and condition of vegetation at site - High number of relevant habitat features • Site context - Good connectivity to other suitable remnants - Site population is of high importance to overall population - Low level of threats occur at site • Species stocking rate - Species is either modelled in the regional area or confirmed at the local level

Habitat quality	Definition
Excellent: 9-10	A combination of the following factors (not all must apply): • Site condition - Excellent diversity of host/food species - Excellent structure and condition of vegetation at site - High number of relevant habitat features • Site context - Good connectivity to other suitable remnants - Site population is of high importance to overall population - None or few level of threats occur at site • Species stocking rate - Species is either modelled in the regional area or confirmed at the local level

Appendix D

Desktop Flora Results

Appendix D Desktop Flora Results

Species	Conservation Code	Habitat	Likelihood
Acacia aphylla	EPBC & WC: VU	This species is largely associated with laterite and granite outcrops on hillsides.Recorded in 2013 on flats with brown-red lateritic soils in disturbed roadside vegetation.	May
Acacia oncinophylla subsp. *oncinophylla*	P3	Shrub with mini-ritchi bark. Flowers august to October. Gound on granitic soils.	May
Acacia trinalis	P1	Brown sand, clay loam. Salt lakes & flats, swampy areas.	Unlikely
Adenanthos cygnorum subsp. *chamaephyton*	P3	Grey sand and lateritic gravel.	May
Anigozanthos humilis subsp. *chrysanthus*	P4	Fl. yellow, Jul to Oct. Grey or yellow sand.	May
Anthocercis gracilis	EPBC & WC: VU	Sandy or loamy soils and granitic outcrops.	May
Asterolasia grandiflora	P4	Lateritic soils, clay over granite. Breakaways and hills. Recorded in 1990 and 1999	May
Banksia nivea subsp. Morangup (M. Pieroni 94/2)	P2	Non-lignotuberous shrub, 0.15-1.5 m high. Fl. cream-yellow-orange-pink/red-brown, Apr.	Likely
Beaufortia purpurea	P3	Erect or spreading shrub, 0.3-1.5 m high. Fl. red-purple, Oct to Dec or Jan to Feb. Lateritic or granitic soils. Rocky slopes.	Known
Boronia scabra subsp. *condensata*	P2	Erect shrub, 0.25-0.7 m high, flowers 4-merous, cymes sessile, staminal filaments tuberculate. Fl. pink, Aug. Sandy clay or gravel. Upper slopes, edges of lateritic breakaways.	May
Caladenia huegelii	EPBC: EN, WA: CE	Caladenia huegelii flowers from September to October and is thought to fruit in the same season. The species dies back to underground tubers over summer. *Caladenia huegelii* grows in well-drained, deep sandy soils in low mixed woodlands of Coast Banksia (*Banksia attenuata*), Firewood Banksia (*B. menziesii*), Holly-leaved Banksia (*Banksia ilicifolia*), Western Sheoak (*Allocasuarina fraseriana*) and Jarrah (*Eucalyptus marginata*). It tends to favour areas of lush undergrowth. The species growth is supressed by weed invasion.	Unlikely

Species	Conservation Code	Habitat	Likelihood
Caladenia integra	P4	Found between Tenterden and Clackline growing under *Allocasuarina huegeliana* predominantly on and around the margins of granite outcrops and sometimes in open *Eucalyptus wandoo* woodland (Brown *et al.,* 2013)	May
Calytrix oncophylla	P2	Shrub, 0.4-0.8 m high. Fl. purple-blue, Sep to Nov. Stony loam. Lateritic breakaways.	May
Chordifex chaunocoleus	P4	Grey, siliceous or peaty sand, well to poorly drained. Drainage lines, depressions.	Likely
Cyanicula ixioides subsp. *ixioides*	P4	Laterite and gravel.	Unlikely
Cyathochaeta teretifolia	P3	Grey sand, sandy clay. Swamps, creek edges.	May
Darwinia pimelioides	P4	Loam, sandy loam. Granite outcrops.	May
Diplolaena andrewsii	WA: VU	Loam and clay soils. Granite outcrops and hillsides.	May
Drosera occidentalis subsp. occidentalis	P4	Sandy and clay soils in swamps and wet depressions.	Unlikely
Eremaea blackwelliana	P4	White sand. Sandy depressions, gentle hillside.	Likely
Eucalyptus loxophleba x wandoo	P4	One location, recorded in 1987.	May
Gastrolobium crispatum	P1	Yellow or brown sandy loam and red laterite soils. Steep gullies, slopes, ridges and breakaways.	Unlikely
Gastrolobium nudum	P2	Red-brown clay, brown loam, gravel, laterite, granite. Flats, slopes, hilltops, ridges, valleys, breakaways.	Unlikely
Grevillea bracteosa subsp. *bracteosa*	WA: EN	No information available. No records in the vicinity.	Unlikely
Grevillea candolleana	P2	Laterite, lateritic loam. Hillsides.	Known
Grevillea christineae	EPBC: EN WA: EN	Amongst tall (sclerophyll) shrubland; in rocky or stony soil, or sand, or loam; occupying breakaways.	May

Species	Conservation Code	Habitat	Likelihood
Grevillea erinacea	P3	Amongst medium trees, or low trees; in gravelly soil, or sand; occupying heathlands, sandplains.	Unlikely
Grevillea flexuosa	EPBC & WC: VU	Amongst medium trees, or low trees, or tall (sclerophyll) shrubland; in rocky or stony soil, or sand; occupying granite hill, breakaway.	Likely
Grevillea florida	P3	Erect shrub, to 0.9 m high. Fl. cream-yellow, Jul to Sep. Sand, sandy clay, gravel, laterite. Sandplain, slopes, road verges.	Likely
Grevillea pimeleoides	P4	Amongst medium trees, or tall (sclerophyll) shrubland, or low (sclerophyll) shrubland; in gravelly soil, or loam, or clay.	May
Halgania corymbosa	P3	Gravelly soils, soils over granite.	Unlikely
Hemigenia rigida	P1	Sandy soils, lateritic gravelly soils. Hillslopes, granite outcrops, flats, ironstone ridges.	Likely
Hibbertia montana	P4	Loam over granite, lateritic soils, gravel. Granite rocks, lateritic ridges & boulders, hills.	Likely
Isopogon drummondii	P3	White, grey or yellow sand, often over laterite.	Unlikely
Juncus meianthus	P2	Black sand, sandy clay. Creeks, seepage areas.	Unlikely
Lasiopetalum trichantherum	P2	One location, recorded in 2001.	Unlikely
Leucopogon sp. Bindoon (F. Hort 2766)	P2	Brown, yellow, white grey sandy clay, brown sandy clay loam, yellow clay, gravel, laterite. Rock outcrops, breakaways, scree slopes drainage lines, gullies.	Unlikely
Meionectes tenuifolia	P3	No information available. No records in the vicinity.	Unlikely
Millotia tenuifolia var. laevis	P2	Granite or laterite soils	Unlikely
Oxymyrrhine coronata	P4	No information available. No records in the vicinity.	May
Persoonia sulcata	P4	Lateritic or granitic soils.	May
Pithocarpa corymbulosa	P3	Gravelly or sandy loam. Amongst granite outcrops.	May
Schoenus sp. Toodyay (G.J. Keighery & N.	P1	Brown loam over gravel. Flat upland areas.	May

Species	Conservation Code	Habitat	Likelihood
Gibson 2918)			
Stylidium cymiferum	P3	Brown loam over laterite. Uplands, Wandoo woodland.	May
Tetratheca pilifera	P3	Gravelly soils.	Known
Tetratheca retrorsa	P3	Lateritic breakaways	Likely
Tetratheca sp. Granite (S. Patrick SP1224)	P3	Clay, moist loam, clayey sand. Granite boulders.	Unlikely
Thelymitra dedmaniarum	EPBC: EN WA: CR	This species inhabits open wandoo woodland on red-brown sandy loam, associated with dolerite and granite outcropping. Associated vegetation consists of *Eucalyptus wandoo, E. accedens* and *Corymbia calophylla*, over low scrub of *Acacia pulchella, A. saligna, Calothamnus quadrifidus, Melaleuca radula* and *Hakea lissocarpha*.	May
Thysanotus anceps	P3	White or grey sand, lateritic gravel, laterite.	Unlikely
Thysanotus glaucus	P4	White, grey or yellow sand, sandy gravel.	Unlikely
Thysanotus isantherus	P4	Granite.	May
Verticordia citrella	P2	Gravelly loam or sand. Low-lying damp areas, swamps in open shrubland. Only known from single locality north-east of Noble Falls.	Known
Verticordia lindleyi subsp. *lindleyi*	P4	Sand, sandy clay. Winter-wet depressions.	Known
Verticordia huegelii var. *tridens*	P3	Sandy or gravelly loam. Winter-wet areas, low hills.	May
Verticordia serrata var. *linearis*	P3	White sand, gravel. Open woodland.	May

Appendix E

Desktop Fauna Results

Appendix E - Desktop Fauna Results

The following table details those fauna species that were identified in the Desktop Assessment from the DPaW Threatened Fauna Database Search and the EPBC Protected Matters Search tool. NatureMap was also used to inform on extra location data and species distribution in WA.

Species	Source		Conservation Status		No. of records	Latest Record	Habitat	Likelihood
	EPBC	DPaW	Commonwealth	State				
Birds								
Actitis hypoleucos - Common Sandpiper		+	Migratory	IA	9	2011	The Common Sandpiper is widespread throughout Australia, with few important sites on the continent. They visit Australia during the non-breeding season. Preferred habitat is coastal wetlands with muddy margins or rocky shores (DotE, 2015).	May overfly the Project Area
Apus pacificus - Fork-tailed Swift	+	+	Migratory	IA	2	2000	The Fork-tailed Swift is almost exclusively aerial, and a non-breeding visitor to Australia (DotE, 2015). They are rarely seen roosting on land.	May overfly the Project Area
Ardea modesta - Eastern Great Egret	+	+	Migratory	IA	49	2013	The Eastern Great Egret is a large bird (~100cm, 1kg) with white plumage and black or yellow bill. The species occurs individually or in small groups when foraging, but roosts in large flocks. Non-breeding individuals have been recorded throughout Australia. Almost all breeding colonies are located in the Top End of the Northern Territory (DotE, 2015). Non breeding individuals have been recorded across much of the Australian continent (DotE, 2015). The Great Egret occupies a wide variety of wet habitats including freshwater wetlands, dams, flooded pastures, estuarine mudflats, mangroves and reefs (Morcombe, 2003). The species is also known to visit shallows of rivers, sewage ponds and irrigation areas (Pizzey & Knight, 2007).	May overfly the Project Area

Species	Source		Conservation Status		No. of records	Latest Record	Habitat	Likelihood
	EPBC	DPaW	Commonwealth	State				
Calyptorhynchus banksii naso - Forest Red-tailed Black Cockatoo	+	+	Vulnerable	VU	2	2010	Requires tree hollows to nest and breed, occurs in forests of Karri (*E. diversicolor*), Jarrah (*E. marginata*) and Marri (*Corymbia calophylla*), with flocks moving out onto the Swan Coastal Plain in search of food from exotic trees such as White Cedar (Johnstone et al, 2010). Foraging habitat for the species consists of Jarrah and Marri woodlands and forest throughout its range. Has become more common in the Metropolitan area in the past few years.	Likely to occur
Calyptorhynchus baudinii - Baudin's Black Cockatoo	+	+	Vulnerable	EN	54	2013	Habitat critical to the survival of this species includes forests of Karri (*E. diversicolor*), Jarrah (E. *marginata*) and Marri (*C. calophylla*), in areas of 600 mm average rainfall per year. Individuals typically move north through the Perth region from March to May and south through the Perth region from August to October. This species ranges north to Gidgegannup and Hoddy Well and west to the Eastern Strip of the Swan Coastal Plain including West Midland in the north, heading south through Armadale, Byford and south and towards the coast until Lake Clifton where it continues to hug the coastline to east of Albany (Johnstone *et al,* 2010).	Likely to occur
Calyptorhynchus latirostris - Carnaby's Black Cockatoo	+	+	Endangered	EN	188	2014	Carnaby's Cockatoo is a postnuptial nomad and typically moves west soon after breeding. The species nests in hollows of smooth-barked eucalypts, particularly Salmon Gum (*Eucalyptus salmonophloia)* and Wandoo (*E. Wandoo)* but is not limited to these eucalypts. Diet consists of an array of Proteaceous and Eucalypt species prevalent on the Swan Coastal Plain. Foraging habitat, including *banksia* woodlands, is considered to be habitat critical to the survival of the species (Johnstone *et al,* 2010).	Likely to occur
Falco peregrinus - Peregrine Falcon		+	-	OS	25	2013	A well-known falcon, the Peregrine inhabits a vast array of environs in Australia. Usually uncommon and migratory (Pizzey & Knight, 2007). This species lays its eggs in recesses of cliff faces, tree hollows or large abandoned nests.	May overfly the Project Area

Species	Source		Conservation Status		No. of records	Latest Record	Habitat	Likelihood
	EPBC	DPaW	Commonwealth	State				
Ixobrychus flavicollis australis - Black Bittern (southwest pop)		+	-	Priority 1	1	1948	The Australian Black Bittern is a sooty dark Bittern with a slender head, dark stiletto like bill and yellowish on the underside. The known range extends from the Pilbara across to far eastern Victoria and is thought to be extinct from the south-west of Western Australia (Pizzey & Knight, 2007).	Unlikely to occur
Leipoa ocellata - Malleefowl	+		Vulnerable	VU	-	No Records	Malleefowl habitat requirements are quite specific. The species requires unburnt mallee and woodland with low scrub and abundant litter to use in nesting mounds (Morcombe, 2003).	Unlikely to occur
Merops ornatus - Rainbow Bee-eater	+	+	Migratory	IA	195	2012	The Rainbow Bee-eater is a common species which occupies numerous habitats including open woodlands with sandy loamy soil, sand ridges, sandpits, riverbanks, road cuttings, beaches, dunes, cliffs, mangroves and rainforests. It is possible that this species will occupy open woodland areas within the survey area. The Rainbow Bee-eater avoids heavy forest that would hinder the pursuit of its insect prey (Morcombe, 2003).	Likely to occur
Motacilla cinerea - Grey-Wagtail	+		Migratory	IA	-	No Records	The Grey Wagtail is a scarce but regular visitor to northern Australia, typically arriving in October and leaving in March. The species is most commonly associated with water and are found across a wide variety of wetlands, watercourses and on the banks of lakes and marshes (Australian Government, 2015)	Unlikely to occur
Oxyura australis - Blue-billed Duck		+	-	Priority 4	4	2012	The Blue-billed Duck is endemic to south eastern and south western Australia. It prefers deep water in large permanent wetlands and swamps with aquatic vegetation. This species of duck is fully aquatic and rarely comes onto land (NSW Government, 2015)	May occur

Species	Source		Conservation Status		No. of records	Latest Record	Habitat	Likelihood
	EPBC	DPaW	Commonwealth	State				
Pandion haliaetus - Osprey	+		Migratory	IA	-	No Records	The Osprey is a medium sized raptor and is found along the coast from Albany north to the state border (DotE, 2015).	Unlikely to occur
Rostratula australis - Australian Painted Snipe	+		Endangered	EN	-	No Records	The Painted Snipe generally inhabits shallow terrestrial freshwater (occasionally brackish) wetlands, including temporary and permanent lakes, swamps and claypans (DotE, 2015) This species is a very rare summer visitor to the south-west of Western Australia. Breeding habitat in Western Australia is not quite known however a nest located near Moora was located in a tussock beside a swamp (Johnstone & Storr, 1998).	Unlikely to occur
Tringa nebularia - Common Greenshank		+	Migratory	IA	2	2010	The Common Greenshank is a largely built wader, weighing up to 190 g for both sexes. The species is found in inland wetlands and sheltered coastal habitats (DotE, 2015).	Unlikely to occur
Tyto novaehollandiae novaehollandiae - Masked Owl (SW ssp)		+	-	Priority 3	1	1971	The Masked Owl occupies a variety of habitats including forests, open woodlands, farmlands with large trees, paperbark woodlands and caves. This species generally occurs in coastal mainland Australia and though widespread it is typically locally uncommon (Pizzey & Knight, 2007).	Unlikely to occur
Invertebrates								
Idiosoma nigrum - Shield-backed Trapdoor Spider	+	+	Vulnerable	VU	4	1993	This species can be found in burrows of heavy clay soils in areas of open York Gum (*Eucalyptus loxophleba)*, Salmon Gum (*E. salmonophloia)* and Wandoo *E. wandoo)* woodland, where *Acacia acuminata* forms a sparse understorey (Avon Catchment Council, 2007). Roadside vegetation and other habitats within the Project area are not expected to provide quality habitat for this species.	Unlikely to occur
Westralunio carteri - (bivalve)		+	-	VU	5	1971	This bivalve species is the only mussel species known to inhabit freshwater systems of south-west Western Australia (Klunzinger *et al,* 2012).	Unlikely to occur

Species	Source		Conservation Status		No. of records	Latest Record	Habitat	Likelihood
	EPBC	DPaW	Commonwealth	State				
Mammals								
Bettongia penicillata ogilbyi - Woylie	+		Endangered	CR	-	No Records	The Woylie previously occurred over large areas of western, central and eastern Australia, however naturally occurring extant populations are now restricted to three small reserves in the Western Australian wheatbelt (Van Dyck & Strahan, 2008). Isolated populations also exist in in several locations in the state following reintroduction trials under the Western Shield Program (DotE, 2015).	Unlikely to occur
Dasyurus geoffroii - Chuditch, Western Quoll	+	+	Vulnerable	VU	4	2009	Following European settlement the range of this species contracted dramatically, from much of the continent to a small area in the south west. It currently only occurs in areas dominated by sclerophyll forest or drier woodland, heath and mallee shrubland (Van Dyck & Strahan, 2008). The majority of records are found in the contiguous Jarrah forests of the south west of Western Australia (DotE, 2015).	May occur
Macropus eugenii derbianus - Tammar Wallaby		+	-	Priority 5	2	2004	The Tamar Wallaby is thought to have persisted in disjunct mainland populations for up to 10,000 years however given the large scale vegetation clearing since the arrival of Europeans, the range of this species has contracted. In the south-west of Western Australia, this species occurs in several reserves in the wheatbelt and national parks in the Great Southern (Van Dyck & Strahan, 2008).	Unlikely to occur
Macropus irma - Western Brush Wallaby		+	-	Priority 4	6	2010	The Western Brush-wallaby occurs in the south-west of Western Australia. Its preferred habitat consists of open sclerophyll forest or woodland and favours open flats over scrub thickets. It is also found in larger areas of mallee and heathland in the wheat belt and is uncommon in wet sclerophyll forest (Van Dyck & Strahan, 2008).	Likely to occur

Species	Source		Conservation Status		No. of records	Latest Record	Habitat	Likelihood
	EPBC	DPaW	Commonwealth	State				
Macrotis lagotis - Bilby, Dalgyte, Ninu		+	Vulnerable	VU	2	1930	The Greater Bilby is the sole surviving member of the sub-family Thylacomyinae (Family Peramelidae) (Pavey, 2006). It is a slight, rabbit-sized marsupial with soft grey fur covering most of the body, large ears and a long, pointed snout. The Bilby occupies arid to semi-arid woodlands and hummock grasslands in the north of Australia. The Bilby formerly occupied much of the Australian mainland however has experienced a vast contraction in its range (Van Dyck & Strahan, 2008).	Unlikely to occur
Notomys longicaudatus - Long-tailed Hopping Mouse, Koolawa		+	Extinct	EX	1	na	Extinct and will not occur	Will not occur
Petrogale lateralis lateralis - Black-flanked Rock-wallaby	+	+	Vulnerable	EN	1	2005	The Black-footed Rock-wallaby is a widespread species however has suffered a vast contraction in its former range, thought to be due to fox predation (Van Dyck & Strahan, 2008). Extant populations occur in few locations in the wheatbelt region, Barrow Island, Salisbury Island, Cape Range and the Little Sandy Desert (DotE, 2015).	Unlikely to occur
Phascogale calura - Red-tailed Phascogale	+		Endangered	CD	-	No Records	Extant populations of the Red-tailed Phascogale are still found in native vegetation in the Wheatbelt of Western Australia. They are recorded north to Beverly (DotE, 2015). This species inhabits reserves in this region comprised of typical woodland communities.	Unlikely to occur

Species	Source		Conservation Status		No. of records	Latest Record	Habitat	Likelihood
	EPBC	DPaW	Commonwealth	State				
Phascogale tapoatafa ssp. (WAM M434) - Brush-tailed Phascogale, Wambenger		+	-	VU	1	2013	The Brush-tailed Phascogale is one of the most arboreal dasyurids and rarely feeds on the ground. The species is distinguished by a large black tail. The species formerly occupied all the dry sclerophyll forests and woodlands of temperate and tropical Australia. The species suffered a drastic reduction in habitat due to clearing of prime habitat for agriculture and now prefers open forest with sparse groundcover. It has been observed in habitats ranging from mallee to rainforest (Van Dyck & Strahan, 2008).	Unlikely to occur
Reptiles								
Morelia spilota imbricata - Western Carpet Python		+	-	OS	2	2013	The South-west Carpet Python occurs in large undisturbed remnant bushland of various habitats including *Banksia* woodland, Eucalypt woodland, forests, dense coastal scrub, granite and limestone crops and along watercourses (Bamford, 2009b).	May occur

Appendix F

TEC Verification Results

Appendix F TEC Verification Results

Observation No.	1
Location	GDA Zone 50 450658 mE 6507147 mN
Site notes	Trees over weeds
TEC Assessment Result	Key diagnostic features not met, no native understorey present. Condition category is therefore not applicable (however still shows criteria that would be applicable).

Key Diagnostic Features – the patch must show the following key diagnostic features	**Y/N**
Distribution of the ecological community is limited to one of the following IBRA regions: - Avon Wheatbelt – subregions AVW01 Merredin and AVW02 Katanning; - Mallee – MAL02 Western Mallee only; - Jarrah Forest – outlying patches in the eastern parts of JAF01 Northern Jarrah Forests and JAF02 Jarrah Forests adjacent to the Avon Wheatbelt that are off the Darling Range, and receive less than 600 mm mean annual rainfall.	Y
Community is a woodland in which the minimum crown cover of the tree canopy in a mature woodland is 10%	Y
Key species of the tree canopy are species of *Eucalyptus* as identified in Table 2a of Commonwealth of Australia (2016).	Y Trees included *E. loxophleba*
A native understorey is present but is of variable composition, being a combination of grasses, other herbs and shrubs, as specified in Table A1 of Appendix A of the Approved Conservation Advice	N Species included: *Oxalis pes-caprae, Avena barbata, Ehrharta calycina, Lolium interstans, Romulea rosea*.

Cover of weeds AND	**Mature trees AND**	**Min. patch size (non-roadside patches) OR**	**Min. patch width (roadsides only)**
Category A: Patches likely to correspond to a condition of Pristine / Excellent / Very good (Keighery, 1994) or a High RCV (RCC, 2014).			
0-30% of total understorey vegetation cover	May be present or absent	2 ha+	5 m+
Category B: Patches likely to correspond to a condition of Good (Keighery, 1994) or a Medium-High RCV (RCC, 2014), AND retains important habitat features.			
30-50%	Present with at least 5 trees/0.5ha	2 ha+	5 m+
Category C: Patches likely to correspond to a condition of Good (Keighery, 1994) or a Medium-High RCV (RCC, 2014).			
30-50%	Either absent or LESS THAN 5 trees/0.5ha	5 ha+	5 m+
Category D: Patches likely to correspond to a condition of Degraded to Good (Keighery, 1994) or a Medium-Low to Medium-High RCV (RCC, 2014) BUT retains important habitat features.			
More than 50-70%	Present with at least 5 trees/0.5ha	5 ha+	5 m+

Plate 1 TEC Assessment observation 1

Observation No.	2
Location	GDA Zone 50 450507 mE 6507348 mN
Site notes	Trees over weeds
TEC Assessment Result	Key diagnostic features not met, no native understorey present. Condition category is therefore not applicable (however still shows criteria that would be applicable).

Key Diagnostic Features – the patch must show the following key diagnostic features	**Y/N**
Distribution of the ecological community is limited to one of the following IBRA regions: - Avon Wheatbelt – subregions AVW01 Merredin and AVW02 Katanning; - Mallee – MAL02 Western Mallee only; - Jarrah Forest – outlying patches in the eastern parts of JAF01 Northern Jarrah Forests and JAF02 Jarrah Forests adjacent to the Avon Wheatbelt that are off the Darling Range, and receive less than 600 mm mean annual rainfall.	Y
Community is a woodland in which the minimum crown cover of the tree canopy in a mature woodland is 10%	Y
Key species of the tree canopy are species of *Eucalyptus* as identified in Table 2a of Commonwealth of Australia (2016).	Y Trees included *E. loxophleba* and some *E. rudis*
A native understorey is present but is of variable composition, being a combination of grasses, other herbs and shrubs, as specified in Table A1 of Appendix A of the Approved Conservation Advice	N Species included *Oxalis pes-caprae, Avena barbata, Ehrharta calycina, Arctotheca calendula*.

Cover of weeds AND	**Mature trees AND**	**Min. patch size (non-roadside patches) OR**	**Min. patch width (roadsides only)**
Category A: Patches likely to correspond to a condition of Pristine / Excellent / Very good (Keighery, 1994) or a High RCV (RCC, 2014).			
0-30% of total understorey vegetation cover	May be present or absent	2 ha+	5 m+
Category B: Patches likely to correspond to a condition of Good (Keighery, 1994) or a Medium-High RCV (RCC, 2014), AND retains important habitat features.			
30-50%	Present with at least 5 trees/0.5ha	2 ha+	5 m+
Category C: Patches likely to correspond to a condition of Good (Keighery, 1994) or a Medium-High RCV (RCC, 2014).			
30-50%	Either absent or LESS THAN 5 trees/0.5ha	5 ha+	5 m+
Category D: Patches likely to correspond to a condition of Degraded to Good (Keighery, 1994) or a Medium-Low to Medium-High RCV (RCC, 2014) BUT retains important habitat features.			
More than 50-70%	Present with at least 5 trees/0.5ha	5 ha+	5 m+

Plate 2 TEC Assessment observation 2

Observation No.	3
Location	GDA Zone 50 450398 mE 6507602 mN
Site notes	Trees over weeds
TEC Assessment Result	Key diagnostic features not met, lacking suitable tree species and native understorey. Condition category is therefore not applicable (however still shows criteria that would be applicable).

Key Diagnostic Features – the patch must show the following key diagnostic features	**Y/N**
Distribution of the ecological community is limited to one of the following IBRA regions: - Avon Wheatbelt – subregions AVW01 Merredin and AVW02 Katanning; - Mallee – MAL02 Western Mallee only; - Jarrah Forest – outlying patches in the eastern parts of JAF01 Northern Jarrah Forests and JAF02 Jarrah Forests adjacent to the Avon Wheatbelt that are off the Darling Range, and receive less than 600 mm mean annual rainfall.	Y
Community is a woodland in which the minimum crown cover of the tree canopy in a mature woodland is 10%	Y
Key species of the tree canopy are species of *Eucalyptus* as identified in Table 2a of Commonwealth of Australia (2016).	N Species included *Acacia acuminata* and *E. rudis.*
A native understorey is present but is of variable composition, being a combination of grasses, other herbs and shrubs, as specified in Table A1 of Appendix A of the Approved Conservation Advice	N

Cover of weeds AND	**Mature trees AND**	**Min. patch size (non-roadside patches) OR**	**Min. patch width (roadsides only)**
Category A: Patches likely to correspond to a condition of Pristine / Excellent / Very good (Keighery, 1994) or a High RCV (RCC, 2014).			
0-30% of total understorey vegetation cover	May be present or absent	2 ha+	5 m+
Category B: Patches likely to correspond to a condition of Good (Keighery, 1994) or a Medium-High RCV (RCC, 2014), AND retains important habitat features.			
30-50%	Present with at least 5 trees/0.5ha	2 ha+	5 m+
Category C: Patches likely to correspond to a condition of Good (Keighery, 1994) or a Medium-High RCV (RCC, 2014).			
30-50%	Either absent or LESS THAN 5 trees/0.5ha	5 ha+	5 m+
Category D: Patches likely to correspond to a condition of Degraded to Good (Keighery, 1994) or a Medium-Low to Medium-High RCV (RCC, 2014) BUT retains important habitat features.			
More than 50-70%	Present with at least 5 trees/0.5ha	5 ha+	5 m+

Plate 3 TEC Assessment observation 3

Observation No.	4
Location	GDA Zone 50 450335 mE 6507780 mN
Site notes	Trees over weeds
TEC Assessment Result	Key diagnostic features not met, lacking suitable tree species and native understorey. Condition category is therefore not applicable (however still shows criteria that would be applicable).

Key Diagnostic Features – the patch must show the following key diagnostic features	**Y/N**
Distribution of the ecological community is limited to one of the following IBRA regions: - Avon Wheatbelt – subregions AVW01 Merredin and AVW02 Katanning; - Mallee – MAL02 Western Mallee only; - Jarrah Forest – outlying patches in the eastern parts of JAF01 Northern Jarrah Forests and JAF02 Jarrah Forests adjacent to the Avon Wheatbelt that are off the Darling Range, and receive less than 600 mm mean annual rainfall.	Y
Community is a woodland in which the minimum crown cover of the tree canopy in a mature woodland is 10%	Y
Key species of the tree canopy are species of *Eucalyptus* as identified in Table 2a of Commonwealth of Australia (2016).	N Species included *Acacia acuminata* and *E. rudis.*
A native understorey is present but is of variable composition, being a combination of grasses, other herbs and shrubs, as specified in Table A1 of Appendix A of the Approved Conservation Advice	N

Cover of weeds AND	**Mature trees AND**	**Min. patch size (non-roadside patches) OR**	**Min. patch width (roadsides only)**
Category A: Patches likely to correspond to a condition of Pristine / Excellent / Very good (Keighery, 1994) or a High RCV (RCC, 2014).			
0-30% of total understorey vegetation cover	May be present or absent	2 ha+	5 m+
Category B: Patches likely to correspond to a condition of Good (Keighery, 1994) or a Medium-High RCV (RCC, 2014), AND retains important habitat features.			
30-50%	Present with at least 5 trees/0.5ha	2 ha+	5 m+
Category C: Patches likely to correspond to a condition of Good (Keighery, 1994) or a Medium-High RCV (RCC, 2014).			
30-50%	Either absent or LESS THAN 5 trees/0.5ha	5 ha+	5 m+
Category D: Patches likely to correspond to a condition of Degraded to Good (Keighery, 1994) or a Medium-Low to Medium-High RCV (RCC, 2014) BUT retains important habitat features.			
More than 50-70%	Present with at least 5 trees/0.5ha	5 ha+	5 m+

Plate 4 TEC Assessment observation 4

Observation No.	5
Location	GDA Zone 50 450277 mE 6507907 mN
Site notes	Trees over weeds
TEC Assessment Result	Key diagnostic features not met, no native understorey present. Condition category is therefore not applicable (however still shows criteria that would be applicable).

Key Diagnostic Features – the patch must show the following key diagnostic features	**Y/N**
Distribution of the ecological community is limited to one of the following IBRA regions: - Avon Wheatbelt – subregions AVW01 Merredin and AVW02 Katanning; - Mallee – MAL02 Western Mallee only; - Jarrah Forest – outlying patches in the eastern parts of JAF01 Northern Jarrah Forests and JAF02 Jarrah Forests adjacent to the Avon Wheatbelt that are off the Darling Range, and receive less than 600 mm mean annual rainfall.	Y
Community is a woodland in which the minimum crown cover of the tree canopy in a mature woodland is 10%	Y
Key species of the tree canopy are species of *Eucalyptus* as identified in Table 2a of Commonwealth of Australia (2016).	N *E. loxophleba* present
A native understorey is present but is of variable composition, being a combination of grasses, other herbs and shrubs, as specified in Table A1 of Appendix A of the Approved Conservation Advice	N Species included *Freesia, Oxalis pes-caprae* and common weedy grasses.

Cover of weeds AND	**Mature trees AND**	**Min. patch size (non-roadside patches) OR**	**Min. patch width (roadsides only)**
Category A: Patches likely to correspond to a condition of Pristine / Excellent / Very good (Keighery, 1994) or a High RCV (RCC, 2014).			
0-30% of total understorey vegetation cover	May be present or absent	2 ha+	5 m+
Category B: Patches likely to correspond to a condition of Good (Keighery, 1994) or a Medium-High RCV (RCC, 2014), AND retains important habitat features.			
30-50%	Present with at least 5 trees/0.5ha	2 ha+	5 m+
Category C: Patches likely to correspond to a condition of Good (Keighery, 1994) or a Medium-High RCV (RCC, 2014).			
30-50%	Either absent or LESS THAN 5 trees/0.5ha	5 ha+	5 m+
Category D: Patches likely to correspond to a condition of Degraded to Good (Keighery, 1994) or a Medium-Low to Medium-High RCV (RCC, 2014) BUT retains important habitat features.			
More than 50-70%	Present with at least 5 trees/0.5ha	5 ha+	5 m+

Plate 5 TEC Assessment observation 5

Observation No.	6
Location	GDA Zone 50 450237 mE 6508399 mN
Site notes	Trees over weeds
TEC Assessment Result	Key diagnostic features not met, no native understorey present. Condition category is therefore not applicable (however still shows criteria that would be applicable).

Key Diagnostic Features – the patch must show the following key diagnostic features	**Y/N**
Distribution of the ecological community is limited to one of the following IBRA regions: - Avon Wheatbelt – subregions AVW01 Merredin and AVW02 Katanning; - Mallee – MAL02 Western Mallee only; - Jarrah Forest – outlying patches in the eastern parts of JAF01 Northern Jarrah Forests and JAF02 Jarrah Forests adjacent to the Avon Wheatbelt that are off the Darling Range, and receive less than 600 mm mean annual rainfall.	Y
Community is a woodland in which the minimum crown cover of the tree canopy in a mature woodland is 10%	Y
Key species of the tree canopy are species of *Eucalyptus* as identified in Table 2a of Commonwealth of Australia (2016).	N *E. loxophleba* present
A native understorey is present but is of variable composition, being a combination of grasses, other herbs and shrubs, as specified in Table A1 of Appendix A of the Approved Conservation Advice	N Species included *Freesia, Oxalis pes-caprae, Morea rosea, Ursinia anthemoides, Lupinus cosentinii* and common weedy grasses.

Cover of weeds AND	**Mature trees AND**	**Min. patch size (non-roadside patches) OR**	**Min. patch width (roadsides only)**
Category A: Patches likely to correspond to a condition of Pristine / Excellent / Very good (Keighery, 1994) or a High RCV (RCC, 2014).			
0-30% of total understorey vegetation cover	May be present or absent	2 ha+	5 m+
Category B: Patches likely to correspond to a condition of Good (Keighery, 1994) or a Medium-High RCV (RCC, 2014), AND retains important habitat features.			
30-50%	Present with at least 5 trees/0.5ha	2 ha+	5 m+
Category C: Patches likely to correspond to a condition of Good (Keighery, 1994) or a Medium-High RCV (RCC, 2014).			
30-50%	Either absent or LESS THAN 5 trees/0.5ha	5 ha+	5 m+
Category D: Patches likely to correspond to a condition of Degraded to Good (Keighery, 1994) or a Medium-Low to Medium-High RCV (RCC, 2014) BUT retains important habitat features.			
More than 50-70%	Present with at least 5 trees/0.5ha	5 ha+	5 m+

Plate 6 TEC Assessment observation 6

Observation No.	7
Location	GDA Zone 50 450232 mE 6507843 mN
Site notes	Trees over weeds
TEC Assessment Result	Key diagnostic features not met, no native understorey present. Condition category is therefore not applicable (however still shows criteria that would be applicable).

Key Diagnostic Features – the patch must show the following key diagnostic features	**Y/N**
Distribution of the ecological community is limited to one of the following IBRA regions: - Avon Wheatbelt – subregions AVW01 Merredin and AVW02 Katanning; - Mallee – MAL02 Western Mallee only; - Jarrah Forest – outlying patches in the eastern parts of JAF01 Northern Jarrah Forests and JAF02 Jarrah Forests adjacent to the Avon Wheatbelt that are off the Darling Range, and receive less than 600 mm mean annual rainfall.	Y
Community is a woodland in which the minimum crown cover of the tree canopy in a mature woodland is 10%	Y
Key species of the tree canopy are species of *Eucalyptus* as identified in Table 2a of Commonwealth of Australia (2016).	Y *E. loxophleba* present
A native understorey is present but is of variable composition, being a combination of grasses, other herbs and shrubs, as specified in Table A1 of Appendix A of the Approved Conservation Advice	N Species included *Freesia, Oxalis pes-caprae, Lupinus cosentinii* and common weedy grasses.

Cover of weeds AND	**Mature trees AND**	**Min. patch size (non-roadside patches) OR**	**Min. patch width (roadsides only)**
Category A: Patches likely to correspond to a condition of Pristine / Excellent / Very good (Keighery, 1994) or a High RCV (RCC, 2014).			
0-30% of total understorey vegetation cover	May be present or absent	2 ha+	5 m+
Category B: Patches likely to correspond to a condition of Good (Keighery, 1994) or a Medium-High RCV (RCC, 2014), AND retains important habitat features.			
30-50%	Present with at least 5 trees/0.5ha	2 ha+	5 m+
Category C: Patches likely to correspond to a condition of Good (Keighery, 1994) or a Medium-High RCV (RCC, 2014).			
30-50%	Either absent or LESS THAN 5 trees/0.5ha	5 ha+	5 m+
Category D: Patches likely to correspond to a condition of Degraded to Good (Keighery, 1994) or a Medium-Low to Medium-High RCV (RCC, 2014) BUT retains important habitat features.			
More than 50-70%	Present with at least 5 trees/0.5ha	5 ha+	5 m+

Plate 7 TEC Assessment observation 7

Appendix G

Species by Community Matrix

Appendix G: Species by Community Matrix

Taxon	CcAaBj	CcLeAp	CcXpHh	CcXpLb	EaXpBe	EaXpBe-b	EdBn	ElAaAb	EmXpBd	ErAbJp	ErAsOp	ErMvLd	ErPlCc	ErToLm	EwAaAb	EwAbBs	EwBsLp	EwGtAl	EwHuAn	EwXpTo	MpHvLl	Planted	Trees mix
?Gompholobium capitatum																		x					
?Goodenia pulchella																		x					
?Thelymitra sp.									x														
Acacia acuminata								x			x				x								
Acacia alata			x															x					
Acacia barbinervis subsp. barbinervis									x														
Acacia browniana																				x			
Acacia burkittii										x	x					x		x					
Acacia candolleana subsp. candolleana			x																				
Acacia celastrifolia				x					x			x	x						x				
Acacia divergens													x										
Acacia drummondii subsp. drummondii																		x					
Acacia extensa			x									x	x					x			x		
Acacia lasiocarpa var. lasiocarpa					x													x	x				
Acacia lasiocarpa var. sedifolia					x												x	x					
Acacia nervosa				x					x										x	x			
Acacia pulchella		x	x	x	x				x			x		x		x	x	x	x	x	x		
Acacia saligna	x				x						x	x		x		x		x		x			
Acacia saligna subsp. pruinescens																x							
Acacia shuttleworthii					x																		
Acacia squamata					x																		
Acacia urophylla			x						x														x
Adenanthos cygnorum subsp. cygnorum		x		x	x	x			x												x		
Adenanthos obovatus									x														
Agrostocrinum hirsutum												x					x						
Agrostocrinum scabrum			x						x														
Aira caryophyllea			x														x	x					
Alexgeorgea nitens					x				x					x			x	x	x	x			
Allocasuarina fraseriana					x				x		x			x									
Allocasuarina huegeliana			x													x		x					
Allocasuarina humilis			x	x	x				x								x				x		
Amphipogon debilis			x																		x		
Amphipogon laguroides subsp. laguroides																					x		
Anigozanthos manglesii			x						x														
Arctotheca calendula			x		x			x			x			x	x	x		x			x		
Asparagus asparagoides			x								x	x		x									
Astartea ? fascicularis			x																				
Astartea affinis	x																				x		
Astartea scoparia	x											x											
Astroloma ciliatum			x						x											x			
Astroloma epacridis					x													x					
Astroloma pallidum		x	x		x				x										x				
Austrostipa elegantissima																		x					
Avena barbata								x			x	x		x	x	x		x	x	x			x
Babingtonia camphorosmae			x																				
Banksia bipinnatifida subsp. bipinnatifida			x		x																		
Banksia dallanneyi var. dallanneyi		x	x	x	x	x			x					x			x	x	x	x			
Banksia fraseri var. fraseri																							
Banksia grandis			x						x														x
Banksia littoralis																					x		
Banksia nivea subsp. Morangup							x																
Banksia sessilis var. sessilis		x	x		x				x							x	x	x	x				
Banksia squarrosa subsp. squarrosa			x	x	x				x								x	x	x	x			
Baumea juncea	x											x											
Billardiera floribunda									x														
Billardiera fusiformis	x		x																		x		
Billardiera venusta			x													x		x					
Blennospora drummondii				x														x					
Boronia ovata									x														
Boronia scabra subsp. condensata					x												x	x					x
Borya sphaerocephala							x													x	x		
Bossiaea aquifolium																							x
Bossiaea eriocarpa		x	x	x	x				x								x	x	x	x			
Bossiaea ornata			x						x											x	x		
Bossiaea pulchella									x														
Bossiaea spinescens																x							
Brassica tournefortii																	x						
Briza maxima		x	x	x					x		x	x			x	x		x	x	x	x		x
Briza minor																		x			x		
Bromus diandrus												x											
Burchardia congesta			x						x							x		x		x			
Caesia micrantha					x									x				x					
Caesia occidentalis			x						x					x									
Caesia sp.Wongan (K.F Kenneally 8820)			x																				
Caladenia barbarossa					x		x											x					
Caladenia falcata																							
Caladenia flava		x	x	x					x								x	x					
Caladenia integra																							
Caladenia longiclavata																							
Callistemon phoeniceus											x												
Calochilus stramenicola					x													x					
Calothamnus quadrifidus subsp. quadrifidus																							

Appendix G: Species by Community Matrix

Taxon	CcAaBj	CcLeAp	CcXpHh	CcXpLb	EaXpBe	EaXpBe-b	EdBn	ElAaAb	EmXpBd	ErAbJp	ErAsOp	ErMvLd	ErPlCc	ErToLm	EwAaAb	EwAbBs	EwBsLp	EwGtAl	EwHuAn	EwXpTo	MpHvLl	Planted	Trees mix
Calothamnus rupestris														x									
Calothamnus sp.					x																		
Calytrix oncophylla					x												x	x					
Calytrix variabilis			x																				
Cassytha glabella			x		x				x												x		
Casuarina obesa		x		x	x						x					x				x	x	x	
Chamaescilla corymbosa var. corymbosa		x	x	x														x	x				
Chamaexeros serra			x																				
Cheilanthes sieberi					x										x	x		x					
Chorizema cordata													x										
Chorizema dicksonii									x										x				
Clematis pubescens			x						x									x					
Comesperma calymega																		x					
Comesperma volubile			x		x													x					
Conospermum amoenum subsp. cuneatum																							
Conospermum glumaceum				x																			
Conostylis androstemma				x													x						
Conostylis caricina subsp. elachys					x														x				
Conostylis serrulata																	x						
Conostylis setigera		x	x	x	x				x								x	x	x				
Conostylis setigera subsp. setigera			x		x															x			
Conostylis setosa			x						x									x	x	x			
Corymbia calophylla	x	x	x	x	x	x			x			x		x		x	x	x		x	x		x
Cotula sp.									x														
Craspedia variabilis			x						x									x					
Crassula colorata var. acuminata																	x						
Cryptandra arbutiflora var. arbutiflora				x	x												x	x		x			
Cryptandra nutans				x																			
Cyanicula gemmata																							
Cyathochaeta avenacea												x							x	x	x		
Cynodon dactylon											x			x									
Dampiera alata			x						x									x		x			
Dampiera lavandulacea			x	x	x	x	x									x	x	x	x				
Dampiera linearis			x						x														
Daviesia angulata																	x						
Daviesia decurrens		x	x						x								x						
Daviesia hakeoides subsp. hakeoides				x			x		x					x			x		x				
Daviesia hakeoides subsp. subnuda				x													x	x					
Daviesia rhombifolia									x														
Desmocladus fasciculatis		x																					
Desmocladus flexuosus			x																				
Dianella revoluta		x	x		x				x			x		x		x	x	x	x	x	x		
Dillwynia laxiflora		x							x								x			x			
Disa bracteata																							x
Diuris corymbosa																							
Diuris longifolia							x											x					
Diuris sp.		x			x				x							x		x	x				
Dodonaea pinifolia				x																			
Drosera barbigera		x					x		x								x		x				
Drosera erythrorhiza subsp. collina			x		x				x								x		x				
Drosera macrantha subsp. macrantha			x	x	x				x								x	x	x				
Drosera menziesii subsp. menziesii																x							
Drosera platystigma				x	x		x																
Echium plantagineum																							
Ehrharta calycina			x		x				x			x		x		x				x			
Ehrharta longiflora			x											x			x						
Elythranthera brunonis				x																			
Eragrostis curvula			x								x										x		x
Eremaea asterocarpa subsp. histoclada																						x	
Erodium cygnorum																x							
Eryngium pinnatifidum																				x			
Eucalyptus accedens			x		x	x												x		x			x
Eucalyptus drummondii				x			x																
Eucalyptus loxophleba subsp. loxophleba					x			x							x	x						x	
Eucalyptus marginata			x						x				x							x			
Eucalyptus patens													x										
Eucalyptus rudis subsp. *rudis*										x	x	x	x	x		x							
Eucalyptus wandoo subsp. *wandoo*			x		x							x	x	x	x	x	x	x	x	x		x	x
Euphorbia peplus																							
Ficinia nodosa											x										x		
Ficus carica																		x			x		
Freesia alba x leightlinii			x												x	x			x				
Fumaria capreolata											x	x		x									
Gahnia trifida														x									
Gastrolobium calycinum			x		x	x			x								x		x	x			x
Gastrolobium capitatum			x																				
Gastrolobium dilatatum			x																				
Gastrolobium hookeri																			x				
Gastrolobium microcarpum					x																		
Gastrolobium parviflorum																		x					
Gastrolobium spinosum				x					x								x	x					
Gastrolobium trilobum					x																		

Appendix G: Species by Community Matrix

Taxon	CcAaBj	CcLeAp	CcXpHh	CcXpLb	EaXpBe	EaXpBe-b	EdBn	ElAaAb	EmXpBd	ErAbJp	ErAsOp	ErMvLd	ErPlCc	ErToLm	EwAaAb	EwAbBs	EwBsLp	EwGtAl	EwHuAn	EwXpTo	MpHvLl	Planted	Trees mix
Gastrolobium truncatum					x													x					
Gastrolobium villosum			x		x																		
Gladiolus caryophyllaceus		x																					
Glischrocaryon aureum				x	x	x												x					
Gnephosis tenuissima																					x		
Gomphocarpus fruticosus												x	x										
Gompholobium marginatum		x	x	x	x				x					x			x	x	x	x	x		
Gompholobium preissii			x						x														
Gompholobium tomentosum		x																			x		
Gompholobium venustum									x														
Gonocarpus cordiger			x																	x			
Goodenia coerulea			x																				
Goodenia fasciculata																				x			
Goodenia pinifolia					x	x																	
Goodenia pulchella																				x			
Goodenia sp.						x																	
Grevillea bipinnatifida			x																	x			
Grevillea candolleana			x		x												x	x					
Grevillea synapheae subsp. synapheae			x		x	x			x									x	x	x			
Grevillea vestita subsp. vestita																x							
Grevillea wilsonii																							
Haemodorum laxum			x		x				x											x			
Haemodorum paniculatum																					x		
Haemodorum sp.			x																				
Hakea incrassata							x																
Hakea lissocarpha			x		x	x			x					x				x	x	x			
Hakea prostrata		x	x																	x	x		x
Hakea stenocarpa				x																			
Hakea trifurcata		x	x		x																x		
Hakea undulata			x	x	x													x	x	x			
Hakea varia			x																		x		
Hemiandra pungens		x																					
Hemigenia incana					x																		
Hibbertia ?commutata		x																					
Hibbertia acerosa			x																				
Hibbertia commutata		x	x		x	x			x					x		x	x	x	x	x			
Hibbertia commutata (hairy form)																		x					
Hibbertia exasperata					x	x																	
Hibbertia hemignosta				x																			
Hibbertia huegelii			x						x														
Hibbertia hypericoides		x	x		x	x			x								x	x		x	x		
Hibbertia lasiopus																			x				
Hibbertia montana			x		x													x					x
Hibbertia ovata			x	x	x				x					x					x				
Hibbertia pilosa																		x					
Hibbertia racemosa					x																		
Hibbertia sp.			x		x				x									x	x	x			
Hibbertia stellata																					x		
Hibbertia subvaginata		x			x												x						
Hovea chorizemifolia			x		x				x								x						
Hovea elliptica				x														x					
Hovea ellipticum									x														
Hyalosperma glutinosum subsp. glutinosum															x								
Hybanthus debilissisimus			x																				
Hypocalymma angustifolium			x		x									x						x	x		
Hypochaeris glabra		x	x	x					x		x	x	x		x	x	x	x	x				x
Hypolaena exsulca																					x		
Iridaceae sp.			x								x												
Isopogon dubius																							
Isotoma hypocrateriformis			x																				
Isotropis cuneifolia									x										x				
Jacksonia floribunda		x																					
Jacksonia restioides					x	x																	
Jacksonia sternbergiana			x																				
Juncus pallidus										x	x	x		x		x		x			x	x	
Kennedia coccinea			x						x		x									x			
Kennedia prostrata		x	x		x											x		x	x		x		
Kunzea micrantha subsp. micrantha				x			x														x		
Labichea lanceolata			x																				
Labichea punctata		x	x						x		x								x	x			
Lagenophora huegelii			x		x				x									x	x	x			
Lagurus ovatus																x				x			
Lawrencia rosea																		x					
Laxmannia grandiflora subsp. grandiflora																		x					
Laxmannia squarrosa		x	x	x		x										x		x					
Lechenaultia biloba			x	x	x	x			x					x			x	x		x			
Lepidobolus preissianus				x	x												x						
Lepidosperma apricola					x																		
Lepidosperma costale					x																		
Lepidosperma drummondii				x	x		x					x						x			x		
Lepidosperma longitudinale			x		x																x		
Lepidosperma obtusum			x	x															x				

Appendix G: Species by Community Matrix

Taxon	CcAaBj	CcLeAp	CcXpHh	CcXpLb	EaXpBe	EaXpBe-b	EdBn	ElAaAb	EmXpBd	ErAbJp	ErAsOp	ErMvLd	ErPlCc	ErToLm	EwAaAb	EwAbBs	EwBsLp	EwGtAl	EwHuAn	EwXpTo	MpHvLl	Planted	Trees mix
Lepidosperma pubisquameum			x						x			x	x	x							x		
Lepidosperma squamatum		x	x						x									x	x	x			
Lepidosperma tenue			x		x				x					x		x	x	x	x	x	x		
Leptocarpus ?coangustatus											x			x									
Leptospermum erubescens		x	x	x	x	x			x								x	x		x			
Lepyrodia muirii													x	x							x		
Leucopogon capitellatus									x														
Leucopogon cinereus																							
Leucopogon conostephioides				x																			
Leucopogon glaucifolius				x																			
Leucopogon nutans		x			x											x		x		x			
Leucopogon propinquus			x						x								x	x	x				
Leucopogon pulchellus																							
Leucopogon sp.					x																		
Linum trigynum																			x				
Lobelia anceps									x														
Lolium perenne								x															
Lomandra caespitosa		x	x		x				x			x					x						
Lomandra effusa					x				x									x					
Lomandra hermaphrodita			x						x										x	x			
Lomandra integra			x																				
Lomandra micrantha																							
Lomandra preissii			x						x														
Lomandra sericea			x						x														
Lomandra sonderi			x						x				x								x		
Lomandra sp.									x				x										
Lotus subbiflorus																					x		
Loxocarya cinerea									x														
Lupinus cosentinii								x															
Lyginia barbata			x																x				
Lyginia imberbis																	x				x		
Lysimachia arvensis var. arvensis				x							x	x		x	x	x	x	x	x		x		
Lythrum hyssopifolia																					x		
Macrozamia riedlei		x	x		x				x			x		x		x		x	x	x	x		
Melaleuca aspalathoides					x																		
Melaleuca carrii			x																				
Melaleuca incana subsp. incana												x		x									
Melaleuca preissiana											x		x								x		
Melaleuca rhaphiophylla											x	x	x	x									
Melaleuca trichophylla			x																				
Melaleuca viminea subsp. viminea												x		x							x		
Mesomelaena tetragona			x											x							x		
Microtis media subsp. densiflora					x																		
Millotia tenuifolia var. tenuifolia				x					x									x					
Monotaxis grandiflora var. grandiflora																			x				
Moraea flaccida												x			x	x							
Moraea miniata					x						x												
Neurachne alopecuroidea		x	x		x	x			x						x	x	x	x	x	x			
Olea europaea											x												
Olearia lehmanniana																				x			
Olearia paucidentata			x																				
Opercularia echinocephala									x									x					
Opercularia hispidula									x											x			
Opercularia vaginata			x	x	x		x		x					x				x	x	x			
Orobanche minor			x																				
Orthrosanthus laxus var. gramineus			x														x	x					
Orthrosanthus laxus var. laxus																				x			
Oxalis compressa																			x				
Oxalis corniculata											x				x			x	x				
Oxalis pes-caprae											x			x		x							
Oxalis purpurea								x			x												
Paraserianthes lophantha subsp. lophantha													x								x		
Parentucellia latifolia				x			x								x			x					
Paspalum dilatatum											x												
Patersonia rudis			x						x								x		x	x	x		
Patersonia rudis var. rudis					x																		
Pentapeltis peltigera									x											x			
Petrophile divaricata					x	x	x											x					
Petrophile serruriae					x																		
Petrophile striata					x												x	x					
Philotheca nodiflora subsp. calycina					x		x												x				
Phyllanthus calycinus		x	x		x				x					x		x	x	x	x	x			
Phyllopodium cordatum		x															x						
Pimelea argentea																x							
Pimelea ciliata subsp. ciliata			x																				
Pimelea imbricata var. piligera																				x			
Pimelea sp.						x																	
Plantago lanceolata												x											
Platysace tenuissima									x														
Poaceae sp.			x																x				
Podolepis gracilis																					x		
Podolepis lessonii															x			x	x				

Appendix G: Species by Community Matrix

Taxon	CcAaBj	CcLeAp	CcXpHh	CcXpLb	EaXpBe	EaXpBe-b	EdBn	ElAaAb	EmXpBd	ErAbJp	ErAsOp	ErMvLd	ErPlCc	ErToLm	EwAaAb	EwAbBs	EwBsLp	EwGtAl	EwHuAn	EwXpTo	MpHvLl	Planted	Trees mix
Poranthera microphylla																		x					
Pterostlyis sp. cauline leaves																							
Pterostylis recurva									x														
Pterostylis sanguinea					x				x							x	x						
Pterostylis sargentii			x		x												x	x					
Pterostylis sp.			x															x					
Ptilotus drummondii																	x						
Ptilotus manglesii			x																x	x			
Ptilotus spathulatus															x								
Pyrorchis nigricans									x														
Romulea rosea var. australis																x			x				
Rubus anglocandicans												x											
Rytidosperma setaceum			x																				
Samolus junceus														x									
Santalum acuminatum					x																		
Scaevola calliptera			x						x											x	x		
Schoenoplectus validus																							
Schoenus asperocarpus																					x		
Schoenus grammatophyllus							x																
Senecio sp.						x																	
Solanum nigrum														x				x					
Sonchus asper												x		x		x		x			x		
Sonchus oleraceus														x						x	x		
Sowerbaea laxiflora																x		x					
Sphaerolobium medium									x								x	x		x			
Stackhousia monogyna		x			x													x	x				
Stirlingia latifolia																					x		
Stenanthemum coronatum																	x						
Stylidium affine					x	x																	
Stylidium amoenum			x						x										x				
Stylidium androsaceum			x						x														
Stylidium brunonianum			x	x	x												x	x		x			
Stylidium dichotomum																				x			
Stylidium lateriticola					x																		
Stylidium leptophyllum																		x					
Stylidium perpusillum																					x		
Stylidium piliferum			x		x				x								x						
Stypandra glauca									x		x					x				x			
Styphelia tenuiflora									x														
Synaphea petiolaris		x			x				x								x						
Synaphea sp. Udumung (A S George 17058)				x																			
Taxandria linearifolia			x																				
Templetonia drummondii			x																				
Tetrarrhena laevis			x						x				x						x	x			
Tetraria capillaris			x	x	x	x			x								x	x	x				
Tetraria octandra			x		x	x			x			x		x				x	x	x			
Tetratheca hirsuta			x						x									x					
Thelymitra antennifera																							
Thelymitra macrophylla									x						x	x		x					
Thomasia foliosa																		x					
Thysanotus dichotomous			x																				
Thysanotus fastigiatus		x	x																		x		
Thysanotus manglesianus		x	x	x	x	x			x							x	x	x	x				
Thysanotus multiflorus			x						x														
Thysanotus scaber					x																		
Trachymene pilosa		x	x	x	x												x	x	x				
Trichocline spathulata			x		x				x					x			x	x	x	x	x		
Tricoryne elatior			x		x							x		x						x			
Trifolium campestre var. campestre																x							
Tripterococcus brunonis						x			x								x		x				
Trymalium ledifolium			x	x	x	x			x					x			x		x	x			
Trymalium ledifolium var. lineare																							
Trymalium odoratissimum subsp. odoratissimum					x							x		x		x		x					
Typha orientalis											x	x		x		x		x			x		
Ursinia anthemoides		x	x	x	x		x		x							x	x	x	x	x			
Velleia trinervis																				x			
Vellereophyton dealbatum																					x		
Verreauxia reinwardtii			x			x																	
Verticordia citrella				x			x																
Verticordia densiflora var. densiflora		x																			x		
Verticordia sp.		x																					
Viminaria juncea	x											x									x		
Waitzia nitida																		x					
Waitzia suaveolens var. suaveolens																		x					
Watsonia meriana var. bulbillifera												x		x		x							
Weeds					x			x															
Wurmbea dioica							x																
Xanthorrhoea gracilis					x				x														
Xanthorrhoea preissii		x	x	x	x	x			x		x	x	x	x		x		x	x	x	x		
Xanthosia atkinsoniana			x		x				x								x	x	x	x			
Xanthosia ciliata									x														
Zaluzianskya divaricata																							

Appendix H

Flora Forms

Department of Parks and Wildlife

Threatened and Priority Flora Report Form

Version 1.2 August 2013

Please complete as much of the form as possible.
For information on how to complete the form please refer to the Threatened & Priority Flora Report Form (TPRF) manual on the DPaW website at http://www.dpaw.wa.gov.au/

TAXON: Banksia nivea subsp. Morangup (M. Pieroni 94/2) **TPFL Pop. No:**

OBSERVATION DATE: 22/09/2015 **CONSERVATION STATUS:** Priority 2 New population ☐

OBSERVER/S: Lyn Van Gorp and Floora de Wit **PHONE:** 6208 0203

ROLE: Environmental Scientist and Senior Botanist **ORGANISATION:** AECOM Australia Pty Ltd

DESCRIPTION OF LOCATION (Provide at least nearest town/named locality, and the distance and direction to that place):

Located in Morangup Nature Reserve, approximately 19km to the south-west of Toodyay township.

Reserve No:

DISTRICT: **LGA:** Shire of Toodyay Land manager present: ☐

DATUM:
GDA94 / MGA94 ☒
AGD84 / AMG84 ☐
WGS84 ☐
Unknown ☐

COORDINATES: (If UTM coords provided, **Zone** is also required)
DecDegrees ☐ DegMinSec ☐ UTMs ☐
Lat / Northing: -31.679802
Long / Easting: 116.330643
Zone:

METHOD USED:
GPS ☒ Differential GPS ☐ Map ☐
No. satellites: Map used:
Boundary polygon captured: ☐ Map scale:

LAND TENURE:

Nature reserve ☒	Timber reserve ☐	Private property ☐	Rail reserve ☐	Shire road reserve ☐
National park ☐	State forest ☐	Pastoral lease ☐	MRWA road reserve ☐	Other Crown reserve ☐
Conservation park ☐	Water reserve ☐	UCL ☐	SLK/Pole _____ to _____	Specify other: _____

AREA ASSESSMENT: Edge survey ☐ Partial survey ☐ Full survey ☐ Area observed (m²): _____

EFFORT: Time spent surveying (minutes): _____ No. of minutes spent / 100 m²: _____

POP'N COUNT ACCURACY: Actual ☐ Extrapolation ☐ Estimate ☒

Count method: (Refer to field manual for list) _____

WHAT COUNTED: Plants ☒ Clumps ☐ Clonal stems ☐

TOTAL POP'N STRUCTURE:

	Mature:	Juveniles:	Seedlings:	Totals:
Alive	100+			
Dead				

Area of pop (m²): _____

Note: Pls record count as numbers (not percentages) for database.

QUADRATS PRESENT: No. _____ Size _____ Data attached ☐ Total area of quadrats (m²): _____

Summary Quad. Totals: Alive

REPRODUCTIVE STATE: Clonal ☐ Vegetative ☐ Flowerbud ☐ Flower ☒
Immature fruit ☐ Fruit ☐ Dehisced fruit ☐ Percentage in flower: _____%

CONDITION OF PLANTS: Healthy ☒ Moderate ☐ Poor ☐ Senescent ☐

COMMENT:

THREATS - type, agent and supporting information:
E.g. clearing, too frequent fire, weed, disease. Refer to field manual for list of threats & agents. **Specify agent** where relevant.
Rate current and potential threat impact: N=Nil, L=Low, M=Medium, H=High, E=Extreme
Estimate time to potential impact: S=Short (<12mths), M=Medium (<5yrs), L=Long (5yrs+)

	Current impact (N-E)	Potential Impact (L-E)	Potential Threat Onset (S-L)
•			
•			
•			

Please return completed form to **Species And Communities Branch** DPaW,
Locked Bag 104, BENTLEY DELIVERY CENTRE WA 6983
RECORDS: Please forward to **Flora Administrative Officer,** Species and Communities Branch.

Record entered by: _____ **Sheet No.:** _____ **Record Accepted in Database** ☐

Department of Parks and Wildlife

Threatened and Priority Flora Report Form

Version 1.2 August 2013

HABITAT INFORMATION: (Check more than one box for combinations or where necessary)

LANDFORM:	**ROCK TYPE:**	**LOOSE ROCK:**	**SOIL TYPE:**	**SOIL COLOUR:**	**DRAINAGE:**
Crest ☐	Granite ☐	(on soil surface; e.g. gravel, quartz fields)	Sand ☐	Red ☒	Well drained ☐
Hill ☐	Dolerite ☐		Sandy loam ☐	Brown ☐	Seasonally inundated ☐
Ridge ☐	Laterite ☐	0-10% ☐	Loam ☐	Yellow ☐	Permanently inundated ☐
Outcrop ☐	Ironstone ☐	10-30% ☐	Clay loam ☐	White ☐	Tidal ☐
Slope ☐	Limestone ☐	30-50% ☐	Light clay ☐	Grey ☐	
Flat ☐	Quartz ☐	50-100% ☐	Peat ☐	Black ☐	
Open depression ☐					
Drainage line ☐	Specify other:		Specify other: Clay	Specify other:	Specify other:
Closed depression ☐					
Wetland ☐					

Specific Landform Element: (Refer to field manual for additional values)

CONDITION OF SOIL:

Dry ☐ Moist ☐ Waterlogged ☐ Inundated ☐ Cracked ☐ Saline ☐ Other:

VEGETATION CLASSIFICATION:* E.g. **1.** Banksia woodland (B. attenuata, B. ilicifolia); **2.** Open shrubland (Hibbertia sp., Acacia spp.) **3.** Isolated clumps of sedges (Mesomelaena tetragona)	1. Eucalyptus drummondii mid isolated trees
	2. Banksia nivea subsp. Morangup (P2), Kunzea micrantha subsp. micrantha and Lepidosperma drummondii low heathland.
	3.
	4.
ASSOCIATED SPECIES: Other (non-dominant) spp	

* Please record up to four of the most representative vegetation layers (with up to three dominant species in each layer). Structural Formations should follow 2009 *Australian Soil and Land Survey Field Handbook* guidelines – refer to field manual for further information and structural formation table.

CONDITION OF HABITAT: Pristine ☐ Excellent ☐ Very good ☐ Good ☐ Degraded ☐ Completely degraded ☐

COMMENT: Vegetation condition: Excellent

FIRE HISTORY: **Last Fire:** Season/Month: _____ Year: _____ **Fire Intensity:** High ☐ Medium ☐ Low ☐ No signs of fire ☒

FENCING: Not required ☐ Present ☒ Replace / repair ☐ Required ☐ Length req'd: _____

ROADSIDE MARKERS: Not required ☐ Present ☐ Replace / reposition ☐ Required ☐ Quantity req'd: _____

OTHER COMMENTS: (Please include recommended management actions and/or implemented actions - include date. Also include details of additional data available, and how to locate it.)

Identification confirmed by M. Hislop (Accession number 6656)

Please return completed form to **Species And Communities Branch** DPaW,
Locked Bag 104, BENTLEY DELIVERY CENTRE WA 6983
RECORDS: Please forward to **Flora Administrative Officer,** Species and Communities Branch.

Record entered by:_____ **Sheet No.:**_____ **Record Accepted in Database** ☐

Department of Parks and Wildlife

Threatened and Priority Flora Report Form

Version 1.2 August 2013

DRF PERMIT/ LICENCE No: Lyn Van Gorp (SL011558)/Floora de Wit (CE005103)

Note if only observing plants (i.e. no specimens or plant matieral is taken) then no permit/licence is required. For further information on permit and licening requirements see the Threatened Flora and Wildlife Licensing pages on DPaW's website. Any actions carried out under licence/permit should be recorded above in the OTHER COMMENTS section.

SPECIMEN: Collectors No: LVG64 WA Herb. ☒ Regional Herb. ☐ District Herb. ☐ Other:

ATTACHED: Map ☐ Mudmap ☐ Photo ☐ GIS data ☐ Field notes ☐ Other:

COPY SENT TO: Regional Office ☐ District Office ☐ Other:

Submitter of record: Lyn Van Gorp **Role:** Environmental Scientist

Signature: **Date submitted:** 14 / 01 / 2016

Please return completed form to **Species And Communities Branch** DPaW,
Locked Bag 104, BENTLEY DELIVERY CENTRE WA 6983
RECORDS: Please forward to **Flora Administrative Officer,** Species and Communities Branch.

Record entered by:_____ **Sheet No.:**_____ **Record Accepted in Database** ☐

Department of Parks and Wildlife

Threatened and Priority Flora Report Form

Version 1.2 August 2013

Please complete as much of the form as possible.
For information on how to complete the form please refer to the Threatened & Priority Flora Report Form (TPRF) manual on the DPaW website at http://www.dpaw.wa.gov.au/

TAXON: Boronia scabra subsp. condensata **TPFL Pop. No:**

OBSERVATION DATE: 22/09/2015 **CONSERVATION STATUS:** Priority 2 New population ☐

OBSERVER/S: Lyn Van Gorp and Floora de Wit **PHONE:** 6208 0203

ROLE: Environmental Scientist and Senior Botanist **ORGANISATION:** AECOM Australia Pty Ltd

DESCRIPTION OF LOCATION (Provide at least nearest town/named locality, and the distance and direction to that place):

Located in bushland in close proximity to Toodyay Road within the Shire of Toodyay. Two individuals recorded: one 6.5km to the SW of Toodyay township and one approximately 6km to the SSW of Toodyay township (refer to Attachment 1 for further details).

Reserve No:

DISTRICT: **LGA:** Shire of Toodyay Land manager present: ☐

DATUM:
GDA94 / MGA94 ☐
AGD84 / AMG84 ☐
WGS84 ☐
Unknown ☐

COORDINATES: (If UTM coords provided, **Zone** is also required)
DecDegrees ☐ DegMinSec ☐ UTMs ☐
Lat / Northing: Please refer to Attachment 1
Long / Easting: for location details
Zone:

METHOD USED:
GPS ☒ Differential GPS ☐ Map ☐
No. satellites: Map used:
Boundary polygon captured: ☐ Map scale:

LAND TENURE:

Nature reserve ☐	Timber reserve ☐	Private property ☒	Rail reserve ☐	Shire road reserve ☐
National park ☐	State forest ☐	Pastoral lease ☐	MRWA road reserve ☒	Other Crown reserve ☐
Conservation park ☐	Water reserve ☐	UCL ☐	SLK/Pole _____ to _____	Specify other: _____

AREA ASSESSMENT: Edge survey ☐ Partial survey ☐ Full survey ☐ Area observed (m²): _____

EFFORT: Time spent surveying (minutes): _____ No. of minutes spent / 100 m²: _____

POP'N COUNT ACCURACY: Actual ☐ Extrapolation ☐ Estimate ☐

Count method: (Refer to field manual for list) Please refer to Attachment 1 for further details

WHAT COUNTED: Plants ☐ Clumps ☐ Clonal stems ☐

TOTAL POP'N STRUCTURE:

	Mature:	Juveniles:	Seedlings:	Totals:
Alive				
Dead				

Area of pop (m²): _____

Note: Pls record count as numbers (not percentages) for database.

QUADRATS PRESENT: No. _____ Size _____ Data attached ☐ Total area of quadrats (m²): _____

Summary Quad. Totals: Alive				

REPRODUCTIVE STATE: Clonal ☐ Vegetative ☐ Flowerbud ☐ Flower ☒
Immature fruit ☐ Fruit ☐ Dehisced fruit ☐ Percentage in flower: _____%

CONDITION OF PLANTS: Healthy ☒ Moderate ☐ Poor ☐ Senescent ☐

COMMENT:

THREATS - type, agent and supporting information: E.g. clearing, too frequent fire, weed, disease. Refer to field manual for list of threats & agents. **Specify agent** where relevant. **Rate current and potential threat impact:** N=Nil, L=Low, M=Medium, H=High, E=Extreme **Estimate time to potential impact:** S=Short (<12mths), M=Medium (<5yrs), L=Long (5yrs+)	**Current impact (N-E)**	**Potential Impact (L-E)**	**Potential Threat Onset (S-L)**
•			
•			

Please return completed form to **Species And Communities Branch** DPaW,
Locked Bag 104, BENTLEY DELIVERY CENTRE WA 6983
RECORDS: Please forward to **Flora Administrative Officer,** Species and Communities Branch.

Record entered by: _____ **Sheet No.:** _____ **Record Accepted in Database** ☐

Department of Parks and Wildlife

Threatened and Priority Flora Report Form

Version 1.2 August 2013

•			
	____	____	____

HABITAT INFORMATION: (Check more than one box for combinations or where necessary)

LANDFORM:	ROCK TYPE:	LOOSE ROCK:	SOIL TYPE:	SOIL COLOUR:	DRAINAGE:
Crest ☐	Granite ☐	(on soil surface; e.g. gravel, quartz fields)	Sand ☐	Red ☐	Well drained ☐
Hill ☐	Dolerite ☐		Sandy loam ☐	Brown ☐	Seasonally inundated ☐
Ridge ☐	Laterite ☒	0-10% ☐	Loam ☐	Yellow ☐	
Outcrop ☐	Ironstone ☐	10-30% ☐	Clay loam ☐	White ☐	Permanently inundated ☐
Slope ☐	Limestone ☐	30-50% ☐	Light clay ☐	Grey ☐	Tidal ☐
Flat ☐	Quartz ☐	50-100% ☐	Peat ☐	Black ☐	
Open depression ☐					
Drainage line ☐	Specify other:		Specify other:	Specify other:	Specify other:
Closed depression ☐					
Wetland ☐					

Specific Landform Element: (Refer to field manual for additional values)

Refer to Attachment 1 for more details

CONDITION OF SOIL:

Dry ☐ Moist ☐ Waterlogged ☐ Inundated ☐ Cracked ☐ Saline ☐ Other:

VEGETATION CLASSIFICATION:* E.g. **1.** Banksia woodland (B. attenuata, B. ilicifolia); **2.** Open shrubland (Hibbertia sp., Acacia spp.) **3.** Isolated clumps of sedges (Mesomelaena tetragona)	1. Please refer to Attachment 1 for details
	2.
	3.
	4.
ASSOCIATED SPECIES: Other (non-dominant) spp	

* Please record up to four of the most representative vegetation layers (with up to three dominant species in each layer). Structural Formations should follow 2009 *Australian Soil and Land Survey Field Handbook* guidelines – refer to field manual for further information and structural formation table.

CONDITION OF HABITAT: Pristine ☐ Excellent ☐ Very good ☐ Good ☐ Degraded ☐ Completely degraded ☐

COMMENT: Please refer to Attachment 1

FIRE HISTORY: **Last Fire:** Season/Month: _____ Year: ~ 10yrs **Fire Intensity:** High ☐ Medium ☐ Low ☐ No signs of fire ☐

FENCING: Not required ☐ Present ☐ Replace / repair ☐ Required ☐ Length req'd: _____

ROADSIDE MARKERS: Not required ☐ Present ☐ Replace / reposition ☐ Required ☐ Quantity req'd: _____

OTHER COMMENTS: (Please include recommended management actions and/or implemented actions - include date. Also include details of additional data available, and how to locate it.)

Identification confirmed by M. Hislop (Accession number 6656)

Please return completed form to **Species And Communities Branch** DPaW,
Locked Bag 104, BENTLEY DELIVERY CENTRE WA 6983
RECORDS: Please forward to **Flora Administrative Officer,** Species and Communities Branch.

Record entered by:_____ **Sheet No.:**_____ **Record Accepted in Database** ☐

Department of Parks and Wildlife

Threatened and Priority Flora Report Form

Version 1.2 August 2013

DRF PERMIT/ LICENCE No: SL011558

Note if only observing plants (i.e. no specimens or plant matieral is taken) then no permit/licence is required. For further information on permit and licening requirements see the Threatened Flora and Wildlife Licensing pages on DPaW's website. Any actions carried out under licence/permit should be recorded above in the OTHER COMMENTS section.

SPECIMEN: Collectors No: LVG137 WA Herb. ☒ Regional Herb. ☐ District Herb. ☐ Other:

ATTACHED: Map ☐ Mudmap ☐ Photo ☐ GIS data ☐ Field notes ☐ Other: Additional notes

COPY SENT TO: Regional Office ☐ District Office ☐ Other:

Submitter of record: Lyn Van Gorp **Role:** Environmental Scientist

Signature: **Date submitted:** 14 / 01 / 2016

Please return completed form to **Species And Communities Branch** DPaW,
Locked Bag 104, BENTLEY DELIVERY CENTRE WA 6983
RECORDS: Please forward to **Flora Administrative Officer,** Species and Communities Branch.

Record entered by:_____ **Sheet No.:**_____ **Record Accepted in Database** ☐

Attachment 1

Species	Location	Latitude	Longitude	Number of individuals*	Vegetation condition	Vegetation Community description
Boronia scabra subsp. *condensata*	Approximately 6.5 km to the SW of Toodyay township	-31.608385	116.441806	1	Very good - Excellent	*Eucalyptus accedens*, *Eucalyptus wandoo* and *Corymbia calophylla* mid open forest over *Xanthorrhoea preissii*, *Banksia squarrosa* subsp. *squarrosa* and *Acacia pulchella* mid to tall isolated clumps of shrubs over *Bossiaea eriocarpa*, *Petrophile divaricata* and *Astroloma* epacridis low open shrubland. Rock type: laterite Soil: loamy clay. Soil colour: brown,
Boronia scabra subsp. *condensata*	Approximately 6 km to the SSW of Toodyay township	-31.607785	116.457514	1	Very good - Excellent	*Eucalyptus accedens*, *Eucalyptus wandoo* and *Corymbia calophylla* mid open forest over *Xanthorrhoea preissii*, *Banksia squarrosa* subsp. *squarrosa* and *Acacia pulchella* mid to tall isolated clumps of shrubs over *Bossiaea eriocarpa*, *Petrophile divaricata* and *Astroloma* epacridis low open shrubland. Topography: hill, outcrop Rock type: laterite Soil: sandy, loam, gravel

*Note: Given that it was not known that the species was a Priority 2 species until after the survey, no formal population counts were undertaken. Population counts were estimated based on foliage cover within quadrats

Department of Parks and Wildlife

Threatened and Priority Flora Report Form

Version 1.2 August 2013

Please complete as much of the form as possible.
For information on how to complete the form please refer to the Threatened & Priority Flora Report Form (TPRF) manual on the DPaW website at http://www.dpaw.wa.gov.au/

TAXON: Caladenia integra **TPFL Pop. No:**

OBSERVATION DATE: 22/09/2015 **CONSERVATION STATUS:** Priority 4 New population ☐

OBSERVER/S: Lyn Van Gorp and Floora de Wit **PHONE:** 6208 0203

ROLE: Environmental Scientist and Senior Botanist **ORGANISATION:** AECOM Australia Pty Ltd

DESCRIPTION OF LOCATION (Provide at least nearest town/named locality, and the distance and direction to that place):

Located in roadside vegetation along Toodyay Road, approximately 6km to the south-west of the township of Toodyay.

Reserve No:

DISTRICT: **LGA:** Shire of Toodyay Land manager present: ☐

DATUM:
GDA94 / MGA94 ☒
AGD84 / AMG84 ☐
WGS84 ☐
Unknown ☐

COORDINATES: (If UTM coords provided, **Zone** is also required) Degrees Decimal minutes
DecDegrees ☑ DegMinSec ☐ UTMs ☐
Lat / Northing: 31° 38.267' S
Long / Easting: 116° 23.773' E
Zone:

METHOD USED:
GPS ☒ Differential GPS ☐ Map ☐
No. satellites: Map used:
Boundary polygon captured: ☐ Map scale:

LAND TENURE:

Nature reserve ☐	Timber reserve ☐	Private property ☐	Rail reserve ☐	Shire road reserve ☐
National park ☐	State forest ☐	Pastoral lease ☐	MRWA road reserve ☒	Other Crown reserve ☐
Conservation park ☐	Water reserve ☐	UCL ☐	SLK/Pole _____ to _____	Specify other: _____

AREA ASSESSMENT: Edge survey ☐ Partial survey ☐ Full survey ☐ Area observed (m²): _____

EFFORT: Time spent surveying (minutes): _____ No. of minutes spent / 100 m²: _____

POP'N COUNT ACCURACY: Actual ☐ Extrapolation ☐ Estimate ☐

Count method: (Refer to field manual for list) _____

WHAT COUNTED: Plants ☐ Clumps ☐ Clonal stems ☐

TOTAL POP'N STRUCTURE:

	Mature:	Juveniles:	Seedlings:	Totals:
Alive	1			
Dead				

Area of pop (m²): _____
Note: PIs record count as numbers (not percentages) for database.

QUADRATS PRESENT: No. _____ Size _____ Data attached ☐ Total area of quadrats (m²): _____

Summary Quad. Totals: Alive

REPRODUCTIVE STATE: Clonal ☐ Vegetative ☐ Flowerbud ☐ Flower ☒
Immature fruit ☐ Fruit ☐ Dehisced fruit ☐ Percentage in flower: _____%

CONDITION OF PLANTS: Healthy ☒ Moderate ☐ Poor ☐ Senescent ☐

COMMENT:

THREATS - type, agent and supporting information:
E.g. clearing, too frequent fire, weed, disease. Refer to field manual for list of threats & agents. **Specify agent** where relevant.
Rate current and potential threat impact: N=Nil, L=Low, M=Medium, H=High, E=Extreme
Estimate time to potential impact: S=Short (<12mths), M=Medium (<5yrs), L=Long (5yrs+)

	Current impact (N-E)	Potential Impact (L-E)	Potential Threat Onset (S-L)
•			
•			
•			

Please return completed form to **Species And Communities Branch** DPaW,
Locked Bag 104, BENTLEY DELIVERY CENTRE WA 6983
RECORDS: Please forward to **Flora Administrative Officer,** Species and Communities Branch.

Record entered by: _____ **Sheet No.:** _____ **Record Accepted in Database** ☐

Department of Parks and Wildlife

Threatened and Priority Flora Report Form

Version 1.2 August 2013

HABITAT INFORMATION: (Check more than one box for combinations or where necessary)

LANDFORM:	ROCK TYPE:	LOOSE ROCK:	SOIL TYPE:	SOIL COLOUR:	DRAINAGE:
Crest ☐	Granite ☐	(on soil surface; e.g. gravel, quartz fields)	Sand ☐	Red ☐	Well drained ☐
Hill ☐	Dolerite ☐		Sandy loam ☒	Brown ☒	Seasonally inundated ☐
Ridge ☐	Laterite ☐	0-10% ☐	Loam ☐	Yellow ☐	Permanently inundated ☐
Outcrop ☐	Ironstone ☐	10-30% ☐	Clay loam ☐	White ☐	Tidal ☐
Slope ☐	Limestone ☐	30-50% ☐	Light clay ☐	Grey ☐	
Flat ☐	Quartz ☐	50-100% ☐	Peat ☐	Black ☐	
Open depression ☐					
Drainage line ☐	Specify other:		Specify other:	Specify other:	Specify other:
Closed depression ☐					
Wetland ☐					

Specific Landform Element: (Refer to field manual for additional values)

CONDITION OF SOIL:

Dry ☐ Moist ☐ Waterlogged ☐ Inundated ☐ Cracked ☐ Saline ☐ Other:

VEGETATION CLASSIFICATION:* E.g. 1. Banksia woodland (B. attenuata, B. ilicifolia); 2. Open shrubland (Hibbertia sp., Acacia spp.) 3. Isolated clumps of sedges (Mesomelaena tetragona)	1. Eucalyptus wandoo, Corymbia calophylla and Eucalyptus accedens mid open forest
	2. Gastrolobium truncatum, Gastrolobium parviflorum and Xanthorrhoea preissii mid open shrubland
	3. Acacia lasiocarpa var. sedifolia, Opercularia vaginata and Hakea lissocarpha mid open heath shrubland.
	4.
ASSOCIATED SPECIES: Other (non-dominant) spp	

* Please record up to four of the most representative vegetation layers (with up to three dominant species in each layer). Structural Formations should follow 2009 *Australian Soil and Land Survey Field Handbook* guidelines – refer to field manual for further information and structural formation table.

CONDITION OF HABITAT: Pristine ☐ Excellent ☐ Very good ☐ Good ☐ Degraded ☐ Completely degraded ☐

COMMENT: Vegetation condition considered Degraded to good

FIRE HISTORY: **Last Fire:** Season/Month: _____ Year: _____ **Fire Intensity:** High ☐ Medium ☐ Low ☐ No signs of fire ☐

FENCING:	Not required ☐	Present ☐	Replace / repair ☐	Required ☐	Length req'd: _____
ROADSIDE MARKERS:	Not required ☐	Present ☒	Replace / reposition ☐	Required ☐	Quantity req'd: _____

OTHER COMMENTS: (Please include recommended management actions and/or implemented actions - include date. Also include details of additional data available, and how to locate it.)

No specimen was collected, only photographs were taken

Please return completed form to **Species And Communities Branch** DPaW,
Locked Bag 104, BENTLEY DELIVERY CENTRE WA 6983
RECORDS: Please forward to **Flora Administrative Officer,** Species and Communities Branch.

Record entered by:_____ **Sheet No.:**_____ **Record Accepted in Database** ☐

Department of Parks and Wildlife

Threatened and Priority Flora Report Form

Version 1.2 August 2013

DRF PERMIT/ LICENCE No: SL011558

Note if only observing plants (i.e. no specimens or plant matieral is taken) then no permit/licence is required. For further information on permit and licening requirements see the Threatened Flora and Wildlife Licensing pages on DPaW's website. Any actions carried out under licence/permit should be recorded above in the OTHER COMMENTS section.

SPECIMEN: Collectors No: WA Herb. ☐ Regional Herb. ☐ District Herb. ☐ Other:

ATTACHED: Map ☐ Mudmap ☐ Photo ☐ GIS data ☐ Field notes ☐ Other:

COPY SENT TO: Regional Office ☐ District Office ☐ Other:

Submitter of record: Lyn Van Gorp **Role:** Environmental Scientist

Signature:

Date submitted: 14 / 01 / 2016

Please return completed form to **Species And Communities Branch** DPaW,
Locked Bag 104, BENTLEY DELIVERY CENTRE WA 6983
RECORDS: Please forward to **Flora Administrative Officer,** Species and Communities Branch.

Record entered by:_____ **Sheet No.:**_____ **Record Accepted in Database** ☐

Department of Parks and Wildlife

Threatened and Priority Flora Report Form

Version 1.2 August 2013

Please complete as much of the form as possible.
For information on how to complete the form please refer to the Threatened & Priority Flora Report Form (TPRF) manual on the DPaW website at http://www.dpaw.wa.gov.au/

TAXON: Calytrix oncophylla **TPFL Pop. No:**

OBSERVATION DATE: 22/09/2015 **CONSERVATION STATUS:** Priority 2 New population ☐

OBSERVER/S: Lyn Van Gorp and Floora de Wit **PHONE:** 6208 0203

ROLE: Environmental Scientist and Senior Botanist **ORGANISATION:** AECOM Australia Pty Ltd

DESCRIPTION OF LOCATION (Provide at least nearest town/named locality, and the distance and direction to that place):

Approximately 6.5km to the south-west of the township of Toodyay. Located in bushland in close proximity to Toodyay Road.

Reserve No:

DISTRICT: **LGA:** Shire of Toodyay Land manager present: ☐

DATUM:
GDA94 / MGA94 ☐
AGD84 / AMG84 ☐
WGS84 ☐
Unknown ☐

COORDINATES: (If UTM coords provided, **Zone** is also required)
DecDegrees ☐ DegMinSec ☐ UTMs ☐
Lat / Northing: Please refer to Attachment 1
Long / Easting: for location details
Zone:

METHOD USED:
GPS ☒ Differential GPS ☐ Map ☐
No. satellites: Map used:
Boundary polygon captured: ☐ Map scale:

LAND TENURE:
Nature reserve ☐ Timber reserve ☐ Private property ☒ Rail reserve ☐ Shire road reserve ☐
National park ☐ State forest ☐ Pastoral lease ☐ MRWA road reserve ☒ Other Crown reserve ☐
Conservation park ☐ Water reserve ☐ UCL ☐ SLK/Pole _____ to _____ Specify other: _____

AREA ASSESSMENT: Edge survey ☐ Partial survey ☐ Full survey ☐ Area observed (m²): _____

EFFORT: Time spent surveying (minutes): _____ No. of minutes spent / 100 m²: _____

POP'N COUNT ACCURACY: Actual ☐ Extrapolation ☐ Estimate ☐

Count method: (Refer to field manual for list) Please refer to Attachment 1 for further details

WHAT COUNTED: Plants ☐ Clumps ☐ Clonal stems ☐

TOTAL POP'N STRUCTURE:

	Mature:	Juveniles:	Seedlings:	Totals:
Alive				
Dead				

Area of pop (m²): _____

Note: Pls record count as numbers (not percentages) for database.

QUADRATS PRESENT: No. _____ Size _____ Data attached ☐ Total area of quadrats (m²): _____

Summary Quad. Totals: Alive				

REPRODUCTIVE STATE: Clonal ☐ Vegetative ☐ Flowerbud ☐ Flower ☒
Immature fruit ☐ Fruit ☐ Dehisced fruit ☐ Percentage in flower: _____%

CONDITION OF PLANTS: Healthy ☒ Moderate ☐ Poor ☐ Senescent ☐

COMMENT:

THREATS - type, agent and supporting information: E.g. clearing, too frequent fire, weed, disease. Refer to field manual for list of threats & agents. **Specify agent** where relevant. **Rate current and potential threat impact:** N=Nil, L=Low, M=Medium, H=High, E=Extreme **Estimate time to potential impact:** S=Short (<12mths), M=Medium (<5yrs), L=Long (5yrs+)	**Current impact (N-E)**	**Potential Impact (L-E)**	**Potential Threat Onset (S-L)**
•			
•			
•			

Please return completed form to **Species And Communities Branch** DPaW,
Locked Bag 104, BENTLEY DELIVERY CENTRE WA 6983
RECORDS: Please forward to **Flora Administrative Officer,** Species and Communities Branch.

Record entered by:_____ **Sheet No.:**_____ **Record Accepted in Database** ☐

Department of Parks and Wildlife

Threatened and Priority Flora Report Form

Version 1.2 August 2013

HABITAT INFORMATION: (Check more than one box for combinations or where necessary)

LANDFORM:	**ROCK TYPE:**	**LOOSE ROCK:**	**SOIL TYPE:**	**SOIL COLOUR:**	**DRAINAGE:**
Crest ☐	Granite ☐	(on soil surface; e.g. gravel, quartz fields)	Sand ☐	Red ☐	Well drained ☐
Hill ☐	Dolerite ☐		Sandy loam ☐	Brown ☒	Seasonally inundated ☐
Ridge ☐	Laterite ☒	0-10% ☐	Loam ☐	Yellow ☐	
Outcrop ☐	Ironstone ☐	10-30% ☐	Clay loam ☒	White ☐	Permanently inundated ☐
Slope ☐	Limestone ☐	30-50% ☐	Light clay ☐	Grey ☐	Tidal ☐
Flat ☐	Quartz ☐	50-100% ☐	Peat ☐	Black ☐	
Open depression ☐					
Drainage line ☐	Specify other:		Specify other:	Specify other:	Specify other:
Closed depression ☐					
Wetland ☐					

Specific Landform Element: (Refer to field manual for additional values)

CONDITION OF SOIL:

Dry ☐ Moist ☐ Waterlogged ☐ Inundated ☐ Cracked ☐ Saline ☐ Other:

VEGETATION CLASSIFICATION:* E.g. **1.** Banksia woodland (B. attenuata, B. ilicifolia); **2.** Open shrubland (Hibbertia sp., Acacia spp.) **3.** Isolated clumps of sedges (Mesomelaena tetragona)	1. Please refer to Attachment 1 for details
	2.
	3.
	4.
ASSOCIATED SPECIES: Other (non-dominant) spp	

* Please record up to four of the most representative vegetation layers (with up to three dominant species in each layer). Structural Formations should follow 2009 *Australian Soil and Land Survey Field Handbook* guidelines – refer to field manual for further information and structural formation table.

CONDITION OF HABITAT: Pristine ☐ Excellent ☐ Very good ☐ Good ☐ Degraded ☐ Completely degraded ☐

COMMENT: Please refer to Attachment 1

FIRE HISTORY: **Last Fire:** Season/Month: _____ Year: _____ **Fire Intensity:** High ☐ Medium ☐ Low ☐ No signs of fire ☐

FENCING: Not required ☐ Present ☐ Replace / repair ☐ Required ☐ Length req'd: _____

ROADSIDE MARKERS: Not required ☐ Present ☐ Replace / reposition ☐ Required ☐ Quantity req'd: _____

OTHER COMMENTS: (Please include recommended management actions and/or implemented actions - include date. Also include details of additional data available, and how to locate it.)

Please return completed form to **Species And Communities Branch** DPaW,
Locked Bag 104, BENTLEY DELIVERY CENTRE WA 6983
RECORDS: Please forward to **Flora Administrative Officer,** Species and Communities Branch.

Record entered by:_____ **Sheet No.:**_____ **Record Accepted in Database** ☐

Department of Parks and Wildlife

Threatened and Priority Flora Report Form

Version 1.2 August 2013

DRF PERMIT/ LICENCE No: SL011558

Note if only observing plants (i.e. no specimens or plant matieral is taken) then no permit/licence is required. For further information on permit and licening requirements see the Threatened Flora and Wildlife Licensing pages on DPaW's website. Any actions carried out under licence/permit should be recorded above in the OTHER COMMENTS section.

SPECIMEN: Collectors No: LVG130 WA Herb. ☒ Regional Herb. ☐ District Herb. ☐ Other:

ATTACHED: Map ☐ Mudmap ☐ Photo ☐ GIS data ☐ Field notes ☐ Other:

COPY SENT TO: Regional Office ☐ District Office ☐ Other:

Submitter of record: Lyn Van Gorp **Role:** Environmental Scientist

Signature: **Date submitted:** 14 / 01 / 2016

Please return completed form to **Species And Communities Branch** DPaW,
Locked Bag 104, BENTLEY DELIVERY CENTRE WA 6983
RECORDS: Please forward to **Flora Administrative Officer,** Species and Communities Branch.

Record entered by:_____ **Sheet No.:**_____ **Record Accepted in Database** ☐

Attachment 1

Species	Location	Latitude	Longitude	Number of individuals*	Vegetation condition	Vegetation Community description
Calytrix oncophylla	Bushland close to road reserve to the south of Toodyay Rd	-31.606915	116.441441	1	Good	*Eucalyptus wandoo* and *Corymbia calophylla* mid woodland over *Banksia squarrosa* subsp. *squarrosa*, *Leptospermum erubescens* and *Banksia sessilis* var. sessilis tall shrubland over *Leucopogon propinquus*, *Dillwynia laxiflora* and *Hibbertia commutata* low isolated heath shrubland.
Calytrix oncophylla	Bushland to the south of Toodyay Rd	-31.608385	116.441806	1	Very good – excellent	*Eucalyptus accedens*, *Eucalyptus wandoo* and *Corymbia calophylla* mid open forest over *Xanthorrhoea preissii*, *Banksia squarrosa* subsp. *squarrosa* and *Acacia pulchella* mid to tall isolated clumps of shrubs over *Bossiaea eriocarpa*, *Petrophile divaricata* and *Astroloma* epacridis low open shrubland.
Calytrix oncophylla	Bushland to the south of Toodyay Rd	-31.607996	116.44241	1	Excellent	*Eucalyptus accedens*, *Eucalyptus wandoo* and *Corymbia calophylla* mid open forest over *Xanthorrhoea preissii*, *Banksia squarrosa* subsp. *squarrosa* and *Acacia pulchella* mid to tall isolated clumps of shrubs over *Bossiaea eriocarpa*, *Petrophile divaricata* and *Astroloma* epacridis low open shrubland.

*Note: population counts were estimated based on foliage cover within quadrats

Department of Parks and Wildlife

Threatened and Priority Flora Report Form

Version 1.2 August 2013

Please complete as much of the form as possible.
For information on how to complete the form please refer to the Threatened & Priority Flora Report Form (TPRF) manual on the DPaW website at http://www.dpaw.wa.gov.au/

TAXON: Grevillea candolleana **TPFL Pop. No:**

OBSERVATION DATE: 22/09/2015 **CONSERVATION STATUS:** Priority 2 New population ☐

OBSERVER/S: Lyn Van Gorp and Floora de Wit **PHONE:** 6208 0203

ROLE: Environmental Scientist and Senior Botanist **ORGANISATION:** AECOM Australia Pty Ltd

DESCRIPTION OF LOCATION (Provide at least nearest town/named locality, and the distance and direction to that place):

Five locations in roadside vegetation or nearby expanses of native vegetation in proximity to Toodyay Road. Individual records located between approximately 6 and 16.5km to the south-west of the township of Toodyay.

Please refer to Attachment 1 for further details in relation to location.

Reserve No:

DISTRICT: **LGA:** Shire of Toodyay Land manager present: ☐

DATUM:
GDA94 / MGA94 ☐
AGD84 / AMG84 ☐
WGS84 ☐
Unknown ☐

COORDINATES: (If UTM coords provided, **Zone** is also required)
DecDegrees ☐ DegMinSec ☐ UTMs ☐
Lat / Northing: Please refer to Attachment 1
Long / Easting: for location details
Zone:

METHOD USED:
GPS ☒ Differential GPS ☐ Map ☐
No. satellites: Map used:
Boundary polygon captured: ☐ Map scale:

LAND TENURE:

Nature reserve ☐	Timber reserve ☐	Private property ☒	Rail reserve ☐	Shire road reserve ☐
National park ☐	State forest ☐	Pastoral lease ☐	MRWA road reserve ☒	Other Crown reserve ☐
Conservation park ☐	Water reserve ☐	UCL ☐	SLK/Pole _____ to _____	Specify other: _____

AREA ASSESSMENT: Edge survey ☐ Partial survey ☐ Full survey ☐ Area observed (m²): _____

EFFORT: Time spent surveying (minutes): _____ No. of minutes spent / 100 m²: _____

POP'N COUNT ACCURACY: Actual ☐ Extrapolation ☐ Estimate ☐

Count method: (Refer to field manual for list) Please refer to Attachment 1 for further details

WHAT COUNTED: Plants ☐ Clumps ☐ Clonal stems ☐

TOTAL POP'N STRUCTURE:	**Mature:**	**Juveniles:**	**Seedlings:**	**Totals:**
Alive				
Dead				

Area of pop (m²): _____

Note: Pls record count as numbers (not percentages) for database.

QUADRATS PRESENT: No. _____ Size _____ Data attached ☐ Total area of quadrats (m²): _____

Summary Quad. Totals: Alive				

REPRODUCTIVE STATE: Clonal ☐ Vegetative ☐ Flowerbud ☐ Flower ☒
Immature fruit ☐ Fruit ☐ Dehisced fruit ☐ Percentage in flower: _____%

CONDITION OF PLANTS: Healthy ☒ Moderate ☐ Poor ☐ Senescent ☐

COMMENT:

THREATS - type, agent and supporting information: E.g. clearing, too frequent fire, weed, disease. Refer to field manual for list of threats & agents. **Specify agent** where relevant. **Rate current and potential threat impact:** N=Nil, L=Low, M=Medium, H=High, E=Extreme **Estimate time to potential impact:** S=Short (<12mths), M=Medium (<5yrs), L=Long (5yrs+)	**Current impact (N-E)**	**Potential Impact (L-E)**	**Potential Threat Onset (S-L)**
•			
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Please return completed form to **Species And Communities Branch** DPaW,
Locked Bag 104, BENTLEY DELIVERY CENTRE WA 6983
RECORDS: Please forward to **Flora Administrative Officer,** Species and Communities Branch.

Record entered by: _____ **Sheet No.:** _____ **Record Accepted in Database** ☐

Department of Parks and Wildlife

Threatened and Priority Flora Report Form

Version 1.2 August 2013

HABITAT INFORMATION: (Check more than one box for combinations or where necessary)

LANDFORM:	ROCK TYPE:	LOOSE ROCK:	SOIL TYPE:	SOIL COLOUR:	DRAINAGE:
Crest ☐	Granite ☐	(on soil surface; e.g. gravel, quartz fields)	Sand ☐	Red ☐	Well drained ☐
Hill ☐	Dolerite ☐		Sandy loam ☐	Brown ☐	Seasonally inundated ☐
Ridge ☐	Laterite ☐	0-10% ☐	Loam ☐	Yellow ☐	
Outcrop ☐	Ironstone ☐	10-30% ☐	Clay loam ☐	White ☐	Permanently inundated ☐
Slope ☐	Limestone ☐	30-50% ☐	Light clay ☐	Grey ☐	Tidal ☐
Flat ☐	Quartz ☐	50-100% ☐	Peat ☐	Black ☐	
Open depression ☐					
Drainage line ☐	Specify other:		Specify other:	Specify other:	Specify other:
Closed depression ☐					
Wetland ☐					

Specific Landform Element: (Refer to field manual for additional values)

Please refer to Attachment 1 for further details on rock and soil information

CONDITION OF SOIL:

Dry ☐ Moist ☐ Waterlogged ☐ Inundated ☐ Cracked ☐ Saline ☐ Other:

VEGETATION CLASSIFICATION:* E.g. **1.** Banksia woodland (B. attenuata, B. ilicifolia); **2.** Open shrubland (Hibbertia sp., Acacia spp.) **3.** Isolated clumps of sedges (Mesomelaena tetragona)	1. Please refer to Attachment 1 for details
	2.
	3.
	4.
ASSOCIATED SPECIES: Other (non-dominant) spp	

* Please record up to four of the most representative vegetation layers (with up to three dominant species in each layer). Structural Formations should follow 2009 *Australian Soil and Land Survey Field Handbook* guidelines – refer to field manual for further information and structural formation table.

CONDITION OF HABITAT: Pristine ☐ Excellent ☐ Very good ☐ Good ☐ Degraded ☐ Completely degraded ☐

COMMENT: Please refer to Attachment 1

FIRE HISTORY: **Last Fire:** Season/Month: _____ Year: _____ **Fire Intensity:** High ☐ Medium ☐ Low ☐ No signs of fire ☐

FENCING: Not required ☐ Present ☐ Replace / repair ☐ Required ☐ Length req'd: _____

ROADSIDE MARKERS: Not required ☐ Present ☐ Replace / reposition ☐ Required ☐ Quantity req'd: _____

OTHER COMMENTS: (Please include recommended management actions and/or implemented actions - include date. Also include details of additional data available, and how to locate it.)

Identification confirmed by M. Hislop (Accession number 6656)

Please return completed form to **Species And Communities Branch** DPaW,
Locked Bag 104, BENTLEY DELIVERY CENTRE WA 6983
RECORDS: Please forward to **Flora Administrative Officer,** Species and Communities Branch.

Record entered by:_____ **Sheet No.:**_____ **Record Accepted in Database** ☐

Department of Parks and Wildlife

Threatened and Priority Flora Report Form

Version 1.2 August 2013

DRF PERMIT/ LICENCE No: SL011558

Note if only observing plants (i.e. no specimens or plant matieral is taken) then no permit/licence is required. For further information on permit and licening requirements see the Threatened Flora and Wildlife Licensing pages on DPaW's website. Any actions carried out under licence/permit should be recorded above in the OTHER COMMENTS section.

SPECIMEN: Collectors No: LVG86 WA Herb. ☒ Regional Herb. ☐ District Herb. ☐ Other:

ATTACHED: Map ☐ Mudmap ☐ Photo ☐ GIS data ☐ Field notes ☐ Other: Additional notes

COPY SENT TO: Regional Office ☐ District Office ☐ Other:

Submitter of record: Lyn Van Gorp **Role:** Environmental Scientist

Signature: **Date submitted:** 14 / 01 / 2016

Please return completed form to **Species And Communities Branch** DPaW,
Locked Bag 104, BENTLEY DELIVERY CENTRE WA 6983
RECORDS: Please forward to **Flora Administrative Officer,** Species and Communities Branch.

Record entered by:_____ **Sheet No.:**_____ **Record Accepted in Database** ☐

Attachment 1

Species	Location	Latitude	Longitude	Number of individuals*	Vegetation condition	Vegetation Community description
Grevillea candolleana	Roadside vegetation along Toodyay Road, approximately 13.5km SW of Toodyay township	-31.64727	116.374785	1	Very good	*Corymbia calophylla* and *Eucalyptus marginata* mid open forest to woodland over *Xanthorrhoea preissii, Banksia sessilis* var. *sessilis* and *Acacia pulchella* mid to tall sparse shrubland over *Hibbertia hypericoides, Tetraria octandra* and *Phyllanthus calycinus.* Soil: Sandy, loam, gravel
Grevillea candolleana	Roadside vegetation along Toodyay Road, approximately 16.5km SW of Toodyay township. Nearby Morangup Nature Reserve	-31.67275	116.354479	1	Very good	*Eucalyptus wandoo, Corymbia calophylla* and *Eucalyptus accedens* mid open forest over *Gastrolobium truncatum, Gastrolobium parviflorum* and *Xanthorrhoea preissii* mid open shrubland over *Acacia lasiocarpa* var. *sedifolia, Opercularia vaginata* and *Hakea lissocarpha* mid open heath shrubland. Soil: Sandy, loam, gravel
Grevillea candolleana	Vegetation nearby Toodyay Road, approximately 6.5km SW of Toodyay township	-31.606159	116.442528	1	Very good	*Eucalyptus wandoo, Corymbia calophylla* and *Eucalyptus accedens* mid open forest over *Gastrolobium truncatum, Gastrolobium parviflorum* and *Xanthorrhoea preissii* mid open shrubland over *Acacia lasiocarpa* var. *sedifolia, Opercularia vaginata* and *Hakea lissocarpha* mid open heath shrubland. Soil: Gravelly, loamy, clay
Grevillea candolleana	Vegetation nearby Toodyay Road, approximately 6km SW of Toodyay township	-31.605102	116.449346	1	Very good	*Eucalyptus wandoo, Corymbia calophylla* and *Eucalyptus accedens* mid open forest over *Gastrolobium truncatum, Gastrolobium parviflorum* and *Xanthorrhoea preissii* mid open shrubland over *Acacia lasiocarpa* var. *sedifolia, Opercularia vaginata* and *Hakea lissocarpha* mid open heath shrubland. Soil: Sandy, loam, gravel
Grevillea candolleana	Vegetation nearby Toodyay Road, approximately 6.3km SW of Toodyay township	-31.607785	116.457514	1	Very good - Excellent	*Eucalyptus accedens*, *Eucalyptus wandoo* and *Corymbia calophylla* mid open forest over *Xanthorrhoea preissii*, *Banksia squarrosa* subsp. *squarrosa* and *Acacia pulchella* mid to tall isolated clumps of shrubs over *Bossiaea eriocarpa*, *Petrophile divaricata* and *Astroloma* epacridis low open shrubland. Landform: Hill, outcrop Rock type: Laterite Soil: Sandy, loam, gravel

*Note: This species was not identified as a conservation significant species at the time of the survey. Therefore, no formal population counts were undertaken. Population counts have been estimated based on foliage cover within quadrats

Department of Parks and Wildlife

Threatened and Priority Flora Report Form

Version 1.2 August 2013

Please complete as much of the form as possible.
For information on how to complete the form please refer to the Threatened & Priority Flora Report Form (TPRF) manual on the DPaW website at http://www.dpaw.wa.gov.au/

TAXON: Hibbertia montana **TPFL Pop. No:**

OBSERVATION DATE: 22/09/2015 **CONSERVATION STATUS:** Priority 4 New population ☐

OBSERVER/S: Lyn Van Gorp and Floora de Wit **PHONE:** 6208 0203

ROLE: Environmental Scientist and Senior Botanist **ORGANISATION:** AECOM Australia Pty Ltd

DESCRIPTION OF LOCATION (Provide at least nearest town/named locality, and the distance and direction to that place):

Located in vegetation in close proximity to Toodyay Road, approximately 14km to the south-west of the township of Toodyay.

Reserve No:

DISTRICT: **LGA:** Shire of Toodyay Land manager present: ☐

DATUM:
GDA94 / MGA94 ☐
AGD84 / AMG84 ☐
WGS84 ☐
Unknown ☐

COORDINATES: (If UTM coords provided, **Zone** is also required)
DecDegrees ☐ DegMinSec ☐ UTMs ☐
Lat / Northing: Please refer to Attachment 1
Long / Easting: for location details
Zone:

METHOD USED:
GPS ☒ Differential GPS ☐ Map ☐
No. satellites: Map used:
Boundary polygon captured: ☐ Map scale:

LAND TENURE:

Nature reserve ☐	Timber reserve ☐	Private property ☒	Rail reserve ☐	Shire road reserve ☐
National park ☐	State forest ☐	Pastoral lease ☐	MRWA road reserve ☒	Other Crown reserve ☐
Conservation park ☐	Water reserve ☐	UCL ☐	SLK/Pole _____ to _____	Specify other: _____

AREA ASSESSMENT: Edge survey ☐ Partial survey ☐ Full survey ☐ Area observed (m²): _____

EFFORT: Time spent surveying (minutes): _____ No. of minutes spent / 100 m²: _____

POP'N COUNT ACCURACY: Actual ☐ Extrapolation ☐ Estimate ☐

Count method: (Refer to field manual for list) Please refer to Attachment 1 for further details

WHAT COUNTED: Plants ☐ Clumps ☐ Clonal stems ☐

TOTAL POP'N STRUCTURE:

	Mature:	Juveniles:	Seedlings:	Totals:
Alive				
Dead				

Area of pop (m²): _____

Note: Pls record count as numbers (not percentages) for database.

QUADRATS PRESENT: No. _____ Size _____ Data attached ☐ Total area of quadrats (m²): _____

Summary Quad. Totals:				
Alive				

REPRODUCTIVE STATE: Clonal ☐ Vegetative ☐ Flowerbud ☐ Flower ☒
Immature fruit ☐ Fruit ☐ Dehisced fruit ☐ Percentage in flower: _____%

CONDITION OF PLANTS: Healthy ☐ Moderate ☐ Poor ☐ Senescent ☐

COMMENT:

THREATS - type, agent and supporting information: E.g. clearing, too frequent fire, weed, disease. Refer to field manual for list of threats & agents. **Specify agent** where relevant. **Rate current and potential threat impact:** N=Nil, L=Low, M=Medium, H=High, E=Extreme **Estimate time to potential impact:** S=Short (<12mths), M=Medium (<5yrs), L=Long (5yrs+)	**Current impact (N-E)**	**Potential Impact (L-E)**	**Potential Threat Onset (S-L)**
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Please return completed form to **Species And Communities Branch** DPaW,
Locked Bag 104, BENTLEY DELIVERY CENTRE WA 6983
RECORDS: Please forward to **Flora Administrative Officer,** Species and Communities Branch.

Record entered by: _____ **Sheet No.:** _____ **Record Accepted in Database** ☐

Department of Parks and Wildlife

Threatened and Priority Flora Report Form

Version 1.2 August 2013

HABITAT INFORMATION: (Check more than one box for combinations or where necessary)

LANDFORM:	**ROCK TYPE:**	**LOOSE ROCK:**	**SOIL TYPE:**	**SOIL COLOUR:**	**DRAINAGE:**
Crest ☐	Granite ☐	(on soil surface; e.g. gravel, quartz fields)	Sand ☐	Red ☐	Well drained ☐
Hill ☐	Dolerite ☐		Sandy loam ☒	Brown ☒	Seasonally inundated ☐
Ridge ☐	Laterite ☐	0-10% ☐	Loam ☐	Yellow ☐	
Outcrop ☐	Ironstone ☐	10-30% ☐	Clay loam ☐	White ☐	Permanently inundated ☐
Slope ☐	Limestone ☐	30-50% ☐	Light clay ☐	Grey ☐	Tidal ☐
Flat ☐	Quartz ☐	50-100% ☐	Peat ☐	Black ☐	
Open depression ☐					
Drainage line ☐	Specify other:		Specify other:	Specify other:	Specify other:
Closed depression ☐					
Wetland ☐					

Specific Landform Element: (Refer to field manual for additional values)

CONDITION OF SOIL:

Dry ☐ Moist ☐ Waterlogged ☐ Inundated ☐ Cracked ☐ Saline ☐ Other:

VEGETATION CLASSIFICATION:* E.g. **1.** Banksia woodland (B. attenuata, B. ilicifolia); **2.** Open shrubland (Hibbertia sp., Acacia spp.) **3.** Isolated clumps of sedges (Mesomelaena tetragona)	1. Please refer to Attachment 1 for details
	2.
	3.
	4.
ASSOCIATED SPECIES: Other (non-dominant) spp	

* Please record up to four of the most representative vegetation layers (with up to three dominant species in each layer). Structural Formations should follow 2009 *Australian Soil and Land Survey Field Handbook* guidelines – refer to field manual for further information and structural formation table.

CONDITION OF HABITAT: Pristine ☐ Excellent ☐ Very good ☐ Good ☐ Degraded ☐ Completely degraded ☐

COMMENT: Please refer to Attachment 1

FIRE HISTORY: **Last Fire:** Season/Month: _____ Year: _____ **Fire Intensity:** High ☐ Medium ☐ Low ☐ No signs of fire ☐

FENCING: Not required ☐ Present ☐ Replace / repair ☐ Required ☐ Length req'd: _____

ROADSIDE MARKERS: Not required ☐ Present ☐ Replace / reposition ☐ Required ☐ Quantity req'd: _____

OTHER COMMENTS: (Please include recommended management actions and/or implemented actions - include date. Also include details of additional data available, and how to locate it.)

Please return completed form to **Species And Communities Branch** DPaW,
Locked Bag 104, BENTLEY DELIVERY CENTRE WA 6983
RECORDS: Please forward to **Flora Administrative Officer,** Species and Communities Branch.

Record entered by:_____ **Sheet No.:**_____ **Record Accepted in Database** ☐

Department of Parks and Wildlife

Threatened and Priority Flora Report Form

Version 1.2 August 2013

DRF PERMIT/ LICENCE No: SL011558

Note if only observing plants (i.e. no specimens or plant matieral is taken) then no permit/licence is required. For further information on permit and licening requirements see the Threatened Flora and Wildlife Licensing pages on DPaW's website. Any actions carried out under licence/permit should be recorded above in the OTHER COMMENTS section.

SPECIMEN: Collectors No: LVG81 WA Herb. ☒ Regional Herb. ☐ District Herb. ☐ Other:

ATTACHED: Map ☐ Mudmap ☐ Photo ☐ GIS data ☐ Field notes ☐ Other: Additional notes

COPY SENT TO: Regional Office ☐ District Office ☐ Other:

Submitter of record: Lyn Van Gorp **Role:** Environmental Scientist

Signature: **Date submitted:** 14 / 10 / 2016

Please return completed form to **Species And Communities Branch** DPaW,
Locked Bag 104, BENTLEY DELIVERY CENTRE WA 6983
RECORDS: Please forward to **Flora Administrative Officer,** Species and Communities Branch.

Record entered by:_____ **Sheet No.:**_____ **Record Accepted in Database** ☐

Attachment 1

Species	Location	Latitude	Longitude	Number of individuals*	Vegetation condition	Vegetation Community description
Hibbertia montana	In vegetation near Toodyay Road, approximately 14km SW of Toodyay township	-31.648295	116.374185	Recorded as an opportunistic observation indicating it was in the area but not within the surveyed quadrat	Good to degraded	*Corymbia calophylla* and *Eucalyptus marginata* mid open forest to woodland over *Xanthorrhoea preissii, Banksia sessilis* var. *sessilis* and *Acacia pulchella* mid to tall sparse shrubland over *Hibbertia hypericoides, Tetraria octandra* and *Phyllanthus calycinus.* Soil: sandy, loamy gravel Soil colour: Brown
Hibbertia montana	In roadside vegetation near Toodyay Road, approximately 14km SW of Toodyay township	-31.64727	116.374785	Recorded with 0.2% foliage cover indicating a population of approximately 10-20 individuals	Very good	

*Note: This species was not identified as a conservation significant species at the time of the survey. Therefore, no formal population counts were undertaken. Population counts have been estimated based on foliage cover within quadrats

Department of Parks and Wildlife

Threatened and Priority Flora Report Form

Version 1.2 August 2013

Please complete as much of the form as possible.
For information on how to complete the form please refer to the Threatened & Priority Flora Report Form (TPRF) manual on the DPaW website at http://www.dpaw.wa.gov.au/

TAXON: Verticordia citrella **TPFL Pop. No:**

OBSERVATION DATE: 21/09/2015 **CONSERVATION STATUS:** Priority 2 New population ☐

OBSERVER/S: Lyn Van Gorp and Floora de Wit **PHONE:** 6208 0203

ROLE: Environmental Scientist and Senior Botanist **ORGANISATION:** AECOM Australia Pty Ltd

DESCRIPTION OF LOCATION (Provide at least nearest town/named locality, and the distance and direction to that place):

Located within Morangup Nature Reserve, approximately 19km to the south-west of the township of Toodyay.

Reserve No:

DISTRICT: **LGA:** Shire of Toodyay Land manager present: ☐

DATUM:
GDA94 / MGA94 ☐
AGD84 / AMG84 ☐
WGS84 ☐
Unknown ☐

COORDINATES: (If UTM coords provided, **Zone** is also required)
DecDegrees ☐ DegMinSec ☐ UTMs ☐
Lat / Northing: Please refer to Attachment 1
Long / Easting: for location details
Zone:

METHOD USED:
GPS ☒ Differential GPS ☐ Map ☐
No. satellites: Map used:
Boundary polygon captured: ☐ Map scale:

LAND TENURE:
Nature reserve ☒ Timber reserve ☐ Private property ☐ Rail reserve ☐ Shire road reserve ☐
National park ☐ State forest ☐ Pastoral lease ☐ MRWA road reserve ☐ Other Crown reserve ☐
Conservation park ☐ Water reserve ☐ UCL ☐ SLK/Pole _____ to _____ Specify other: _____

AREA ASSESSMENT: Edge survey ☐ Partial survey ☐ Full survey ☐ Area observed (m²): _____

EFFORT: Time spent surveying (minutes): _____ No. of minutes spent / 100 m²: _____

POP'N COUNT ACCURACY: Actual ☐ Extrapolation ☐ Estimate ☐

Count method: (Refer to field manual for list) Please refer to Attachment 1 for further details

WHAT COUNTED: Plants ☐ Clumps ☐ Clonal stems ☐

TOTAL POP'N STRUCTURE:	**Mature:**	**Juveniles:**	**Seedlings:**	**Totals:**
Alive				
Dead				

Area of pop (m²): _____
Note: Pls record count as numbers (not percentages) for database.

QUADRATS PRESENT: No. _____ Size _____ Data attached ☐ Total area of quadrats (m²): _____

Summary Quad. Totals: Alive				

REPRODUCTIVE STATE: Clonal ☐ Vegetative ☐ Flowerbud ☐ Flower ☒
Immature fruit ☐ Fruit ☐ Dehisced fruit ☐ Percentage in flower: _____%

CONDITION OF PLANTS: Healthy ☒ Moderate ☐ Poor ☐ Senescent ☐

COMMENT:

THREATS - type, agent and supporting information: E.g. clearing, too frequent fire, weed, disease. Refer to field manual for list of threats & agents. **Specify agent** where relevant. **Rate current and potential threat impact:** N=Nil, L=Low, M=Medium, H=High, E=Extreme **Estimate time to potential impact:** S=Short (<12mths), M=Medium (<5yrs), L=Long (5yrs+)	**Current impact (N-E)**	**Potential Impact (L-E)**	**Potential Threat Onset (S-L)**
•			
•			
•			

Please return completed form to **Species And Communities Branch** DPaW,
Locked Bag 104, BENTLEY DELIVERY CENTRE WA 6983
RECORDS: Please forward to **Flora Administrative Officer,** Species and Communities Branch.

Record entered by: _____ **Sheet No.:** _____ **Record Accepted in Database** ☐

Department of Parks and Wildlife

Threatened and Priority Flora Report Form

Version 1.2 August 2013

HABITAT INFORMATION: (Check more than one box for combinations or where necessary)

LANDFORM:	ROCK TYPE:	LOOSE ROCK:	SOIL TYPE:	SOIL COLOUR:	DRAINAGE:
Crest ☐	Granite ☐	(on soil surface; e.g. gravel, quartz fields)	Sand ☐	Red ☐	Well drained ☐
Hill ☐	Dolerite ☐		Sandy loam ☐	Brown ☐	Seasonally inundated ☐
Ridge ☐	Laterite ☒	0-10% ☐	Loam ☐	Yellow ☐	
Outcrop ☐	Ironstone ☐	10-30% ☐	Clay loam ☐	White ☐	Permanently inundated ☐
Slope ☒	Limestone ☐	30-50% ☐	Light clay ☐	Grey ☐	
Flat ☐	Quartz ☐	50-100% ☐	Peat ☐	Black ☐	Tidal ☐
Open depression ☐					
Drainage line ☐	Specify other:		Specify other: gravelly	Specify other:	Specify other:
Closed depression ☐					
Wetland ☐					

Specific Landform Element: (Refer to field manual for additional values)

CONDITION OF SOIL:

Dry ☐ Moist ☐ Waterlogged ☐ Inundated ☐ Cracked ☐ Saline ☐ Other:

VEGETATION CLASSIFICATION:* E.g. 1. Banksia woodland (B. attenuata, B. ilicifolia); 2. Open shrubland (Hibbertia sp., Acacia spp.) 3. Isolated clumps of sedges (Mesomelaena tetragona)	1. Please refer to Attachment 1 for details
	2.
	3.
	4.
ASSOCIATED SPECIES: Other (non-dominant) spp	

* Please record up to four of the most representative vegetation layers (with up to three dominant species in each layer). Structural Formations should follow 2009 *Australian Soil and Land Survey Field Handbook* guidelines – refer to field manual for further information and structural formation table.

CONDITION OF HABITAT: Pristine ☐ Excellent ☐ Very good ☐ Good ☐ Degraded ☐ Completely degraded ☐

COMMENT: Please refer to Attachment 1

FIRE HISTORY: **Last Fire:** Season/Month: _____ Year: _____ **Fire Intensity:** High ☐ Medium ☐ Low ☐ No signs of fire ☒

FENCING: Not required ☐ Present ☒ Replace / repair ☐ Required ☐ Length req'd: _____

ROADSIDE MARKERS: Not required ☐ Present ☐ Replace / reposition ☐ Required ☐ Quantity req'd: _____

OTHER COMMENTS: (Please include recommended management actions and/or implemented actions - include date. Also include details of additional data available, and how to locate it.)

Please return completed form to **Species And Communities Branch** DPaW,
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Record entered by:_____ **Sheet No.:**_____ **Record Accepted in Database** ☐

Department of Parks and Wildlife

Threatened and Priority Flora Report Form

Version 1.2 August 2013

DRF PERMIT/ LICENCE No: Lyn Van Gorp (SL011558)/Floora de Wit (CE005103)

Note if only observing plants (i.e. no specimens or plant matieral is taken) then no permit/licence is required. For further information on permit and licening requirements see the Threatened Flora and Wildlife Licensing pages on DPaW's website. Any actions carried out under licence/permit should be recorded above in the OTHER COMMENTS section.

SPECIMEN: Collectors No: LVG49 WA Herb. ☒ Regional Herb. ☐ District Herb. ☐ Other:

ATTACHED: Map ☐ Mudmap ☐ Photo ☐ GIS data ☐ Field notes ☐ Other: Additional notes

COPY SENT TO: Regional Office ☐ District Office ☐ Other:

Submitter of record: Lyn Van Gorp **Role:** Environmental Scientist

Signature: **Date submitted:** 14 / 10 / 11 2016

Please return completed form to **Species And Communities Branch** DPaW,
Locked Bag 104, BENTLEY DELIVERY CENTRE WA 6983
RECORDS: Please forward to **Flora Administrative Officer,** Species and Communities Branch.

Record entered by:_____ **Sheet No.:**_____ **Record Accepted in Database** ☐

Attachment 1

Species	Location	Latitude	Longitude	Number of individuals*	Vegetation condition	Vegetation Community description
Verticordia citrella	Morangup Nature Reserve, Shire of Toodyay	-31.680729	116.328424	2-5	Excellent	*Corymbia calophylla* and *Casuarina obesa* low to mid open woodland over *Xanthorrhoea preissii*, *Leptospermum erubescens* and *Adenanthos cygnorum* subsp. *cygnorum* tall open shrubland over *Lechenaultia biloba*, *Bossiaea eriocarpa* and *Acacia pulchella* mid to low open heath shrubland.
Verticordia citrella	Morangup Nature Reserve, Shire of Toodyay	-31.679802	116.330643	25-50	Excellent	*Eucalyptus drummondii* mid isolated trees over *Banksia nivea* subsp. Morangup (P2), *Kunzea micrantha* subsp. *micrantha* and *Lepidosperma drummondii* low heathland. Sandy clay red soils

*Population counts are an estimate, not an exact count

Appendix I

Species List

Appendix I: Species List

Family and Taxon	Naturalised	Conservation status
Amaranthaceae		
Ptilotus manglesii		
Ptilotus spathulatus		
Anarthriaceae		
Lyginia barbata		
Lyginia imberbis		
Apiaceae		
Eryngium pinnatifidum		
Pentapeltis peltigera		
Platysace tenuissima		
Xanthosia atkinsoniana		
Xanthosia ciliata		
Apocynaceae		
Gomphocarpus fruticosus	Y	
Araliaceae		
Trachymene pilosa		
Asparagaceae		
Asparagus asparagoides	Y	
Chamaescilla corymbosa var. *corymbosa*		
Chamaexeros serra		
Laxmannia grandiflora subsp. *grandiflora*		
Laxmannia squarrosa		
Lomandra caespitosa		
Lomandra effusa		
Lomandra hermaphrodita		
Lomandra integra		
Lomandra micrantha		
Lomandra preissii		
Lomandra sericea		
Lomandra sonderi		
Lomandra sp.		
Sowerbeae laxiflora		
Thysanotus fastigiatus		
Thysanotus manglesianus		
Thysanotus multiflorus		
Thysanotus scaber		
Asteraceae	46	
Arctotheca calendula	Y	
Blennospora drummondii		
Cotula sp.		
Craspedia variabilis		
Gnephosis tenuissima		
Hyalosperma glutinosum subsp. *glutinosum*		
Hypochaeris glabra	Y	
Lagenophera huegelii		
Lawrencia rosea		
Millotia tenuifolia var. *tenuifolia*		
Olearia lehmanniana		
Olearia paucidentata		
Podolepis gracilis		
Podolepis lessonii		
Sonchus asper	Y	
Sonchus oleraceus	Y	
Trichocline spathulata		
Ursinia anthemoides	Y	
Vellereophyton dealbatum	Y	
Waitzia nitida		
Waitzia suaveolens var. *suaveolens*		
Boryaceae		
Borya sphaerocephala		
Campanulaceae		
Isotoma hypocrateriformis		
Lobelia anceps		

Appendix I: Species List

Family and Taxon	Naturalised	Conservation status
Casuarinaceae		
Allocasuarina fraseriana		
Allocasuarina huegeliana		
Allocasuarina humilis		
Casuarina obesa		
Celastraceae		
Stachhousia monogyna		
Tripterococcus brunonis		
Colchicaceae		
Burchardia congesta		
Wurmbea dioica		
Cyperaceae		
Baumea juncea		
Cyathochaeta avenacea		
Ficinia nodosa		
Gahnia trifida		
Lepidosperma apricola		
Lepidosperma costale		
Lepidosperma drummondii		
Lepidosperma longitudinale		
Lepidosperma obtusum		
Lepidosperma pubisquameum		
Lepidosperma squamatum		
Lepidosperma tenue		
Mesomelaena tetragona		
Schoenoplectus validus		
Schoenus asperocarpus		
Schoenus grammatophyllus		
Tetraria capillaris		
Tetraria octandra		
Dillenaceae		
Hibbertia acerosa		
Hibbertia commutata		
Hibbertia commutata (hairy form)		
Hibbertia exasperata		
Hibbertia hemignosta		
Hibbertia huegelii		
Hibbertia hypericoides		
Hibbertia montana		P4
Hibbertia ovata		
Hibbertia pilosa		
Hibbertia sp.		
Hibbertia stellata		
Hibbertia subvaginata		
Droseraceae		
Drosera barbigera		
Drosera erythrorhiza subsp. *collina*		
Drosera macrantha subsp. *macrantha*		
Drosera menziesii subsp. *menziesii*		
Drosera platystigma		
Elaeocarpaceae		
Tetratheca hirsuta		
Ericaceae		
Astroloma ciliatum		
Astroloma epacridis		
Astroloma pallidum		
Leucopogon capitellatus		
Leucopogon cinereus		
Leucopogon conostephioides		
Leucopogon glaucifolius		
Leucopogon nutans		
Leucopogon propinquus		
Leucopogon pulchellus		
Styphelia tenuiflora		

Appendix I: Species List

Family and Taxon	Naturalised	Conservation status
Euphorbiaceae		
Euphorbia peplus	Y	
Monotaxis grandiflora var. *grandiflora*		
Fabaceae		
Acacia acuminata		
Acacia alata		
Acacia barbinervis subsp. *barbinervis*		
Acacia browniana		
Acacia burkitti		
Acacia candolleana subsp. *candolleana*		
Acacia celastrifolia		
Acacia divergens		
Acacia drummondii subsp. *drummondii*		
Acacia extensa		
Acacia lasiocarpa var. *lasiocarpa*		
Acacia lasiocarpa var. *sedifolia*		
Acacia nervosa		
Acacia pulchella		
Acacia saligna		
Acacia saligna subsp. *pruinescens*		
Acacia shuttleworthii		
Acacia squamata		
Acacia urophylla		
Billardiera venusta		
Bossiaea aquifolium		
Bossiaea eriocarpa		
Bossiaea ornata		
Bossiaea pulchella		
Bossiaea spinescens		
Chorizema cordata		
Chorizema dicksonii		
Daviesia angulata		
Daviesia decurrens		
Daviesia hakeoides subsp. *hakeoides*		
Daviesia hakeoides subsp. *subnuda*		
Daviesia rhombifolia		
Dillwynia laxiflora		
Gastrolobium calycinum		
Gastrolobium capitatum		
Gastrolobium dilatatum		
Gastrolobium microcarpum		
Gastrolobium parviflorum		
Gastrolobium spinosum		
Gastrolobium trilobum		
Gastrolobium truncatum		
Gastrolobium villosum		
?Gompholobium capitatum		
Gompholobium marginatum		
Gompholobium tomentosum		
Gompholobium preissii		
Gompholobium venustum		
Hovea chorizemifolia		
Hovea elliptica		
Hovea ellipticum		
Isotropis cuneifolia		
Jacksonia restioides		
Jacksonia sternbergiana		
Kennedia coccinea		
Kennedia prostrata		
Labichea punctata		
Lotus subbiflorus	Y	
Paraserianthes lophantha subsp. *lophantha*		
Sphaerolobium medium		
Trifolium campestre var. *campestre*	Y	
Viminaria juncea		

Appendix I: Species List

Family and Taxon	Naturalised	Conservation status
Geraniaceae		
Erodium cygnorum		
Goodeniaceae		
Dampiera alata		
Dampiera lavandulacea		
Dampiera linearis		
Goodenia coerulea		
Goodenia fasciculata		
Goodenia pinifolia		
?Goodenia pulchella		
Goodenia pulchella		
Lechenaultia biloba		
Scaevola calliptera		
Velleia trinervis		
Verreauxia reinwardtii		
Haemodoraceae		
Anigozanthos manglesii		
Conostylis androstemma		
Conostylis caricina subsp. elachys		
Conostylis serrulata		
Conostylis setigera		
Conostylis setigera subsp. setigera		
Conostylis setosa		
Haemodorum laxum		
Haemodorum paniculatum		
Lomandra caespitosa		
Haloragaceae		
Glischrocaryon aureum		
Gonocarpus cordiger		
Hemerocallidaceae		
Agrostocrinum hirsutum		
Agrostocrinum scabrum		
Caesia micrantha		
Caesia occidentalis		
Caesia sp.Wongan (K.F Kenneally 8820)		
Dianella revoluta		
Stypandra glauca		
Tricoryne elatior		
Iridaceae		
Freesia alba x leightlinii	Y	
Moraea flaccida	Y	
Moraea miniata	Y	
Orthrosanthus laxus var. *gramineus*		
Orthrosanthus laxus var. *laxus*		
Patersonia rudis		
Patersonia rudis var. *rudis*		
Romulea rosea var. *australis*	Y	
Watsonia meriana var. *bulbillifera*	Y	
Juncaceae		
Juncus pallidus		
Lamiaceae		
Hemigenia incana		
Lauraceae		
Cassytha glabella		

Appendix I: Species List

Family and Taxon	Naturalised	Conservation status
Lythraceae		
Lythrum hyssopifolia	Y	
Malvaceae		
Thomasia foliosa		
Moraceae		
Ficus carica	Y	
Myrtaceae		
Astartea affinis		
Astartea ? fascicularis		
Astartea scoparia		
Callistemon phoeniceus		
Calothamnus quadrifidus subsp. *quadrifidus*		
Calothamnus rupestris		
Calytrix oncophylla		P2
Calytrix variabilis		
Corymbia calophylla		
Eremaea asterocarpa subsp. *histoclada*		
Eucalyptus accedens		
Eucalyptus drummondii		
Eucalyptus loxophleba subsp. *loxophleba*		
Eucalyptus marginata		
Eucalyptus rudis		
Eucalyptus wandoo		
Hypocalymma angustifolium		
Kunzea micrantha subsp. *micrantha*		
Leptospermum erubescens		
Melaleuca aspalathoides		
Melaleuca carrii		
Melaleuca incana subsp. *incana*		
Melaleuca preissiana		
Melaleuca rhaphiophylla		
Melaleuca trichophylla		
Melaleuca viminea subsp. *viminea*		
Petrophile divaricata		
Verticordia citrella		P2
Verticordia densiflora var. *densiflora*		
Oleaceae		
Olea europaea	Y	
Orchidaceae		
Caladenia barbarossa		
Caladenia falcata		
Caladenia flava		
Caladenia integra		P4
Calochilus stramenicola		
Disa bracteata		
Diuris corymbosa		
Diuris longifolia		
Diuris porrifolia		
Diuris sp.		
Elythranthera brunonis		
Microtis media subsp. *densiflora*		
Pterostlyis sp. cauline leaves		
Pterostylis recurva		
Pterostylis sanguinea		
Pterostylis sargentii		
Pterostylis sp.		
Pyrorchis nigricans		
?Thelymitra sp.		
Thelymitra macrophylla		
Orobanchaceae		
Orobanche minor	Y	
Parentucellia latifolia	Y	
Oxalidaceae		
Oxalis corniculata	Y	
Oxalis pes-caprae	Y	
Papaveraceae		
Fumaria capreolata	Y	

Appendix I: Species List

Family and Taxon	Naturalised	Conservation status
Phyllanthaceae		
Phyllanthus calycinus		
Poranthera microphylla		
Pittosperaceae		
Billardiera venusta		
Pittosporaceae		
Billardiera floribunda		
Billardiera fusiformis		
Plantaginaceae		
Plantago lanceolata	Y	
Poaceae		
Aira caryophyllea	Y	
Amphipogon debilis		
Amphipogon laguroides subsp. *laguroides*		
Austrostipa elegantissima		
Avena barbata	Y	
Briza maxima	Y	
Briza minor	Y	
Bromus diandrus	Y	
Cynodon dactylon	Y	
Ehrharta calycina	Y	
Ehrharta longiflora	Y	
Eragrostis curvula		
Lagurus ovatus	Y	
Neurachne alopecuroidea		
Poaceae sp.		
Rytidosperma setaceum		
Tetrahena laevis		
Polygalaceae		
Comesperma calymega		
Comesperma volubile		
Primulaceae		
Lysimachia arvensis var. *arvensis*	Y	
Samolus junceus		
Proteaceae		
Adenanthos cygnorum subsp. *cygnorum*		
Adenanthos obovatus		
Banksia bipinnatifida subsp. *bipinnatifida*		
Banksia dallanneyi var. *dallanneyi*		
Banksia fraseri var. *fraseri*		
Banksia grandis		
Banksia littoralis		
Banksia nivea subsp. Morangup (M. Pieroni 94.2)		P2
Banksia sessilis var. *sessilis*		
Banksia squarrosa subsp. *squarrosa*		
Conospermum amoenum subsp. *cuneatum*		
Conospermum glumaceum		
Gevillea synapheae subsp. *synapheae*		
Grevillea bipinnatifida		
Grevillea candolleana		P2
Grevillea synapheae subsp. *synapheae*		
Grevillea vestita subsp. *vestita*		
Grevillea wilsonii		
Hakea incrassata		
Hakea lissocarpha		
Hakea prostrata		
Hakea stenocarpa		
Hakea trifurcata		
Hakea undulata		
Hakea varia		
Isopogon dubius		
Jacksonia floribunda		
Petrophile divaricata		
Petrophile serruriae		
Petrophile striata		
Stirlingia latifolia		
Synaphea petiolaris		
Synaphea sp. Udumung (A S George 17058)		

Appendix I: Species List

Family and Taxon	Naturalised	Conservation status
Pteridaceae		
Cheilanthes sieberi		
Ranunculaceae		
Clematis pubescens		
Restionaceae		
Alexgeorgea nitens		
Desmocladus flexuosus		
Hypolaena exsulca		
Lepidobolus preissianus		
Lepyrodia muirii		
Loxocarya cinerea		
Rhamnaceae		
Cryptandra arbutiflora var. *arbutiflora*		
Cryptandra nutans		
Stenanthemum coronatum		
Trymalium ledifolium		
Trymalium ledifolium var. lineare		
Trymalium odoratissimum subsp. odoratissimum		
Rosaceae		
Rubus anglocandicans	Y	
Rubiaceae		
Opercularia echinocephala		
Opercularia hispidula		
Opercularia vaginata		
Rutaceae		
Boronia ovata		
Boronia scabra subsp. *condensata*		P2
Philotheca nodiflora subsp. *calycina*		
Santalaceae		
Santalum acuminatum		
Sapindaceae		
Dodonaea pinifolia		
Solanaceae		
Solanum nigrum	Y	
Stylidiaceae		
Stylidium affine		
Stylidium amoenum		
Stylidium androsaceum		
Stylidium brunonianum		
Stylidium dichotomum		
Stylidium lateriticola		
Stylidium leptophyllum		
Stylidium perpusillum		
Stylidium piliferum		
Thymelaeaceae		
Pimelea argentea		
Pimelea ciliata subsp. *ciliata*		
Pimelea imbricata var. *piligera*		
Typhaceae		
Typha orientalis	Y	
Xanthorrhoeaceae		
Xanthorrhoea gracilis		
Xanthorrhoea preissii		
Zamiaceae		
Macrozamia riedlei		

Appendix J

Weed Species

Appendix J: Weed Species

Family	Taxon	Common name	BAM Act
Apocynaceae			
	Gomphocarpus fruticosus	Swan Plant, Narrow Cottonbush	C3
Asparagaceae			
	Asparagus asparagoides	Bridal Creeper	C3
Asteraceae			
	Arctotheca calendula	Cape Weed	C1
	Hypochaeris glabra	Smooth Cat's Ear	C1
	Sonchus asper		C1
	Sonchus oleraceus	Common Sowthistle	C1
	Ursinia anthemoides	Ursinia	C1
	Vellereophyton dealbatum	White Cudweed	C1
Boraginaceae			
	Echium plantagineum	Paterson's Curse	C3 (part)
Brassicaceae			
	Brassica tournefortii	Wild Turnip	C1
Euphorbiaceae			
	Euphorbia peplus	Petty Spurge	C1
Fabaceae			
	Lotus subbiflorus		C1
	Lupinus cosentinii	Sandplain Lupin	C1
	Trifolium campestre var. campestre	Hop Clover	C1
Iridaceae			
	Freesia alba x leightlinii	Freesia	C1
	Gladiolus caryophyllaceus	Wild Gladiolus	C1
	Moraea flaccida	One-Leaf Cape Tulip	C1
	Moraea miniata	Two-Leaf Cape Tulip	C1
	Romulea rosea var. australis	Guildford Grass	C1
	Watsonia meriana var. bulbillifera	Bungle Lily	C1
Lythraceae			
	Lythrum hyssopifolia	Lesser Loosestrife	C1
Moraceae			
	Ficus carica	Fig	C1
Oleaceae			
	Olea europaea		C1
Orobanchaceae			
	Orobanche minor	Lesser Broomrape	C1
	Parentucellia latifolia	Common Bartsia	C1
Oxalidaceae			
	Oxalis compressa		C1
	Oxalis corniculata		C1
	Oxalis pes-caprae	Soursob	C1
	Oxalis purpurea	Four O'Clock	C1
Papaveraceae			
	Fumaria capreolata	Whiteflower Fumitory	C1
Plantaginaceae			
	Plantago lanceolata	Ribwort Plantain	C1
Poaceae			
	Aira caryophyllea	Silver Hair Grass	C1
	Avena barbata	Bearded Oat	C1
	Briza maxima	Blowfly Grass	C1
	Briza minor	Shivery Grass	C1
	Bromus diandrus	Great Brome	C1
	Cynodon dactylon	Couch	C1
	Ehrharta calycina	Veld Grass or Perennial Veld Grass	C1
	Ehrharta longiflora	Annual Veldgrass	C1
	Lagurus ovatus	Hare's Tail Grass	C1
	Lolium perenne	Perennial Rye Grass	C1
	Paspalum dilatatum	Paspalum	C1

Primulaceae			
	Lysimachia arvensis var. arvensis	Pimpernel	C1
Rosaceae			
	Rubus anglocandicans		C3
Scrophulariaceae			
	Phyllopodium cordatum		C1
	Zaluzianskya divaricata		C1
Solanaceae			
	Solanum nigrum	Black Berry Nightshade	C1
Typhaceae			
	Typha orientalis	Bullrush	C1

*Environmental Weed Strategy of Western Australia (EWSWA) rating

Appendix K

Fauna Species

Appendix K Fauna Species List

Table 1 Fauna Species List of the Project area

Species	Vernacular	Conservation status / comment
Amphibians		
Crinia georgiana	Quacking Frog	Native
Crinia glauerti	Rattling or Clicking Froglet	Native
Crinia pseudinsignifera	Bleating Froglet	Native
Litoria moorei	Motorbike Frog	Native
Pseudophryne guentheri	Crawling Toadlet	Native
Birds		
Acanthiza apicalis	Broad-tailed Thornbill (Inland Thornbill)	Native
Acanthiza chrysorrhoa	Yellow-rumped Thornbill	Native
Anthochaera carunculata	Red Wattlebird	Native
Cacatua roseicapilla	Galah	Native
Cacatua sanguinea sanguinea	Little Corella	Native
Calyptorhynchus banksii naso	Forest Red-tailed Black Cockatoo	Threatened
Calyptorhynchus latirostris	Carnaby's Cockatoo	Threatened
Chenonetta jubata	Australian Wood Duck (Wood Duck)	Native
Chrysococcyx basalis	Horsfield's Bronze Cuckoo	Native
Cincloramphus cruralis	Brown Songlark	Native
Cincloramphus mathewsi	Rufous Songlark	Native
Colluricincla harmonica	Grey Shrike-thrush	Native
Coracina novaehollandiae	Black-faced Cuckoo-shrike	Native
Corvus coronoides	Australian Raven	Native
Coturnix pectoralis	Stubble Quail	Native
Cracticus tibicen	Australian Magpie	Native
Dacelo novaeguineae	Laughing Kookaburra	Naturalised Exotic
Dicaeum hirundinaceum	Mistletoebird	Native
Falco berigora	Brown Falcon	Native
Falco cenchroides	Australian Kestrel	Native
Gerygone fusca	Western Gerygone	Native
Grallina cyanoleuca	Magpie-lark	Native
Hirundo nigricans	Tree Martin	Native
Lichmera indistincta	Brown Honeyeater	Native
Malurus splendens	Splendid Fairy-wren	Native
Merops ornatus	Rainbow Bee-eater	Migratory
Neophema elegans	Elegant Parrot	Native
Ninox novaeseelandiae	Boobook Owl	Native

Species	Vernacular	Conservation status / comment
Ocyphaps lophotes	Crested Pigeon	Native
Pachycephala pectoralis	Golden Whistler	Native
Pachycephala rufiventris	Rufous Whistler	Native
Pardalotus punctatus	Spotted Pardalote	Native
Pardalotus striatus	Striated Pardalote	Native
Petroica multicolor	Scarlet Robin	Native
Phaps chalcoptera	Common Bronzewing	Native
Phylidonyris novaehollandiae	New Holland Honeyeater	Native
Platycercus icterotis	Western Rosella	Native
Platycercus zonarius	Australian Ringneck (Ring-necked Parrot)	Native
Rhipidura fuliginosa	Grey Fantail	Native
Rhipidura leucophrys	Willie Wagtail	Native
Smicrornis brevirostris	Weebill	Native
Tachybaptus novaehollandiae	Australasian Grebe	Native
Todiramphus sanctus	Sacred Kingfisher	Native
Mammals		
Bos taurus	European Cattle	Naturalised Exotic
Canis lupus subsp. familiaris	Dog	Naturalised Exotic
Felis catus	Cat	Naturalised Exotic
Macropus fuliginosus	Western Grey Kangaroo	Native
Oryctolagus cuniculus	Rabbit	Naturalised Exotic
Vulpes vulpes	Red Fox	Naturalised Exotic
Reptiles		
Crenadactylus ocellatus ocellatus	Southwestern Clawless Gecko	Native
Cryptoblepharus buchanii	-	Native
Menetia greyii	-	Native
Tiliqua rugosa rugosa	Western Bobtail	Native